An Bord Achomhairc Um Cheadúnais Dobharshaothraithe
Aquaculture Licences Appeals Board

Supplemental EIS Submission

From Inland Fisheries Ireland

Received 19 December 2018

Cúirt Choill Mhinsí, Bóthar Bhaile Átha Cliath, Port Laoise, Contae Laoise, R32 DTW5
Kilminchy Court, Dublin Road, Portlaoise, County Laois, R32 DTW5

Guthán/Telephone: 057 8631912 R-phost/Email: info@alab.ie Láithreán Gréasáin/Website: www.alab.ie

OHara, Mary

From: Paddy Gargan <Paddy.Gargan@fisheriesireland.ie>
Sent: 18 December 2018 17:14
To: Ohara, Mary (Alab)
Cc: Alab, Info
Subject: RE: Update on AP2-1-14/2015 Shot Head
Attachments: IFI Response to the Shot Head Supplementary EIS 18.12.18.docx

Dear Mary

Please see attached the submission of Inland Fisheries Ireland on the supplementary EIS for Shot Head proposed salmon farm in Bantry Bay.

The submission has also been sent to you by registered post.

Regards

Paddy

Patrick Gargan Ph.D
Senior Research Officer

Iascach Intíre Éireann
Inland Fisheries Ireland

Tel +353 (0)1 884 2616
Mob +353 (0)87 646 8611
Fax +353 (0)1 836 0060
Email paddy.gargan@fisheriesireland.ie

Web www.fisheriesireland.ie

From: Ohara, Mary (Alab) [mailto:Mary.Ohara@alab.ie]
Sent: 29 November 2018 14:51
Subject: Update on AP2-1-14/2015 Shot Head

To whom it concerns

The following update has been posted on the ALAB website www.alab.ie:

Update re AP2/2015 Shot Head – November 2018

Pursuant to Section 47 of the Fisheries (Amendment) Act, 1997, ALAB issued a Notice to the Applicant, Bradan Fanad Teo t/a Marine Harvest, on 20 December 2017. http://www.alab.ie/media/alab/content/technicalreports/Section47toMarineHarvest20Dec2017120318.pdf
In response to the Notice the Applicant furnished the Board with a Supplementary Environmental Impact Statement (Supplementary EIS). The Supplementary EIS is available on the ALAB website at http://www.alab.ie/boarddeterminations/2015/scheduleofdocuments/supplementaleis/

IASCACH INTIRE ÉIREANN
INLAND FISHERIES IRELAND

Mary O'Hara
Secretary
Aquaculture Licences Appeals Board
Kilminchy Court,
Dublin Road,
Portlaoise,
County Laois,
R32 DTW5

18/12/18

PUBLICATION OF A SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT IN CONNECTION WITH THE APPEAL OF AN APPLICATION FOR AN AQUACULTURE LICENCE UNDER THE FISHERIES (AMENDMENT) ACT, 1997 (NO. 23)(AS AMENDED) AND APPLICATION FOR A FORESHORE LICENCE UNDER THE FORESHORE ACT, 1933 (NO. 12)

Reference AP2/1-14/2015

Dear Mary

Please find the submission of Inland Fisheries Ireland on the Supplementary EIS for Shot Head proposed salmon farm.

This submission has also been sent by email to info@alab.ie on 18/12/2018.

Yours sincerely,

Patrick Gargan.

Dr Patrick Gargan
Senior Research Officer
Inland Fisheries Ireland

AQUACULTURE LICENCES
APPEALS BOARD
19 DEC 2018
RECEIVED

Inland Fisheries Ireland Response to the Supplementary Environmental Impact Statement (EIS) for a proposed salmon farm site at Shot Head, Bantry Bay, County Cork, Ireland. 18/12/2018

The Minister for Agriculture, Food and the Marine granted Aquaculture and Foreshore Licences to Marine Harvest Ireland (MHI), for a proposed salmon farm site at Shot Head, Bantry Bay, in September 2015. Following its granting, the licence was appealed to the Aquaculture Licences Appeals Board (ALAB). Following written appeals, and two sessions of oral hearing, granted to appellants, ALAB has required a Supplementary EIS to be compiled which addresses the following two issues:-

Issue 1: The risk (*i.e. posed by the proposed salmon farm installation*) of sea-lice infestation of wild salmonids migrating from/to the Dromogowlane and Trafrask rivers and any resulting implications for local freshwater pearl mussel (FPM) populations.

Issue 2: The impact of salmon farm waste on water quality in Bantry Bay, having regard to the maintenance of 'good water status' as required under the Water Framework Directive.

IFI wish to make the following comments on these two issues in the Supplementary EIS.

Issue 1: The risk (*i.e. posed by the proposed salmon farm installation*) of sea-lice infestation of wild salmonids migrating from/to the Dromogowlane and Trafrask rivers and any resulting implications for local freshwater pearl mussel (FPM) populations.

The Supplementary EIS assesses the direct risk of infestation of wild anadromous salmonids, entering or leaving the Trafrask system by Copepodids, primarily by *L. salmonis*, generated from ovigerous female lice that infest the proposed salmon farm site. The Supplementary EIS comments (Page 16) that farm-origin lice have no evolved mechanism by which to carry high numbers of newly-metamorphosed, infective Copepodids into close contact with their out-migrating hosts, in their natural infestation zones. Rather, they can be expected to disperse, dilute, be predated upon and age, amongst the plankton, in the open water conditions in which they find themselves. Further, the Supplementary EIS states that, whilst it may be possible for some farm-origin lice to continue to infest the same farm site or, perhaps to drift downstream into other sites, their fate is largely a matter of chance and hydrography, as their Copepodids drift, in diminishing densities, from their birth-site. It is the view of IFI that this contention that there no potential for farm origin lice to infect wild salmonids is incorrect (see Sections below) and is also not supported by the literature.

Previous studies in Ireland (Tully and Whelan, 1993), Scotland (Butler 2002) and Norway (Heuch and Mo, 2001) have indicated that in spring, the majority of nauplii sea lice arise from ovigerous lice infesting farmed salmon. Tully *et al.* (1999) have demonstrated that the presence of salmon farms significantly increased the level of sea lice infestation on sea trout post smolts in Ireland. Similar findings have been reported from Norway (Grimnes et al. 2000) and Scotland (Mackenzie et al. 1998, Butler, 2002). In a recent study, Taranger et al. (2014) undertook a risk assessment of the effects of salmon lice on wild salmonid populations along the intensively farmed Norwegian coastline over the 2010-2013 period and found that sea trout from the majority of sampled sites from Hordaland to Finnmark had salmon lice infections, mainly resulting from salmon farming, that indicated moderate or high mortality of sea trout while twenty-seven of these stations indicated moderate or high likelihood of mortality for wild migrating salmon smolts.

In Ireland, Shephard & Gargan (2017) undertook a study of a 26 year record from the Erriff River to evaluate the contribution of sea lice from salmon aquaculture to declining returns of wild 1 sea-winter (1SW) salmon. Statistical models suggested that returns were >50% lower in years following high lice levels on nearby salmon farms during the smolt out-migration. Serra-Llinares et al. (2016) concluded that there is solid evidence of a significant influence of lice originating from nearby farms on the observed abundances on wild fish in Norway. Gargan & Shephard (2016) analysed a 20 year time series (1985–2004) using 15 sea trout population response variables in the Erriff River, western Ireland. Over this period, when time was considered as a categorical variable comprising 4 sequential periods of 5 yr, important life history changes were observed. The most dramatic of these changes corresponded with the period immediately after the commencement of salmon farming in the local estuary, with significant decreases in the number and length of sea trout kelts, the estimated number of eggs deposited, the sea trout rod catch, the proportion of older (1+ and 2+ sea age) fish and the frequency of repeat spawners. They found a significant positive relationship between the number of salmon lice *Lepeophtheirus salmonis* in the local salmon farm and the number of lice found on sea trout collected contemporaneously in local rivers. Results of this long-term monitoring programme demonstrate that significant changes in sea trout population structure with respect to quantitative life history traits can occur over a relatively short time period and suggest that the introduction of salmon farming into the local estuary most likely contributed to the observed changes in sea trout population dynamics.

The Supplementary EIS concludes that the direct risk of infestation of wild anadromous salmonids entering or leaving the Trafrask River system by copepodids originating from the proposed Shot Head site may be regarded as low and totally subject to chance. The Supplementary EIS states that, however, outcomes are likely to depend, more than anything, on the numerical scale of the dispersal from the proposed site and local hydrography. This latter statement seems at odds with the previous statement on page 16 that farm-origin lice have no evolved mechanism by which to carry high numbers of newly-metamorphosed, infestive Copepodids into close contact with their out-migrating hosts. IFI concur that the direct risk of infestation of wild anadromous salmonids entering or leaving the Trafrask River system by copepodids originating from the proposed Shot Head site will depend on the level of lice on the farm site, the numerical scale of the dispersal and local hydrography and that this does provide a potential mechanism by which high numbers of newly-metamorphosed, infective Copepodids can be carried into close contact with their out-migrating hosts.

Comment on Dispersion modelling of *L. salmonis* larvae in Bantry Bay.

With regard to dispersion of sea lice larvae in Bantry bay, in Section 2.3.2, Page 33, the Supplementary EIS comments that all plots indicate that insignificant numbers of Copepodids will disperse towards any salmonid river estuary during the 14-day post-hatch dispersal, even in the hypothetical case of Maximum plume plots. The Supplementary EIS concludes that collectively, these observations on modelled farm-origin lice dispersion in Bantry Bay show that no grid cells with density values above the lowest contour level mapped travel eastwards much beyond 2.1km from the site centre and this only along the inshore margin, just east of the site. Time series plots across the mouth of Trafrask Bay show that zero Copepodids enter Trafrask Bay. These therefore show that no farm origin lice reach the Trafrask River system. Because of their geographic and hydrographic distance from salmon farm sites, much the same is held to be true for other river estuaries in the bay. The EIS comments that this indicates, under all conditions tested, no farm origin Copepodids can augment natural wildlife infestation in Bantry Bay river estuaries and that in the case of the open, destratified waters of Bantry Bay and the locations of its existing and proposed salmon farm sites, the risk of a farm-origin infestation of wild salmonids by a potentially mating pair of lice will always lie in the range of zero to many millions to one, even close to the farm larval source. The Supplementary EIS goes on to state that the only conclusion that these findings can lead to is that there is effectively zero direct risk of infestation of wild salmonids by one or more mating pairs of lice, either of wild smolt within any natural inshore infestation zone of any river, or of in-migrating adults or out-migrating smolt in the open waters of Bantry Bay. These statements are not supported by scientific studies conducted in Bantry bay rivers in the 1990's.

Gargan et al. (2017) examined the increased risk of individual sea trout mortality due to salmon lice infection from salmon farms in a range of Irish rivers. The sum of the increased mortalities of individual sea trout for the different "infection classes" in a sample was then used to calculate the population-level increase in mortality risk, or compromised seawater growth and/or reproduction, reflecting the distribution of the intensity of salmon lice infections for the individuals sampled (Taranger *et al.*, (2014). The risk was further scored according to the system proposed by Taranger *et al.*, (2012) to assess lice related increased mortality risk at the population level. The increased mortality risk of sea trout due to salmon lice infections at the population level in individual Irish bays was examined. For Bantry Bay and Kenmore Bay, Gargan et al. (2017) found a high risk of sea trout mortality at the population level at many sites in the early 1990s when salmon farms were operating in both bays. The Adrigole river, in Bantry Bay, close to the Roancarraig salmon farm site, had a very high population-level increase in mortality risk (average risk 53.6%) due to salmon lice infections in 4 out of the 5 years examined (1993, 1994, 1995 & 1999). This finding is completely contrary to the conclusions reached in the Supplementary EIS that, in the case of the open, destratified waters of Bantry Bay and the locations of its existing and proposed salmon farm sites, that the risk of a farm-origin infestation of wild salmonids by a potentially mating pair of lice is effectively zero, even close to the farm larval source.

Regarding Margritifera margritifera in the Trafrask River System, and evaluation of risk exposure; The EIS concludes that the risks for the Trafrask FPM lies within their freshwater environment. However this is at odds with IFI's contention (issue 1 above) since any factor which reduces the number of salmonids in a river system, including lice risk, will by extension reduce the number of vector hosts for the growth and dispersal of Glochidial larvae, particularly in a system where fish populations would appear to be sub optimal for this purpose currently.

Comment on additional mortality of salmon caused by sea lice infestation.

The Supplementary EIS states that there has been a remarkably sustained and focused campaign to blame salmon farming with wild salmonid lice infestations and stock reductions and collapses over almost three decades. It comments that even so, there is something of a consensus in the results in that even the most damning studies estimate that only 1 to 2% of additional marine mortality is caused by "lice". Krkosek et al. (2013) commented on a loss of 1-2% marine survival of wild salmon due to sea lice infestation from salmon farms. They point out that if, in the absence of parasites, final adult recruitment is 6% of smolt production, then the effect of parasite mortality reduces that recruitment to 4%, according to some authors, that is a change of 2%. However, the realized effect is that it reduces the abundance of adult spawners returning to a river from, say, 6000 down to 4000; this one-third loss of salmon returns could have significant conservation or fishery implications. Thorstad et al. (2015) reviewed all experimental studies conducted on the mortality of salmon lice on Atlantic salmon post-smolts, comparing fish chemically treated to provide protection from salmon lice with control groups of untreated fish. These field studies have been conducted with the presumption that salmon lice originating from local farm sources might confer increased mortality risk to the untreated control smolts, and that this effect will extend to the wild Atlantic salmon smolt population. The review concluded that comprehensive meta-analyses, long-term studies, and similar results from an increasing number of experimental studies, support that mortalities caused by salmon lice in farmcurrents are not uniform across the water column. We have further consulted with these colleagues, on the appropriateness of assuming that sea lice are neutrally buoyant particles, and they are in agreement that this is an inadequate assumption to make and thus compromises the output of the sea lice particle tracking simulations in providing an accurate reflection of their potential dispersal in the bay.

The Supplementary EIS (Page 28) states that, after Amundrud and Murray (2009), that *L. salmonis* larvae are treated as neutrally buoyant, which is regarded as wholly realistic for the destratified, open water conditions of Outer Bantry Bay, where the larval lice are modelled as drifting in the plankton. Later on Page 65, the Supplementary EIS comments on the issues raised by IFI regarding neutrally buoyant particles as follows;

"Regarding freshwater, it is submitted that freshwater inputs are so low into Outer Bantry Bay relative to oceanic influx and mixing that there are no freshwater layers for farm-origin Copepodids to avoid, or haloclines under which to accumulate, anywhere between Bantry Bay salmon farm sites and the near-coastal zone. Thus, this cannot play any part in farm-origin Copepodid dispersal or accumulated infestation pressure in this case. Whilst under favourable conditions, free-living Copepodids may be able to respond to light by a positive phototaxis, with a maximum sustainable daytime "hop and sink" swim speed of 1.38cmsec-1, vertical current speed amplitudes (i.e. between upward and downward flow), at all depths of the water column in Bantry Bay are of the order of 3 to 5 times this. Under these circumstances, such a phototaxis can only be disrupted and can therefore have no role in the vertical position or concentration of L. salmonis larvae in the water column. It should also be noted that phototactic larvae sink at night. Thus, it is submitted that, under these circumstances and in the specific case of Bantry Bay, as further explained in preceding sections, treatment of free-living L. salmonis larvae as neutrally buoyant particles is a reasonable and justifiable approach to their dispersion modelling, in contradiction of the view expressed by IFI".

The Amundrud and Murray (2009) model cited in the Supplementary EIS uses particles that are retained in the surface layer, i.e. they are 100% positively buoyant and completely resist any mixing to deeper layers. This is the reverse of being neutrally buoyant. The treatment of sea lice larvae as neutrally buoyant based on Amundrud and Murray (2009), is a complete misinterpretation of Amundrud and Murray (2009) in the original and Supplementary EIS as these authors refer to surface layer dependence and it is an explicit assumption of the model that lice are retained in the surface layer and this means they are positively buoyant.

Therefore treatment of sea lice larvae as neutrally buoyant is totally inappropriate. With regard to vertical mixing, the response in the Supplementary EIS may have some validity if vertical mixing is very strong then positive buoyancy might not be 100%, but this would require specific modelling of vertical swimming behaviour and is entirely at odds with the assumptions in Amundrud and Murray (2009). It is therefore the view of IFI that the issues raised regarding the appropriateness of assuming that sea lice are neutrally buoyant particles is incorrect and thus compromises the output of the sea lice particle tracking simulations in providing an accurate reflection of their potential sea lice dispersal in the bay.

Reference is made on Page 68 of the Supplementary EIS to the Norwegian "Traffic Light System". In this system, sea lice effect on wild salmon mortality will be the indicator with respect to production growth in salmon farming. In areas where sea lice cause wild salmon smolt mortality less than 10%, a green light for increasing production by 6% will be given. A yellow light will be given in the case where sea lice induced mortality is between 10 and 30% which means that the growth is on hold. If an area gets a red light, the sea lice induced mortality is higher than 30%, and production should be reduced. The Supplementary EIS interprets these figures as losses of 0.5%, 1.5% and >1.5% loss of escapement of adult salmon whereas the system is based on mortality of salmon smolts caused by sea lice from salmon farms. There is considerable concern among some scientists in Norway and elsewhere that salmon farming would be allow to continue at current production levels even though lice emanating from such farms have been implicated in the mortality of 10% - 30% of wild salmon smolts migrating from local rivers.

In a recent review of Environmental problems and regulation in the aquaculture industry in Norway, Olaussen (2018) comments that the main problem with the previous and current regulation in light of environmental concerns seems to be that there are too weak incentives to shift towards new and less damaging ways of production. One of the most promising solutions would be the development of closed containment production systems for salmon aquaculture, that is, a transmission from the open net cages to more closed containment facilities. Small-scale aquaculture production is already available, and projects of a commercial scale have also been conducted in Canada and Denmark. Investing in such technologies will be costly in the short run for the aquaculture sector, but may turn out beneficial in the long run; in any case, this technology has the potential to solve many of the infections in 4 out of the 5 years examined and this finding completely dispels the conclusions reached in the Supplementary EIS regarding the threat posed by salmon farm origin lice to wild salmonids in Bantry Bay.

The assumption in the original EIS and the Supplementary EIS that sea lice are neutrally buoyant particles is incorrect and remains a false assumption to make, misinterprets Amundrud and Murray (2009) and thus compromises the output of the sea lice particle tracking simulations in providing an accurate reflection of their potential sea lice dispersal in the bay. Therefore it is the view of IFI that the conclusions reached in the Supplementary EIS that there is effectively no sea lice risk projected from the proposed Shot Head site, to wild salmonids at any location, either in the open waters of Bantry Bay or in the immediate vicinity of the Trafrask River or any other estuary in the bay is not correct. Further, based on the above, the conclusion in the Supplementary EIS that there is zero risk that anadromous salmonids will be reduced in numbers in their freshwater phase, as a result lice larva dispersal from the proposed Shot Head site, to impact on the availability of vector hosts for Freshwater Pearl Mussel Glochidia larval development and dispersal therefore cannot be reached.

REFERENCES

Amundrud T.L. and Murray A.G 2009. Modelling sea lice dispersion under varying environmental forcing in a Scottish sea loch. Journal of Fish Diseases 32, 27-44

Butler, J.R.A. 2002. Wild salmonids and sea louse infestations on the west coast of Scotland: sources of infection and implications for the management of marine salmon farms. Pest Management Science 58, 595-608.

Gargan, P.G., Shephard, S & MacIntyre, C. (2017). Assessment of the increased mortality risk and population regulating effect of sea lice (*Lepeophtheirus salmonis*) from marine salmon farms on wild sea trout in Ireland and Scotland. In: (Harris, G, ed.) *Sea Trout: Science & Management. Proceedings of the 2nd International Sea Trout Symposium*. pp. 507-522.

Grimnes, A., Finstad, B., and Bjorn, P.A. (2000). Registrations of salmon lice on Atlantic salmon, sea trout and charr in 1999. NINA Oppdragsmelding 634: 1-34. (In Norwegian with English Abstract).

Heuch, P.A., and Mo, T.A. (2001). A model of salmon louse production in Norway: effects of increasing salmon production and public management measures. Diseases of Aquatic Organisms 45: 145-152.

ICES (2016) Report of the Workshop on possible effects of salmonid aquaculture on wild Atlantic salmon populations in the North Atlantic (WKCULEF) ICES WKCULEF

REPORT ICES Advisory Committee ICES CM 2016/ACOM: Ref. ACOM1–3 March Copenhagen, Denmark.

Krkosek M, Revie C.W, Gargan, P.G, Skilbrei O.T, Finstad B, Todd C.D. (2013). Impact of parasites on salmon recruitment in the Northeast Atlantic Ocean. Proc. R. Soc. B. 20122359 .http://dx. doi.org/10.1098/rspb. 2012.2359

Mackenzie, K., Longshaw, M., Begg, G.S., and McVicar, A.H. (1998). Sea lice (Copepoda: Caligidae) on wild sea trout (*Salmo trutta* L.) in Scotland. ICES Journal of Marine Science 55: 151-162.

Olaussen, O. J. (2018). Environmental problems and regulation in the aquaculture industry. Insights from Norway.Marine Policy Volume 98, December 2018, Pages 158-163.

Serra-Llinares, R. M., Bjørn, P. A., Finstad, B., Nilsen, R., and Asplin, L. 2016. Nearby farms are a source of lice for wild salmonids: a reply to Jansen et al. 2016. Aquaculture Environment Interactions, 8: 351–356.

Shephard, S, & Gargan, P.G. (2017). Quantifying the contribution of sea lice from quaculture to declining annual returns in a wild Atlantic salmon population. Aquacult Environ Interact. Vol. 9 :181–192, https: /doi.org/ 10.3354/ aei00223

Taranger, G.L., Svåsand, T., Kvamme, B.O., Kristiansen, T.S. & Boxaspen, K.K. (2012a). Risk assessment of Norwegian aquaculture [Risikovurdering norsk fiskeoppdrett] (*In Norwegian*). Fisken og havet, særnummer 2-2012, 131 pp.

Taranger, G.L., Karlsen, Ø., Bannister, R.J., Glover, K.A., Husa, V., Karlsbakk, E., Kvamme, B.O., Boxaspen, K.K., Bjørn, P.A., Finstad, B., Madhun, A.S., Craig Morton, H. & Svåsand, T. 2014. Risk assessment of the environmental impact of Norwegian Atlantic salmon farming. ICES J Mar Sci 72: 997–1021.

Thorstad E. B, Todd C. D, Uglem I., Bjørn P. A, Gargan P. G, Vollset K. W, Halttunen E, Kålås S, Berg M, Finstad, B. (2015) Effects of salmon lice *Lepeophtheirus salmonis* on wild sea trout *Salmo trutta*—a literature review. Aquacult Environ Interact. Vol. 7: 91–113.

Tully, O. & Whelan, K.F. 1993. Production of nauplii of *Lepeophtheirus salmonis* (Krøyer) (Copepoda: Caligidae) from farmed and wild salmon and its relation to the infestation of wild sea trout (*Salmo trutta* L.) off the west coast of Ireland in 1991. Fisheries Research 17, 187-200.

Tully, O. Gargan, P.G., Poole, W. R., and Whelan, K.F. (1999). Spatial and temporal variation in the infestation of sea trout (*Salmo trutta* L.) by the caligid copepod *Lepeophtheirus salmonis* (Kroyer) in relation to sources of infestation in Ireland. Parasitology, 119, 41-51.