Managing Interactions Aquaculture Project

Locational Guidance Tool Development

Paper 4: MIASG Proposed Approach to Consider Distance in Locational Tool

Developing an Approach to Include Distance in Sensitivity / Risk Matrix

1. Purpose and Introduction:

This is a discussion paper to propose a system to incorporate "distance" in both the sensitivity / risk matrix of the aquaculture and river/fisheries sections of the locational guidance tool.

It tries to recognise that the relationship between an aquaculture site (a static point at varying distances from a range of river mouths with each distance presenting a different risk) to river(s) is different from a river (a static point at varying distances of range of aquaculture sites with each distance presenting a different risk with this risk influenced also by the biomass / production at each aquaculture site). Given this difference a different system of recognising the distance of a farm to river(s) and the distance of a river from farm(s) is required in each of the aquaculture and river/ fisheries assessment matrices.

2. Distance of Aquaculture Production Site from River(s)

Each farm unit has a fixed location. That location will have a calculable distance to a number of river mouths. The distance from each river will change the risk of sea lice from that farm affecting any given river (accepting that smolt migration needs to be considered separately and in addition to try and generate some basis for interaction between smolt and farm where general migration routes can be generated or assumed). The risk from any farm is also related to the volume of production at the site as large production sites are likely to generate greater lice numbers due simply to the larger numbers of fish held.

To match distance of farm from rivers risk is proposed to vary on the bands below:

- 0-5km = High risk
- 5-15km = Medium Risk
- 15 -25km = Low Risk

For farms >25km from the nearest river it is assumed there is no risk. This end point is required as without it all farms will present a risk to all rivers. However, smolt migration routes (where these are known or can be assumed) will be required in addition to identify situations where a farm distant from a river mouth may still have an influence due to proximity during smolt migration.

To consider the production of the site and relate this to distance the following tonnage bands are proposed for consideration:

- <1000 tonnes = Low Risk
- 1000 – 2000 tonnes = Medium Risk
- >2000 tonnes = High Risk

These bandings would combine in **Table 1** below to generate a risk assessment for each farm which considers both the distance of any farm to any river and also the production of fish from at that site.

Table 1: Combined Aquaculture Risk Matrix Considering Distance from River and Farm Production

Distance (km) and Production (tonnes)	<1000	1000 - 2000	>2000
0-5	High x Low = Medium	High x Medium = High	High x High = High
5-15	Medium x Low = Low	Medium x Medium = Medium	Medium x High = High
15-25	Low x Low = Low	Low x Medium = Low	Low x High = Medium

To give balance to the combined assessment any risk derived from a low risk factor multiplied by medium risk is scored low risk. Any risk from a high risk multiplied by medium is scored high. If either a uniformly conservative or uniformly precautionary approach is adopted the table would change to those below (**Tables 1A** (conservative) and **Table 1B** (precautionary). The approach here should be discussed as either option has consequences for the output derived.

Table 1A: Combined Aquaculture Risk Matrix Considering Distance from River and Farm Production (Conservative)

Distance (km) and Production (tonnes)	<1000	1000 - 2000	>2000
0-5	High x Low = Medium	High x Medium = Medium	High x High = High
5-15	Medium x Low = Low	Medium x Medium = Medium	Medium x High = Medium
15-25	Low x Low = Low	Low x Medium = Low	Low x High = Medium

Table 1B: Combined Aquaculture Risk Matrix Considering Distance from River and Farm Production (Precautionary)

Distance (km) and Production (tonnes)	<1000	1000 - 2000	>2000
0-5	High x Low = Medium	High x Medium = High	High x High = High
5-15	Medium x Low = Medium	Medium x Medium = Medium	Medium x High = HIgh
15-25	Low x Low = Low	Low x Medium = Medium	Low x High = Medium

This risk assessment approach can be replicated for each river within each distance band and an accumulated risk assessment derived for each site.

E.g. 1 A farm of 1500 tonnes production may have x3 rivers between 0-5km, a further 5 rivers within 5-15km and 10 within 15-25km and this would generate 18 risk scores to accumulate.

E.g.2 A farm elsewhere of the same 1500 tonnes production may have x1 river between 0-5km, a further 2 rivers within 5-15km and 5 within 15-25km and this would generate 8 risk scores to accumulate.

3. Distance of River from Aquaculture Production Site(s)

Each river mouth has a fixed location. That location will have a calculable distance to any fish farm. The distance of each river from each farm will change the risk of sea lice from that farm affecting any given river. The risk from any farm is also related to the volume of production at the site as large production sites are likely to generate greater lice numbers due simply to the larger numbers of fish held but this factor, it is proposed, is better handled in the aquaculture assessment set out in **Section 2** (above).

There are at least two main ways to consider the relationship between river distance and farm. Most simply it is just a distance relationship where risk decreases with distance from farm (see **Table 2**). Alternatively the assessment might be based on a combination of distance and "total score" generated from the rest of the river assessment matrix (see **Table 2A**).

To match distance of river to each farm risk is proposed to vary on the bands below:

- 0-5km = High risk
- 5-15km = Medium Risk
- 15 -25km = Low Risk

For rivers >25km from the nearest farm it is assumed there is no risk. This end point is required as without it all rivers will collect a risk score from all farms. However, smolt migration routes (where these are known or can be assumed) will be required in addition to identify situations where a farm distant from a river mouth may still have an influence due to proximity during smolt migration.

To consider the overall assessment score of the river and relate this to distance bands a general grouping could be generated as below. Note what constitutes a low, medium or high total assessment score is not currently determined as the assessment matrix and weightings within it are not finalised.

- Low total assessment score = Low Priority
- Medium total assessment score = Medium Priority
- High total assessment score = High Priority

Table 2: River Risk Matrix Based Upon Distance of River from Farm

Distance (km)	0-5	5-15	15-25
All rivers	High	Medium	Low

Table 2A: Combined River Risk Matrix Considering Distance from Farm and Overall River Assessment Score

Distance (km) and River Assessment Score	Low Score	Medium Score	High Score
0-5	High x Low = Medium	High x Medium = High	High x High = High
5-15	Medium x Low = Low	Medium x Medium = Medium	Medium x High = High
15-25	Low x Low = Low	Low x Medium = Low	Low x High = Medium

In the same way summarised in **Section 2 Table 2A** could be revised based on a conservative or precautionary approach to risk and generate matrices similar to **Tables 1A** and **1B**. The preferred approach to be followed requires discussion amongst the project partners.

In respect of the two approaches presented in **Table 2** and **Table 2A** the simple distance relationship of **Table 2** is preferred. This will calculate a cumulative risk to rivers from the aquaculture unit which is based on the fixed variable of distance from farm to river mouth. The **Table 2A** approach uses the priority score of the river which is itself an modelled and derived output and open to change determined by the rules of the river prioritisation and the extent of data and information behind the prioritisation score. As such it is considered to be less applicable for use in the generation of the aquaculture risk score.

4. Discussion Points and Recommendations:

Distance of farm location from rivers and distance of river from farm locations are important features of the relationship between wild fish and fisheries and aquaculture. The extent of production on any farm is also an important part of this relationship and interaction. The paper above presents options for discussion as to how these issues can be pragmatically considered within the locational guidance part of the Managing Interactions Project.

Suggested discussion points are:

a) Are the distance bands and tonnage levels reasonable to generically separate risk and levels of influence?
b) In **Tables 1, 1A** and **1B** is there a preference as to how risk should be considered which affords reasonable protection and is seen externally to be fair and equitable? Do any of the options presented provide this?
c) Does this sort of approach allow the identification of accumulated risk from a farm linked to many rivers at different distances and a river linked to many farms at different distances?

Having discussed the issues above the Steering Group is recommended to:

a) Approve the use and integration of these systems into the river and aquaculture prioritisation and risk assessment matrices to support prioritisation and risk assessments for later review within the overall protocol development.
b) Approve the use of the simple distance relationship between farms and rivers where all rivers are considered equally (**Table 2**) as opposed to the use of overall assessment scores in combination with distance (**Table 2A**) to provide a risk score.

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08 June 2012