Rivers and Fisheries Trusts of Scotland
Scottish Government
Managing Interactions Aquaculture Project

Sweep Netting Project: Steering Group Briefing July 2011

Purpose:
This paper summarises the work completed and the samples reported (to date) following completion of the post smolt sweep netting activities undertaken as part of the above project.

It sets out:
- Sites meeting the agreed sampling requirements and where payments to trusts are recommended;
- Sites not meeting agreed sampling requirements but where payments to trusts are recommended due to efforts made to secure samples; and
- A proposal for a single report of these results to be prepared for the entire study area.

1. Update on the strategic programme of post smolt monitoring sites

1.1   Post smolt sweep netting

Agreement was reached within the steering group for the establishment of a network of 28 sweep netting Monitoring Sites (**Figure 1A**) to be surveyed in spring/summer 2011, 21 of these identified monitoring sites were already well established sites and 7 sites are new.

Standard SFCC protocols were to be used during sampling with the following refinements on sample collection agreed:

- 30 post smolts as a target minimum sample;
- at least x2 surveys to be undertaken to gather the minimum sample;
- additional fish and sampling effort welcomed.

Of the 28 sites currently being monitored in this project, 17 sites met the minimum requirements of the study (Figure 1B) set out above. Further details on all site samples can be found in **Table A (see annex 1)**. Final updates have still to be received from Argyll Fisheries Trust and these may increase the sites meeting minimum requirements.

A sampling data return form was developed and issued to all Trusts. All data collected in 2011 is being compiled into a structured Access Database (Version. 2010). Additional work was undertaken by the project co-ordinators to identify and acquire the previous monitoring site sample data. This has been incorporated into the established structured database.
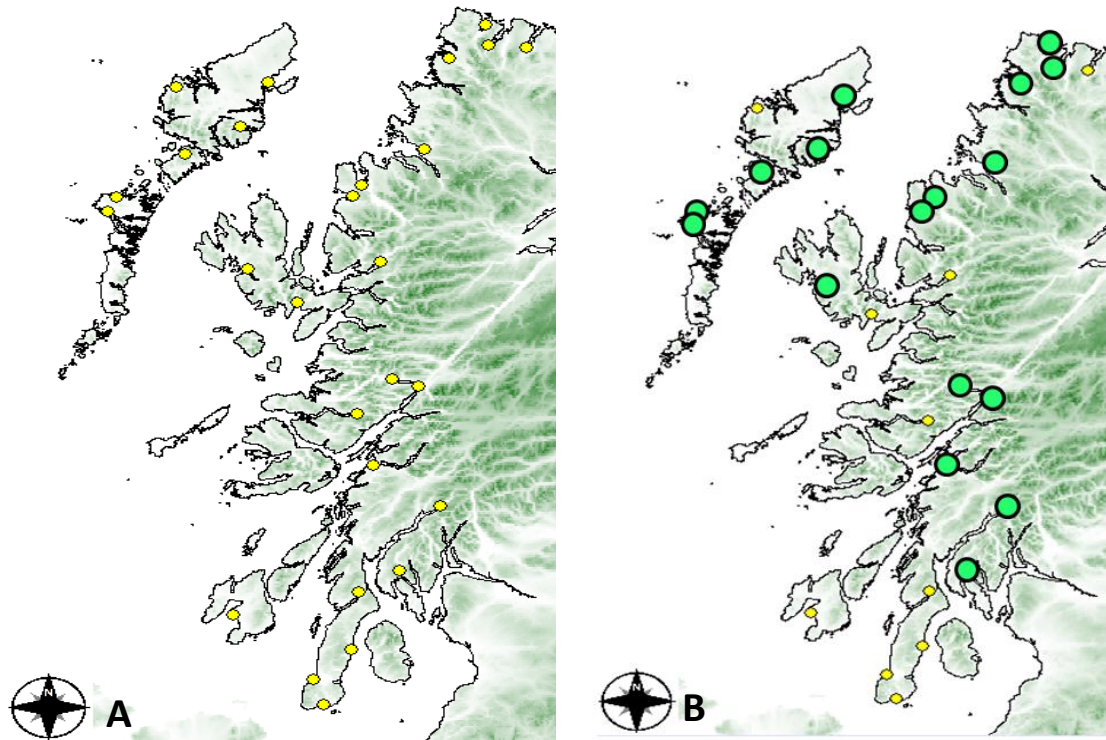
Figure 1: A. Geographical spread of all chosen monitoring sites (yellow circles). Figure B. Indication (Green Circles) of the monitoring sites which have achieved the minimum study requirements.

1.2   Payments for sweep netting

Table A (**annex 1**) shows that 17 sites meet the sampling requirements asked of the sweep netting programme. As such per site payments (£3k) are due to be made to the respective trusts. Note that a single payment is required for the Kyles / Malacliet sites as these were visited together although exceptional travel costs for sites in the Outer Hebrides may be incurred. Further data is to be received from Argyll FT and when this data is received additional payments are anticipated for complete sites.

In addition payments are recommended despite minimum fish numbers having not been met for the sites below due to the efforts made to capture the necessary samples (in particular at Sunart and by Lochaber FT):

- Sunart: 6 fish captured on 9 visits
- Adroil: 17 fish captured on 4 visits
- Loch Slapin: 27 fish captured on 3 visits
- Carron/Gruinard Bay: 7 fish captured on 4 visits

1.3   Comparison of wet and dry counting of lice

As part of this project it was agreed by the Steering Group that it would be used to explore the potential differences between wet and dry counting of sea lice. The co-ordinators issued guidance on a protocol for the Comparison Test Counting and this was issued to all Trusts. The coordinators then analysed the results and consulted with Marine Science Scotland (MSS). The results are shown below in **Table 1**.

Table 1: Results from Comparison Protocol Testing.

Trust	Comparison results provided (Y/N)	Results of comparison of wet and dry counting.
Argyll	N	None Possible
Lochaber	Y	No difference in comparison, any method to be used
Outer Hebrides	Y	No difference in comparison, any method to be used
Skye	Y	Currently being analysed
West Sutherland	N	None Possible
Wester Ross	Y	Difference in counts by method. Final resolution of methods to be undertaken for 2012 counts OR surface counts to be required by project in future

These results indicate evidence of a disparity in the counting protocols which, will need to be further explored in 2012 to enable the project to proceed with consistent and comparable monitoring processes in any future years of sampling and survey. It may be necessary for future netting to explicitly require the application of either a wet or dry counting method or for future work to arrange for further count verification via a programme of staff mixing.

1.4   Environmental conditions

The environmental conditions experienced over the study period were varied and can be seen on **Table B (see Annex 1)** They ranged from the lowest mean water temperature experienced at Laxford in West Sutherland of 9.5 (^{o}C) to highest mean water temperature of 16.03 (^{o}C) on the Outer Hebrides at the Malacleit. The mean air temperature ranged from a low 10.00 (^{o}C) in Kinnaird Wester Ross and a high of 15.63 (^{o}C) at the Malacleit monitoring site on the Outer Hebrides. Finally mean salinities the lowest level was 2.50 (PSU) recorded in the Polla in West Sutherland and highest was 35.2 (PSU) in Camas Na Gaul, Lochaber.

2 Proposed reporting structure of post smolt sweep netting analysis

It is now proposed that a single full regional report is produced from these results which will explore the *Salmo trutta* (Sea Trout) Populations and the *L. salmonis* and *C. elongates* (Sea

Lice) results at each of the monitoring sites. It is proposed that the Steering Group, in consultation with MSS, identify what areas of analysis should be explored. It is proposed that analysis of the data collected will involve descriptive statistics and graphs which will be prepared in Excel (2010). Further in depth statistical comparison techniques will be employed to examine any differences between the monitoring sites.

All results for all areas and sites will be reported within the single report proposed.

3. Recommendations

The Steering Group is invited to:

- Note the sweep netting results presented and the dry and wet count comparisons shown;
- Approve the site payments to trusts for sweep netting work competed, for the sites specified where target requirements were not met and for sites meeting requirements when pending data is received;
- Approve the preparation of a single project wide report of the sweep netting programme results.

Donna-Claire Hunter and Diane Kennedy
RAFTS Aquaculture Coordinators
18 July 2011

Annex 1: Sweep Net Survey Results

Table A: Monitoring Site Number of visit and number of *Salmo trutta* (Sea Trout) caught over the study period

Site ID	Monitoring Site	Number Site Visits (minimum of 2 visits)	Number of Fish (minimum number of fish 30)	Study Requirements Met
1	Carradale	1	35	No
2	Southend			No
3	Machrihanish			No
4	Loch Fyne	2	60	Yes
5	West Riddon	2	33	Yes
6	Dunstaffnage	2	42	Yes
7	West Tarbert			No
8	Laggan Bay, Islay	1	6	No
9	Loch Eil	8	81	Yes
10	Camas na Gaul	6	44	Yes
11	Sunart	9	8	No
12	Tong	4	89	Yes
13	Adroil	4	17	No
14	Borve	4	194	Yes
15/16	Eishken/Tiorsdam	Eishken = 3 Tiorsdam = not sampled	Eishken = 42 Tiorsdam = 0	Yes
17/18	Kyles/Malacliet	Kyles = 3 Malacliet = 3	Kyles = 74 Malacliet = 45	Yes
19	Loch Slapin	3	27	No
20	Loch Harport	3	30	Yes
21	Kyle of Durness	2	62	Yes
22	Polla	3	38	Yes
23	Laxford	2	49	Yes
24	Kinloch	1	0	No
25	Kannaird	2	31	Yes
26	Boor Bay	3	34	Yes
27	Flowerdale	2	41	Yes
28/29	Carron/Gruinard Bay	4	7	No

Table B: Monitoring Site Environmental Conditions over the study period

Site ID	Sweep Netting Site	Mean Water Temperature	Mean Air Temperature	Mean Salinity
1	Carradale			
2	Southend			
3	Machrihanish			
4	Loch Fyne			
5	West Riddon			
6	Dunstaffnage			
7	West Tarbert			
8	Laggan Bay			
9	Loch Eil	11.60	10.80	28.80
10	Camas na Gaul	13.20	11.80	35.20
11	Sunart	14.50	11.80	33.20
12	Tong	10.95	13.23	35.00
13	Ardroil	12.85	14.03	19.50
14	Borve	13.78	14.63	17.75
15	Eishken	13.67	13.80	35.00
17	Kyles	15.13	14.13	23.30
18	Malacleit	16.03	15.63	35.00
19	Loch Slapin	11.86	12.50	31.10
20	Loch Harport	10.50	11.57	26.62
21	Kyle of Durness	13.35	14.35	11.50
22	Polla	11.88	14.50	2.50
23	Laxford	9.5	13.70	5.50
24	Kinloch	*	*	*
25	Kannaird	13.00	10.00	27.00
26	Boor Bay	12.25	13.50	24.50
27	Flowerdale	11.50	14.00	16.00
28	Carron	*	14.50	*

* No Data

Rivers and Fisheries Trusts of Scotland
Scottish Government

Aquaculture Mitigation Project

Steering Group Paper:

Locational Guidance
Briefing Paper
July 2011

1. Background

This briefing paper aims to demonstrate the Locational Guidance database and provide a basic user guide. It will also aid in the further development of a scoring and weighting matrix for the risk assessment of wild fisheries, aquaculture sites and water bodies.

2. Security

Some Trusts have indicated that raw data used in the database development should not get into the public domain. It is therefore imperative that the databases are locked with very strict Administrator access only. The raw data held within the database will be hidden behind a user interface.

3. Version Control

This database and modelling tool will require continual updating and maintenance for it to remain a useful and accurate device for the assessment of the aquaculture planning proposals. Therefore the Steering Group are required to assist in the development of a robust version control system.

4. Data Collected

Data collected so far include
- SEPA benthic surveys to date
- MS catch returns
- FOI dossier from MSS site inspections
- Escape and containment information from Scottish Government,
- Distance analysis from fishery to aquaculture site
- West coast stocking information by site from SEPA
- Fishing effort information from Trusts
- Five year average statistics for catches
- Water body physical properties from Scottish Government Locational Guidance documents
- Water body topography
- Environmental designations of water bodies from SNH and MarLIN

5. Software Requirements

The software required to run this database is MS Access 2007. This is the best and most commonly used software to use for incorporation and running of GIS models.

6. Local Knowledge

At present each Trust's database is identical. As a Steering Group we need to come up with ways of incorporating local knowledge, quirks of the fisheries and catchments and extra information that each Trust may feel is useful in having to hand when responding to their aquaculture planning applications. It is proposed that the Project Coordinators visit each of the Trusts to download the databases and ensure they work and also discuss with Trusts any extra information they want included in their datasets.

7. Database

At present there is a separate database for each Trust area. The database contains a front page which will appear when the database is opened and then there are labelled buttons to take you to a Fishery Information Page, Aquaculture Information Page and a Water Body Information Page. All the results from the above datasets have been analysed and organised within each of these information pages.

Within each of the information sections there are separate pages containing full size maps and graphs, each new page being accessed by a labelled button. Each page is easily navigable with drop down choice boxes and buttons.

At present there are no links (queries and visual basic macros) between the datasets on the pages so ease of rearranging the fields and formatting is possible. There is an Understanding the Data section included on each page as an aid to origins of each dataset and reminders for Administrator (me).

7.1 Front Page

This page will automatically appear when you open the database, ensuring that raw data held behind the database is secure. This data can only be accessed by those with Administrator privileges.

Below is the Front Page of the database.

All of the Information Pages are accessible from this screen using labelled buttons.

7.2 Fisheries Information Page

Below is the Wild Fisheries Information Page of the database.

As you can see all data choices are made using drop down combo boxes with the information appearing in the corresponding list boxes. All information pages can be accessed from here also. The fishery map and historic catches graph are accessed by pressing a button. The data here is presented by fishery.

The five year average dataset is used to measure the economic value of the fishery as described by the Scottish Assessors. This shows the data in terms of high value and low value fisheries as calculated by catch return data.

The Declining/Improving Salmonid populations are divided into Sea trout and Salmon catches by fishery and basic trend analysis shows whether the five year average figures is representative of the salmonid populations. This dataset is not robust enough to use independently so each Trust has been asked to provide a description of fishing effort, pressures such as poaching and netting and whether the fishery is let commercially or not.

The Biomass information corresponds to the nearest aquaculture marine site to demonstrate the total biomass at X km away and basically the fisheries that have aquaculture sites on their doorstep at present.

From this information page it helps to give an appreciation of the economic value of the fishery, the total aquaculture biomass at a given distance, the number of fish farm sites in the vicinity of the fishery and whether the salmonid populations at present accurately reflects the catchment pressures and the historic and futuristic capacity of the fishery.

There are trends already showing here and the next step is identifying the most at risk fisheries, least at risk fisheries and the stretches of coastline that would be less critically impacted by a new aquaculture development (see open DC model button).

7.3 Aquaculture Information page

Below is the Aquaculture Information Page of the database.
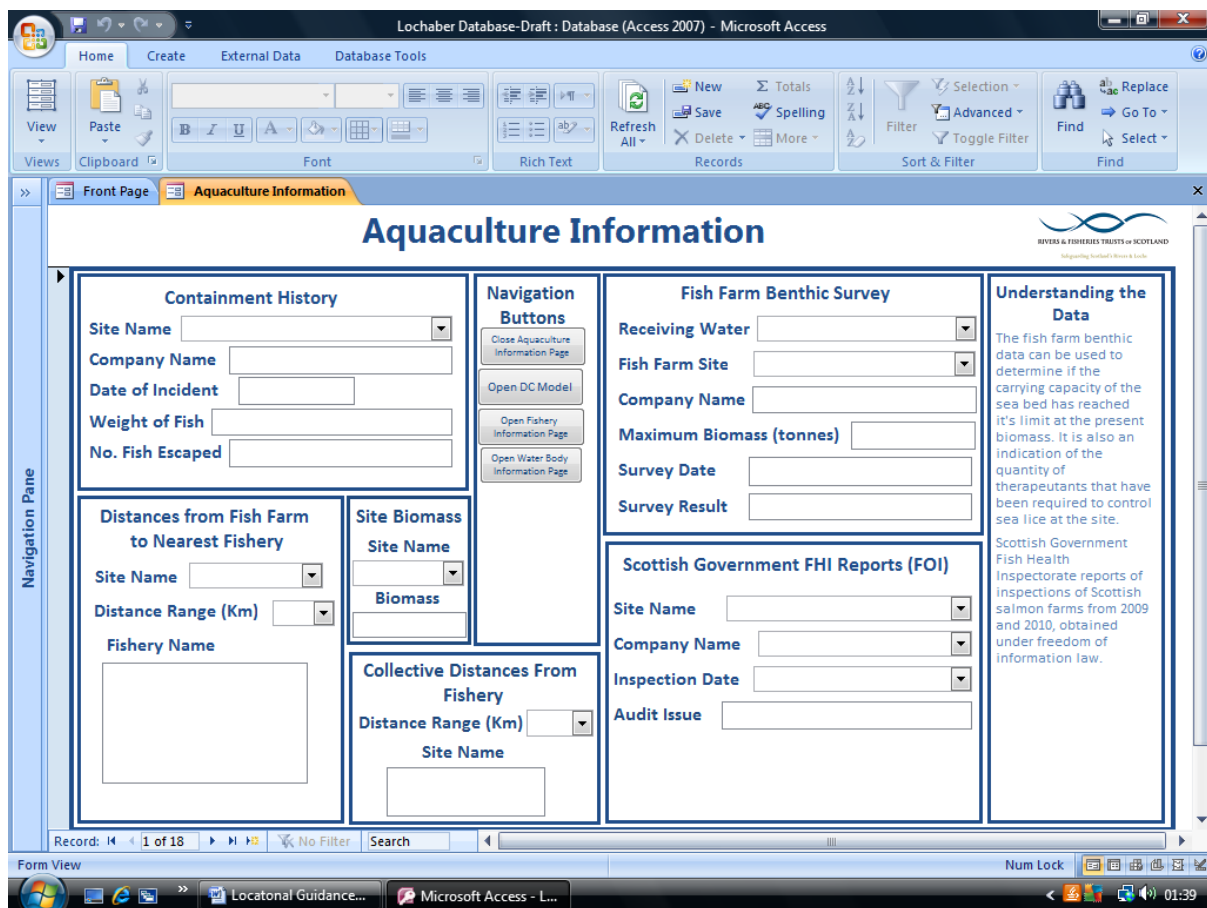
The Containment History dataset is from the Scottish Government and this shows all breaches of containment and supporting information by site since 2001.

The Biomass Information was supplied by SEPA and again this is on a site by site basis.

The Distance to Nearest Fish Farm is useful in determining what fish farms are nearest to the fishery and the Collective Distance to Fishery dataset allows you to see from increasing distance all the fish farms that are nearest to all the fisheries.

The Fish Farm Benthic Data was again supplied by SEPA and this is a good indication of the carrying capacity of the fish farm foot print at the present biomass. If the benthic sample shows a consistent unsatisfactory result then really the site has reached the biomass it can environmentally cope with. This was organised by receiving water mainly because some water bodies contain more than one site and if all sites within a water body are failing then aquaculture in the area could be causing a wide spread deterioration of the sea bed.

The Freedom of Information dossier from Scottish Government fish farm inspectors audits was added as it indicates fish husbandry (sea lice) and general housekeeping (record keeping) performance.

Again as with the Fishery Information Page this page shows up some patterns and trends also. If you look at each fish farm site over all the data sets you begin to see indications of what sites may be deemed high risk and are candidates for relocation or for having their biomass capped or even reduced. If you then look back at their nearest fishery, trends appear that again support at the risk fisheries. You also see the sites that consistently perform well, have no wild fishery neighbours and thus would be considered for expansion and development with low risk to the salmonid populations. Obviously migration routes of salmonid populations would need to be known also.

7.4 Water Body Information Page

Below is the Water Body Information Page of the database.

Water Body Physical Properties and Water Body Characterisation was compiled to ensure the optimum situation of a fish farm site. All this is explained in the Understanding the Data section on this page.

The Water Body and Topography dataset provides information on the fjordic shape of a loch, which is said to influence flushing, and sea lice transportation, and the orientation of the loch which is said to increase the water body's susceptibility to sea lice infestation.

The Water Body Environmental Designations dataset shows whether a water body has an SAC attached to it and whether Maerl beds are present. Any other environmental designation information will be added also.

7.5 Input New Data Page

This page will be useful when new sites are developed and data can be added into existing dataset. It is not developed yet.

8. Risk Assessment

This is one of the most crucial aspects of the database so a whole section is being dedicated to its development. Risk assessment is carried out in all industries and walks of life. A complicating issue for environmental risk assessment is the lack of an easily defined measure of what constitutes *harm* to the environment. In some cases definitions of environmental damage are laid down in statute, but in others appropriate criteria will need to be selected on the basis of scientific and social judgments.

Firstly, it is imperative to establish what the problem is and that is the crux of this project, declining salmonid populations. To start the risk assessment process a useful concept to think about is the SOURCE ➡ PATHWAY ➡ RECEPTOR model. In this model the PATHWAY between a hazard SOURCE and a RECEPTOR are investigated. If no PATHWAY exists then no risk exists!

So what is the SOURCE, PATHWAY, RECEPTOR relationship? The SOURCE is where all identified hazards originate from. In the case of this project there are three SOURCES, the fishery, the fish farm site and the wider catchment i.e. the water body. The RECEPTORs in this case is the water body and the fishery. The PATHWAY is the linkage by which the RECEPTOR could come into contact with the SOURCE. This is an environmental risk assessment process so several permanent PATHWAYS exist, the sea and tide, the wind and lastly sea lice infected escaped and contained farmed Atlantic salmon and introgression.

SOURCE	PATHWAY	RECEPTOR
FISHERY		FISHERY
FISH FARM SITE		WATER BODY

WATER BODY

A very basic Risk Assessment Page has been compiled. Each of the hazards have been identified and nominally scored. No weightings or categorisations have been carried out at this stage. Each Information page has its own section and on completion of the assessment a score will be generated. This score will fall into one of three categories, low risk, medium risk and high risk.

See below the Risk Assessment Page of the database.

8.1 Hazard and Risk Terminology

One of the difficulties with the concept of risk is that it relates to common experiences for which a language has been developed across a diverse range of disciplines and activities. It is important to set out clearly the way that the terms *hazard* and *risk* are used here:

hazard - a property or situation that in particular circumstances could lead to harm.

risk - a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

8.1.2 Hazard Identification

The first stage in risk assessment is the hazard identification. Identification of primary hazards has been carried out. Secondary hazard identification has not been carried out at this stage, this is where spin off hazards occur in relation to the primary hazards i.e. fish escape due to seal attack (primary hazard), escaped fish suspected of having a notifiable disease (secondary hazard). Below is a list of the primary hazards identified so far from the database. Included in this also is consideration towards assigning weightings to the assessment scores.

8.1.2.1   Wild Fishery Hazard Identification

- Declining catch trends at a fishery not related to low fishing effort i.e poor cumulative water quality in the river, susceptibility of fishery to low rainfall and poor management of the fishery, these are considerations to take into account when ranking and weighting the risk score.
- Decreasing five year average as a measure of the economic value of the fishery (when assessing this category it would be very easy to state downward trend five year average is high risk and upward trend is low risk BUT what about if the low catch, downward trend fishery was never a highly productive fishery (even before aquaculture pressure)? What about the fishery that has the capacity to increase its catch statistics (historically productive) but has a poorly performing fish farm on its doorstep? Lastly what about the fishery that is highly productive, of high economic value and has no aquaculture pressures in its catchment?
- Aquaculture sites within close vicinity of the fishery
- Large existing biomass near by the fishery
- Seasonal variance of sea lice prevalence in areas without aquaculture pressure.

8.1.2.2   Aquaculture Hazard Identification

- Consistently poor benthic survey results
- Poor escape record
- Large existing biomass of site
- Site has a poor husbandry and housekeeping record
- Poor therapeutic success (treatment efficacy)
- No AMA, so possibly no synchronised treatments and fallowing

8.1.2.3   Water Body Hazard Identification

- Water body has environmental designations i.e SAC and WFD classification ('Good ecological status'), maybe not a true hazard but would affect ranking and weighting.
- Water body has fjordic shape
- Water body as a whole contains a large fish farm biomass
- Water body has a SW orientation

- Prevailing wind and tidal information indicates water body susceptibility to sea lice infection.

8.1.3   Risk Assessment Threshold Criteria

The risk threshold criteria are conditions that need to be met before the hazard can have an effect. If we look at the identified hazards above all can have associated risk threshold criteria.

Hazard Number	Identified Hazard	SOURCE	Risk Threshold Criteria
1	Catch trends at a fishery (not related to low fishing effort)	Wild Fishery	DOWN STATIC UP
2	Five year average as a measure of the economic value of the fishery	Wild Fishery	<50 50-100 100-200 200-300 300+
3	Aquaculture sites vicinity of the fishery (Km)	Wild Fishery	<5 5-10 10-20 20-30 30+
4	Existing biomass near by the fishery (tonnes)	Wild Fishery	<500 500-1000 1000-2000 2000-3000 3000+
5	Benthic survey results	Aquaculture	SATISFACTORY UNSATISFACTORY BORDERLINE
6	Escape recorded	Aquaculture	YES NO
7	Existing biomass of site (tonnes)	Aquaculture	<500 500-1500 1500-2000 2000-2500 2500+
8	Site husbandry and housekeeping record (FOI Dossier)	Aquaculture	YES NO
9	Therapeutic success (treatment efficacy)	Aquaculture	YES NO
10	AMA, so possibly no synchronised treatments and fallowing	Aquaculture	YES NO
11	Water body as a whole total fish farm biomass (tonnes)	Water Body	<500 500-1000 1000-2000

			2000-3000 3000+
12	Water body has orientation (SW)	Water Body	YES NO
13	Prevailing wind and tide	Water Body	?
14	Water body has shape	Water Body	FJORDIC NOT FJORDIC
15	Water body has environmental designations	Water Body	YES NO

8.1.4   Risk Assessment Weighting, Ranking and Scoring

This is a technique of assigning the order of relative importance of a particular hazard and risk threshold criteria and applying a multiplier to reflect this importance.

For example if we look at the identified hazards associated with catch numbers (Hazard no. 1), aquaculture site in close vicinity (Hazard no. 3), benthic survey results (Hazard no. 5), escape recorded (Hazard no. 6) and their associated risk threshold criteria of <50, <5 Km and YES respectively they would all score as HIGH RISK. Then we start to get a picture of why a fishery may be decling, poorly performing fish farm site

So either by ALL identified hazards or by SOURCE the identified hazards should be ranked by order of importance. This requires discussion with the steering group.

To ensure that the 'highest value' or 'most important' hazards influence the final risk score a multiplier called a weighting must be added. This requires discussion with the steering group.

Hazard Number	Identified Hazard	SOURCE	Risk Threshold Criteria	Risk Score	Weighting	Risk score x Weighting=Final Score
1	Catch trends at a fishery (not related to low fishing effort)	Wild Fishery	DOWN STATIC UP	5 3 1		
2	Five year average as a measure of the economic value of the fishery	Wild Fishery	<50 50-100 100-200 200-300 300+	5 4 3 2 1		
3	Aquaculture sites vicinity of the fishery (Km)	Wild Fishery	<5 5-10 10-20 20-30 30+	5 4 3 2 1		

4	Existing biomass near by the fishery (tonnes)	Wild Fishery	<500 500-1000 1000-2000 2000-3000 3000+	1 2 3 4 5		
5	Benthic survey results	Aquaculture	SATISFACTORY BORDERLINE UNSATISFACTORY	1 3 5		
6	Escape recorded	Aquaculture	YES NO	5 1		
7	Existing biomass of site (tonnes)	Aquaculture	<500 500-1500 1500-2000 2000-2500 2500+	1 2 3 4 5		
8	Site husbandry and housekeeping record (FOI Dossier)	Aquaculture	Issues Found No Issues Found	5 1		
9	Therapeutic success (treatment efficacy)	Aquaculture	YES NO	1 5		
10	AMA, so possibly no synchronised treatments and fallowing	Aquaculture	YES NO	1 5		
11	Water body as a whole total fish farm biomass (tonnes)	Water Body	<500 500-1000 1000-2000 2000-3000 3000+	1 2 3 4 5		
12	Water body orientation (SW)	Water Body	YES NO	5 1		
13	Prevailing wind and tide	Water Body	?			
14	Water body has shape	Water Body	FJORDIC NOT FJORDIC	5 1		
15	Water body has environmental	Water Body	YES NO	5 1		

	designations					

8.1.5   Final Score

The database will calculate a final score for the risk assessment. This final score requires validation. Notionally the final score could appear as a traffic light configuration where

1-20 LOW RISK
21-36 MODERATE RISK
37-60 HIGH RISK

8.1.6   Risk assessment Output

The database has the capacity to produce a report type document that can be used as an appendix to the aquaculture planning responses. The report can contain anything from a catchment map, the risk assessment and the final risk score and any supporting information that maybe out with the scope of the database.

Rivers and Fisheries Trusts of Scotland

Proposal to Marine Scotland

West Coast Wild Fisheries:

Aquaculture Mitigation, Management and Liaison Programme

1. Purpose:

This paper sets out a proposal to Marine Scotland to support a programme of action to be undertaken by Rivers and Fisheries Trusts of Scotland (RAFTS) and its member fishery trusts and partner district salmon fishery boards on the west coast of Scotland to support the better coordination and management of wild fisheries and stocks with the aquaculture industry.

The proposal recognises both the economic importance of the aquaculture industry and the current and potential economic and cultural importance of healthy and vibrant wild fisheries and populations on the west coast. As such the programme sets out to support and inform the better integration and alignment of these sometimes competing and conflicting sectors to maximise the total economic, cultural and societal benefits of having both strong aquaculture and wild fishery activities to the west coast of Scotland.

This proposal has been prepared by RAFTS and its participating members in order to maintain some of the positive aspects of the Tripartite Working Group (TWG) (http://www.tripartiteworkinggroup.com/content.asp?ArticleCode=2) programme, which will close at the end of 2010/11, and set out a number of further targeted work areas to support policy development and practical action consistent with the ethos of the new strategy for Scottish aquaculture "A fresh start: The renewed strategic framework for Scottish aquaculture" (http://www.scotland.gov.uk/Publications/2009/05/14160104/0).

2. Introduction, context and priorities of proposal:

Aquaculture is a contentious and divisive issue on the west coast of Scotland and has caused conflict between wild fish and aquaculture interests for many years.

2.1   Tripartite Working Group and Scottish Aquaculture Framework
The TWG process and activities has made a number of positive contributions to informing the debate and dialogue between the wild fish and aquaculture sectors and the support of the Scottish Government has been crucial in maintaining this work. In addition, the renewed Scottish Aquaculture Framework provides further impetus and priority to improve practice and develop policy on issues such as farm location and licensing, prevention of escapes and control of sea lice levels.   However, fundamental disagreements still remain despite the relationships and understanding developed, the data gathered, the Area Management Agreements (AMA) now in place and the policy commitments of the Scottish Aquaculture Framework.

As such this proposal seeks to support the delivery of the vision and guiding principles of the Scottish Aquaculture Framework (see **Appendix 1**).

Specifically the proposal will:

- Help to identify optimal and sub-optimal locations of aquaculture operations where these activities can best proceed with reduced or acceptable risks to wild fish populations and fisheries;

- Support the sustainable growth of the aquaculture industry by providing information that underpins the economic, environmental and social principles of sustainable development by:
    - Helping to support and direct growth to appropriate locations via the provision of locational guidance in terms of wild fish and fisheries;
    - Supporting the reduction of risk to the environment via lice monitoring and dialogue with the sector to negotiate local accommodations;
    - Allowing aquaculture to provide strong social benefits in the areas in which it operates having identified preferred and non-preferred locations for development and operation.

- By the use of applied genetics tools and a strategic sampling programme identify when or if genetic material of aquaculture origin is present in sampled wild fish populations to inform the need for further improved stock retention measures and demonstrate conclusively when such genetic ingress takes place.

2.2   Wild Fish Priorities and Strategic Objectives
Whilst RAFTS and its members recognise the importance and permanence of the aquaculture industry to Scotland, particularly on the west coast of Scotland, and of the need for the industry to sustainably develop further in the future, this proposal is developed recognising our own view and perception of the industry and its relationship with wild fish and fisheries.

We view the industry, its development and practice under three general descriptors:

I.   Protection of Sensitive and High Value Sites
There are many locations and sites on the west coast from which, although potentially available to aquaculture development, the industry is currently absent and where we view sensitivities and environmental risks to be so high that development in such areas should be prevented.

The development of locational guidance and sensitivity analysis would identify such areas whist at the same time identify areas where further development is, in our view, possible within acceptable risk levels. This analysis will be made available to the Marine Spatial Planning system to support and inform their decision making processes.

II.   Improvement of Practice and Management at Existing Sites
Aquaculture operates in many locations where the industry is considered to be immovable and should be considered permanent. In such locations we are keen to seek improvements in management practice and environmental protection. Such improvement would include the retention of fish in sites and the reduction of escapees, the further development and harmonisation of lice control and fallowing and rapid response to elevated sea lice levels on a local basis.

The implementation of the Scottish Aquaculture Framework will take forward policy to improve stock retention and reduce numbers of escapes whilst, we feel, that the provision of post smolt lice counts, for example, will support the refinement and improvement of local management practice in conjunction with lice counts undertaken by, and on, the farms themselves. The application of robust

genetic tools and markers will demonstrate conclusively when and if aquaculture genetic materials are detected in wild fish samples.

III. Relocation and Reallocation of Biomass from Inappropriate Sites
The wild fish sector holds the view that there are a number of aquaculture operations active in sites and locations where the site is so sensitive and the impact so great that available mitigation, management and best practice cannot reduce these risks and impacts to acceptable levels in terms of wild fish and fisheries. In such instances it is our view that some sites should be relocated and/or have biomass and production reallocated elsewhere.

However, we recognise that this must and can only happen on a planned and prioritised basis and will require the support of Government and the aquaculture industry itself. Currently there is not strategic intention or commitment to undertake site relocation or biomass reallocation. The locational guidance and site prioritisation work of this proposal could, however, inform, in a logical and evidence based manner, decisions as to the current and future locations of aquaculture development and of the levels of production that may be most appropriate were such a process to be inititated.

2.3   Priorities of Proposal
RAFTS and fishery trusts wish to contribute constructively to improve aquaculture policies and practices, improve relationships between wild fish interests and aquaculture, and enhance the sustainability of both the aquaculture industry and the long standing and valuable wild fish and fisheries of the west coast of Scotland.

Within that context this proposal seeks to deliver activities which:

- Transparently gather and report data and information;

- Seek to reduce or support the reduction of aquaculture impacts on wild fish and fisheries and which lead to better understanding and recognition of these impacts and interactions;

- Develop policy and guidance on fish farm location sensitivities and priorities in respect of wild fish and fisheries in order to:
  - Support better informed responses to aquaculture planning applications made by wild fish interests; and
  - Provide guidance to the Marine Spatial Planning process, planners more generally and other policy and decision makers so that the concerns of wild fish bodies are more clearly expressed, known and understood and can be incorporated and/or considered in planning and policy related decisions.

- Gather and provide data that, in conjunction with locational guidance, will support the consideration of most appropriate aquaculture site locations and realignments or targeted reallocation of biomass and production from sensitive to less sensitive locations in the future.

- Gather and provide data to inform local management of aquaculture operations and maintain and develop good local relationships and dialogue between aquaculture and wild fish bodies to support the negotiation of local agreements and protocols using this data and information.

- Via a strategic programme of sampling and screening and the application of cost effective and robust genetic tools will allow the identification of genetic material of aquaculture origin in wild

fish populations. This will support the ongoing development of improved containment regimes and demonstrate conclusively when genetics of aquaculture origin are present in wild fish populations.

3. Participating bodies, coordination of approach and governance

3.1   Participating bodies and coordination of approach
This application is submitted by RAFTS which is the membership body for all of Scotland's fishery and rivers trusts and foundations. A number of RAFTS members and related District Salmon Fisheries Boards will be engaged and support the programme. In the main, work will be undertaken by the participating fisheries trusts.

The participating fishery trusts and boards are:
• Argyll Fisheries Trust
• Argyll District Salmon Fishery Board
• Lochaber Fisheries Trust
• Lochaber District Salmon Fishery Board
• Wester Ross Fisheries Trust
• Wester Ross District Salmon Fishery Board
• Skye Fisheries Trust
• Skye District Salmon Fisheries Board
• West Sutherland Fisheries Trust
• Outer Hebrides Fisheries Trust
• Western Isles Salmon Fisheries Board

In preparing this submission RAFTS and its partners are conscious of the need to contribute both strategically and locally to the policy and practical interactions between wild fish interests and aquaculture throughout the programme of work.

Therefore, we confirm that work will be:

• Coordinated across and by participating partners
The projects and work streams will be coordinated and have application across the whole of the affected west coast. This proposal brings together local activities into a single programme to ensure that local and strategic relevance and application is maximised.

• Undertaken against shared priorities and coordinated by shared / common staff
The priorities of the application are shared across the participating trusts although the level of involvement from each may vary from trust to trust. Project staff applied to the project will be, equally, the staff of all the participating trusts and their job is to deliver, or ensure the delivery of, the whole programme of work. They may be employed by local trusts, and are certainly likely to be based within local trusts, but they do not work for any trust specifically.

Job descriptions will be prepared to reflect the suite of activities proposed in the programme and the shared nature of the staff regardless of base location.

3.2   Governance

A Steering Group will be formed to oversee and guide the work programme. RAFTS currently has an Aquaculture Working Group drawn from its members and the bodies in **3.1** (above) and members from this existing group would fulfil this Steering Group function. However, in order to ensure that progress and activities proceed in line with agreed periods and to develop strong working relationships between Marine Scotland, RAFTS and the wild fish partners, Marine Scotland would be invited to provide Steering Group representation.

Financial governance and reporting would be provided by RAFTS and it is anticipated that funds awarded would be received by RAFTS and distributed and used on project activities. A restricted fund in RAFTS accounts would be formed to ensure appropriate financial reporting.

4. Programme activities:

RAFTS and the programme partners have considered carefully the current activities of the TWG, their own priorities and objectives for the interaction and relationship between wild fish and fisheries and aquaculture and the Scottish Aquaculture Framework in developing this proposal.   As a result this proposal and submission contains a suite of programme activities which bring together the shared priorities of these policy drivers and priorities and recognise the positive contribution made to current practice and relations by the TWG.

The activities proposed are described in general terms in **Table 1** (below).   Indicative costs and delivery mechanisms are provided against each activity.   Within the overall programme some flexibility would be retained to relocate funds within the programme where agreed by the Steering Group. A more detailed work programme would be prepared by staff for consideration by the Steering Group in due course.

We intend that the programme would be delivered by fishery trusts and supported by a core of 2 shared programme staff. These staff would be responsible for the equitable delivery of the work programme across the area, for the delivery of specific outcomes and for the coordination and reporting of tasks delivered by trusts or boards. For activities not undertaken directly by programme staff funding support would be provided to those bodies undertaking the activities; normally fisheries trusts or boards. In such areas we intend to add value to the activities by contributing funds directly or by making staff time available to complete tasks. All programme staff would be a shared resource with a shared responsibility for delivery of the work and tasks proposed.

5. Programme Costs

Indicative project costs are set out in **Table 1**. These costs would support the range of project activities proposed with participating trusts and other organisations making in kind contributions. We recognise that there may be costs in respect of equipment or data set purchase and these have not been specifically determined. However, the fund distribution set out is anticipated to provide sufficient flexibility to accommodate such purchases.

A shared staff resource of 2 fte will coordinate the work programme; provide necessary support to fishery trusts and to deliver reporting requirements. Project staff, RAFTS and the project partners will develop a work programme for 2010/11 for consideration and approval by the Steering Group.

A single year programme is now proposed reflecting the budget period likely to be approved by the Scottish Government. However, this single year proposal should be considered to be part of a longer

term 3-year programme of work. As such although 1 year project outcomes are presented these would provide maximum benefit by their continuation and application beyond the single year programme period.

6. Next steps

This proposal is submitted by RAFTS on behalf of the project partners identified in section 3 and is intended for consideration by Marine Scotland within the forthcoming Comprehensive Spending Review. It is revised from an October 2010 draft following initial consideration by Marine Scotland and subsequent feedback provided. RAFTS would be pleased to provide further information or clarifications as required or to discuss the proposal and its costings at any time.

Callum Sinclair
RAFTS
08 February 2011

Table 1: Summary aquaculture projects

No.	Title	Description	Mechanism	Output	Cost
1	Programme Staff Resource	• x2 fte staff employed either by RAFTS or host fishery trusts with responsibility for: • Development of locational guidance and zones of sensitivity protocols (see 1a below); • Coordination of post smolt sweep netting programme undertaken by trusts against strategic sampling programme and to standard methodologies (see 1b below); • Ensuring that local AMA groups continue to meet as required locally	• Staff employed by RAFTS or host trusts (tbc); • Governance by Steering Group with local direction provided by host trust; • Overall work plan and programme to be develop and approved by Steering Group; • Financial governance and accounting provided via RAFTS.	• See 1a, 1b and 1c; • Coordinated and reported work programme	**£100k** including salary, overheads and expanses)
1a	Locational guidance and zones of sensitivity	• Development of locational guidance in GIS and hard copy format for distribution to planners and other policy / decision makers; • Develop risk criterion for wild fish / fisheries and apply to determined zones across west coast; • Consider inclusion of other risk and sensitivity criterion e.g. landscape, biodiversity and visual impact; • Application of GIS layer with aquaculture developments to identify most sensitive sites for potential reallocation or relocation of production and potential areas for aquaculture expansion.	• Undertaken by programme staff with expertise in GIS and risk modelling; • Partnership with academic institutes e.g. Institute of Aquaculture, Stirling, Marine Scotland Science; • Potential purchase of GIS layers and software; • Partnership and liaison with end users e.g. planners in development and scoping of appropriate output • Consultation throughout development of guidance with other project partners to ensure an agreed product output is delivered.	• Locational guidance in GIS format; • Ranking of sites / zones across the west coast in respect of sensitivity to wild fish interests; • Overlay with aquaculture developments.	Within staff budget (see 1. Above) although some data or equipment costs may be additional.
1b	Strategic programme of post smolt sweep netting and lice counts	• Identify strategic network of key sweep netting and post smolt monitoring locations across area refined from existing TWG sampling points (may be max of 20 sites included based on 3-4 per trust area) and in consultation with Marine Scotland Science;	• Netting and field work / counts undertaken by fishery trust biologists; • Count reporting to programme staff and farms by trust biologists and	• Immediate, monthly and annual publication of lice loads at monitoring sites; • Provision of information	Coordination and reporting within staff budget (see 1. Above) with **£75k** allocated

		• Undertake post smolt sweep netting at network of sites to agreed and standard protocol (frequency of samples, method, reporting timetables, lice counting etc); • Application of standard Scottish Fisheries Coordination Centre (SFCC) method, use of standardised lice count protocol and application of counts against threshold lice levels to rank risk;	compilation and publication of monthly and annual counts by programme staff; • Protocol and threshold levels identified and published prior to monitoring commencement; • Site network identified and published prior to commencement of monitoring and may be advised by external / academic partners to ensure robust network.	to farms to allow consideration of additional treatments if necessary and appropriate	to bodies undertaking sweep netting surveys
1c	Liaison between local wild fish and aquaculture AMA groups	• Maintain dialogue and liaison between wild fish and aquaculture bodies in trust operational areas; • Convene AMA group meetings to discuss priority issues as required.	• Convening of meetings between wild fish and aquaculture interests locally to discuss and take forward local management strategies.	• Maintain and develop constructive and working relationships between local wild fish and aquaculture bodies established through AMA; • Application of local accommodations between sectors as and when agreed.	Within staff and expenses budget (see 1. Above)
2	Programme of genetic sampling and analysis	• Programme of sampling of juvenile and adult migratory salmonids from rivers across west coast in order to identify natural genetic structure and identify evidence of aquaculture genetic ingress to these populations; • Development and purchase to river group or area specific SNP chip for west coast systems to allow genetic analysis to be undertaken at appropriate resolution; • Analysis of genetic materials and annual reporting; • For expanded summary of basis of programme see **Appendix 2**.	• Sampling undertaken by fishery trust biologists against agreed strategy and network as advised by RAFTS Molecular Geneticists; • Analysis and reporting undertaken by RAFTS Molecular Geneticists based at Marine Scotland, Pitlochry; • SNP chip developed by RAFTS Molecular Biologists from programme of initial sampling and analysis.	• Annual programme of sampling and genetic analysis; • Annual reporting of genetic stocks and identification of "damaged" genetics when / if aquaculture ingress identified; • SNP chip allows powerful genetic analysis of west coast wild fish populations on an ongoing basis;	**£40k** (see estimated costs in **Appendix 2**)

				• Management responses can be identified to protect vulnerable population or genetic structures.	
3	Programme management and coordination	• A programme of this scale requires effective coordination and management in order to ensure that dispersed staff work to a combined work programme across the whole programme area; • Workload planning and task scheduling and programming will be required to ensure activities are delivered equitably.	• The overall work programme will be overseen by a Steering Group; • Management and leadership of the Steering Group as well as a range of provisions for staff administration will be required; • Programme management will be provided by RAFTS with other staff costs and overheads considered within overall activity costs above; • Local supporting management provided by host trusts and some contribution towards additional hosting costs may be considered and necessary.	• Effectively managed and coordinated work programme; • Effective management of staff; • Effective reporting of outputs.	**£10k**
TOTAL FUNDING REQUIREMENT: **Year 1: £225k**					

<div align="center">**Appendix 1:**</div>

<div align="center">**A Fresh Start: The renewed Strategic Framework for Scottish Aquaculture**</div>

The vision and guiding principles of the Scottish Aquaculture Framework are reproduced below.

Vision and Guiding Principles:

"We want industry to operate in optimal locations, with access to good growing waters, providing jobs in local communities and acting responsibly, respectful of environmental considerations and the needs of other stakeholders"

Our Shared Vision

Scotland should have sustainable, growing, diverse, market-led and profitable farmed fish and shellfish industries, which promote best practice and provide significant economic and social benefits for their people, while respecting the marine and freshwater environment. The industries will contribute to the overall vision for Scotland's marine environment of "clean, healthy, safe, productive and biologically diverse seas managed to meet the long-term needs of nature and people".

Sustainable Growth

The aquaculture industry is ambitious to grow but growth must be sustainable. Growth must be within the carrying capacity of the aquatic environment and balanced against the needs of others.

Economic principle: Farmed fish and shellfish industries should be able to fulfil their ambitions for growth, be market-led with a focus on quality leading to improved economic returns for the industry and greater market stability.

Environmental principle: Farmed fish and shellfish industries should act as a good neighbour by minimising risks to biodiversity and impact on the environment and other aquatic activities. Growth should be within the carrying capacity of the environment.

Social principle: Farmed fish and shellfish industries should underpin strong local communities and provide benefits to those communities.

Appendix 2:

Aquaculture related genetic tool development, sampling and analysis

Due to recent progress and developments in the application of genetic tools in respect of Atlantic salmon it is increasingly possible to identify the region, river and, in some cases, the location within a river of origin of fish from tissue sample analysis. In addition it has recently become possible to identify genetically, and in a cost-effective manner, whether any given fish sample is of wild or aquaculture origin. Therefore, we can now sample fish from across west coast catchments to identify if, or the extent to which, genetic material of aquaculture origin is present in wild fish populations.

By being able to identify the presence or absence of aquaculture origin genetic material the extent to which current management practice may need to be refined can be considered. Initially sampling will identify whether each fish sampled is of wild or farmed origin. However, after the tool is developed and initial analysis is completed, it may also be possible to identify samples where aquaculture origin genetic material is still present after initial introgression in the past, perhaps after 1 or more generations of further selection and breeding with the populations as a whole.

Although this is a stand-alone unit of work it will complement other genetic work currently underway within Marine Scotland Science.

This part of the programme will:

- **Develop a cost effective and Scotland specific tool to allow wild and aquaculture strains to be identified from tissue sample analysis**
  RAFTS, Marine Scotland Science and individual fisheries trusts have worked collaboratively in respect of the FASMOP (Focusing Salmon Management on Populations), SALSEA (Salmon at Sea) and POPMOD (Population Modelling of Atlantic salmon) salmon genetic projects over the past 2 years. Such integrated working has allowed both management objectives and scientific research goals to be addressed in a cost-effective way.

  In a similar way the development of a tool to allow identification of fish of wild and aquaculture origin again addresses both management and research aims. Development of a Scottish specific tool will focus on the optimisation of a genetic tool which has been developed, and is at present working, in a Norwegian setting. Work will focus on confirmation that, as is confidently expected, the tool is of use in a Scottish situation; and further that, as again might be expected due to the significant genetic differences between Scottish wild fish and farmed fish of Norwegian origin, the cost-effectiveness of the tool in a Scottish situation can be significantly increased.

  To complete the development of this tool x2 sites on x3 rivers will be sampled to prepare x2 SNP (Single Nucleotide Polymorphisms) plates. This will allow a Scotland (west coast) specific suite of markers to be identified that best reflect the genetic variation of our rivers and which; therefore, allow the identification of aquaculture-origin genetic material in a cost-effective manner in future screenings. Each plate will cost circa £6k to develop with a total cost of £12k.

- **Develop an annual sampling network across the west coast allowing catchment to be sampled systematically to assess the extent or presence of genetic materials of aquaculture origin**
RAFTS FASMOP Staff will work with trust biologists and Marine Scotland Science colleagues to develop a sampling network for use based upon the principle areas and catchments of concern, the results of the initial FASMOP work and the need for a robust pan west coast sampling network. The principal cost here will be staff costs associated with FASMOP staff and are estimated at £5k.

- **Support fishery trusts in the gathering of samples from an agreed sampling network across west coast catchments**
A total of 6 fisheries trusts will participate in a sampling programme in each year. Although the extent to which sampling is required in each area is likely to vary from trust to trust depending on the network agreed an average payment of £2k/trust is assumed to support this sampling effort in each year giving a total cost of £12k.

- **Provide resources for samples gathered to be analysed and results reported for prospective application in policy and management practice**
Samples gathered in each year must be analysed and the budgeted cost of analysis (including staff time and consumables) is £20/sample. The balance of the budget shall be used to support the analysis of samples taken; with a total budget of £40k and an allocated expenditure of £29k a total of £11k remains for sample analysis. This equates to 550 individual samples taken and analysed from approximately 20 locations in year 1.

The total cost of this genetics component of the programme is estimated to be £40k.

RAFTS / Marine Scotland

February 2011

Managing Interactions Aquaculture Project

Steering Group Meeting 22/06/12

Paper 5: MIASG Proposed Approach to use of Catch Statistics

Purpose:
The project and the Steering Group have previously considered and agreed in general terms that available catch statistics should be considered within the Locational Guidance work-stream of the Managing Interactions Aquaculture Project.   This paper sets out the series of ways by which the project team propose to present catch statistics within the project outputs. An example District, Loch Roag (which was historically a district itself but is now part of the Western Isles DSFB), has been used to present an example set of analyses which would initially be replicated for all Districts in the current study. These analyses can be replicated for systems within Districts if verifiable and robust catch statistics are available at these more local scales.

The paper also proposes where within the Locational Guidance piece of work the analysis of catch statistics would be placed for Steering Group discussion and decision.

1.   Introduction

Catch statistics can be analysed in many different ways. This paper sets out an example suite of analyses for a single example area (Loch Roag) for Steering Group review. For the purpose of this analysis the Loch Roag fisheries catch data for Salmon and Sea trout from 1952 to Present day, provided by Marine Scotland Science, Montrose, has been used.

2.   Analysis of Catch Statistics

For each District a standard set of analyses is proposed. These will be set out in the following sections. Initially this will be replicated for each District (as reliable time sequence data is available at the District scale) with the intention being to add further more local replicates of this analysis as and when data is available and verified.

2.1   Total rod catch trend analysis 1952-Present

For both salmon (salmon and grilse, retained and released) and sea trout an initial figure showing total catch over the 1952-Present time sequence will be prepared. Linear trend lines will be included.   This figure is shown as **Figure 1**.

2.2   Shorter Period Comparison Trend Lines

The project has discussed how to recognise the performance of the fishery now in relation to past performance. If an appropriate means of comparison the present day with a range of periods in the past can be determined then this will allow wild fisheries to represent a range of fishery states within planning processes. Most notably the current performance of a fishery could be:

- Less than historic performance

  Such fisheries could be presented as capable of recovery, currently damaged and worthy of restoration and protection to reinstate past performance.

- About the same as historic performance

  Such fisheries are performing much as they have always done and could be presented as worthy of protection to maintain functional fisheries.

- Better than historic performance

  Such fisheries could be presented as delivering increasing economic, social and natural heritage benefits and worthy of protection to secure these benefits for the future.

To begin to present the current catch against a range of historic catch periods it is proposed to present the 1952 data series with a total trend line (as per **Figure 1**) but with additional trend lines for 5, 15 and 25 year periods separately for both salmon and sea trout. This proposal, shown in **Figures 2 and 3**, would allow the fishery manager to begin to describe and place the current fishery performance in context over a range of historic periods.

Figure 1:   **Loch Roag Catch Statistics 1952-Present for Salmon (salmon and grilse, retained and released) and sea trout with linear trend lines**
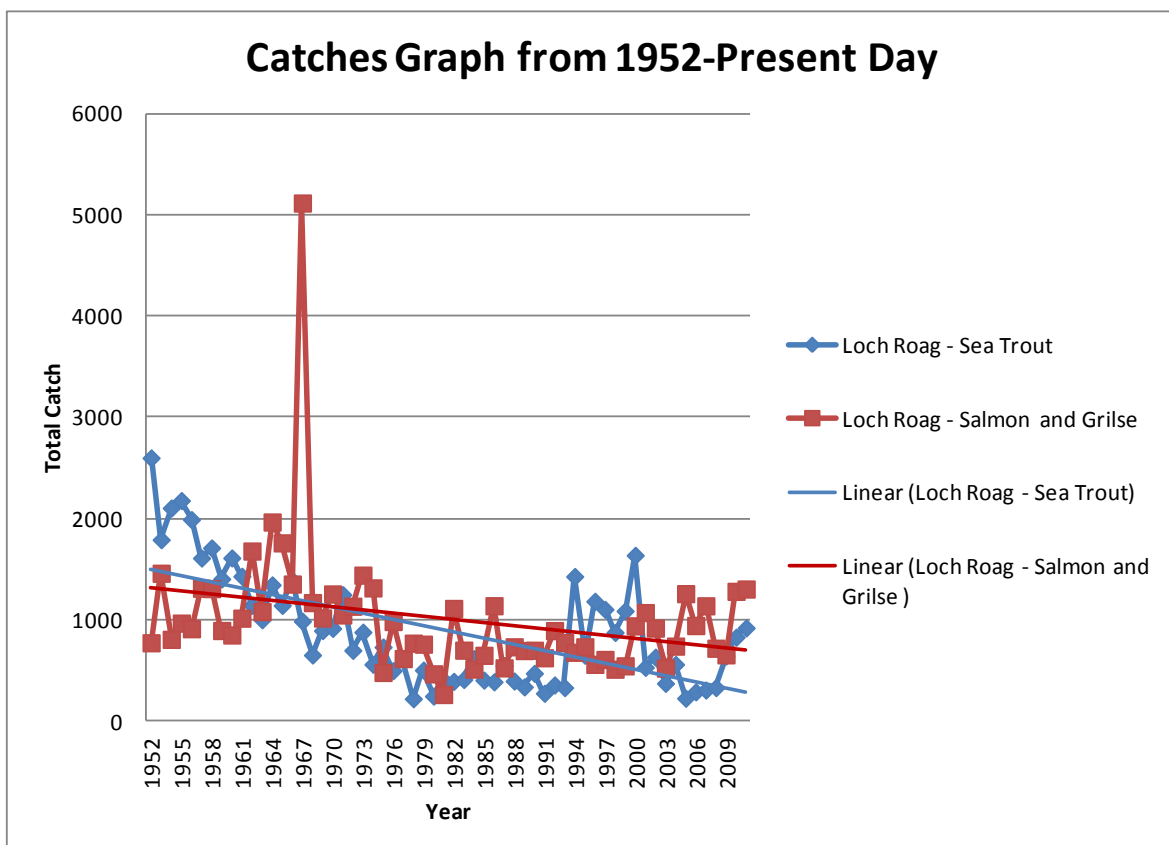
Figure 2:   Loch Roag Salmon Catch Statistics with 5, 15, 25 year and total period trend lines
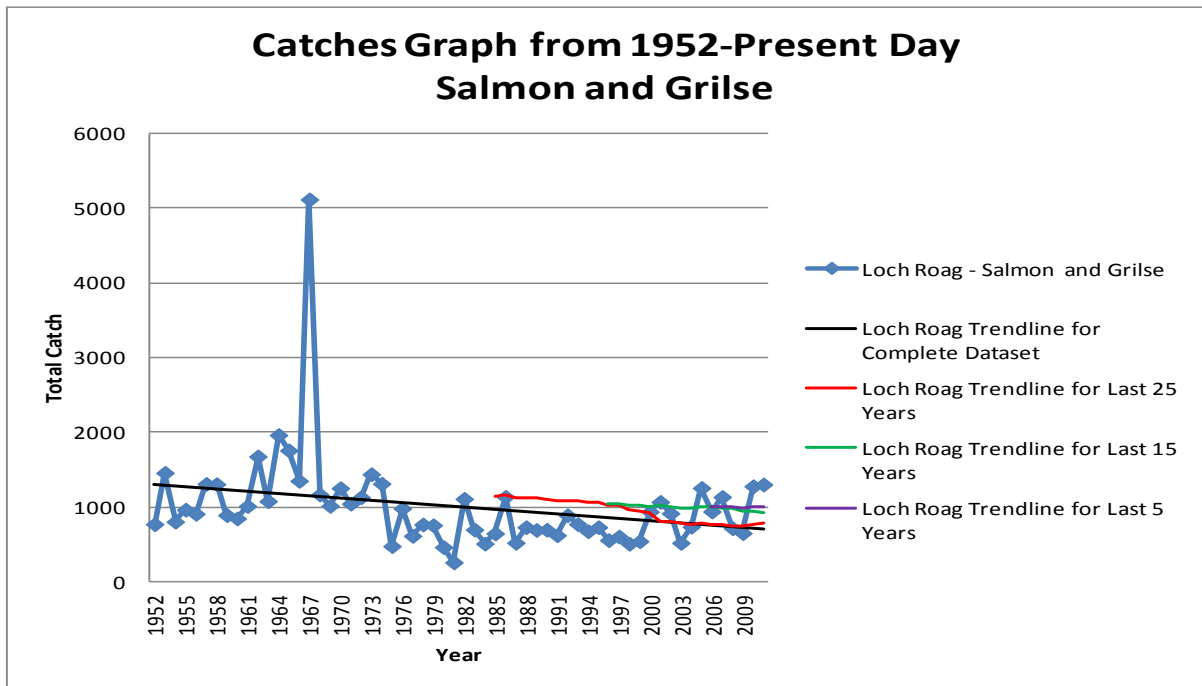
Figure 3:   Loch Road Sea Trout Catch Statistics with 5, 15, 25 year and total period trend lines
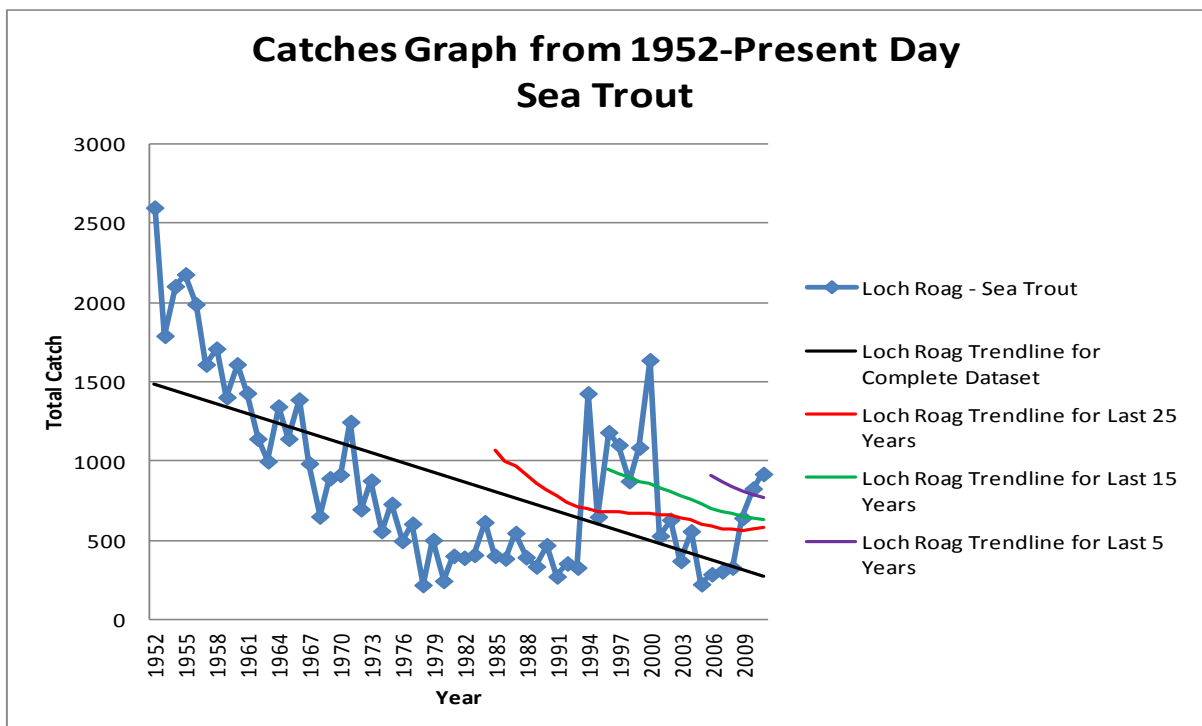
2.3   Average Catch Statistics Ratio Analysis From Range of Time Series Averages

Following from **Section 2.2** a further analysis is proposed to try to support fishery managers in representing and describing the current performance against average catch over longer historic periods. The intention of this exercise is to allow fisheries currently underperforming to be prioritised for restoration and protection, to allow fisheries performing much as they have always done to be prioritised for protection due to their current normal performance and to allow fisheries where current performance is improving or better than in the past to be prioritised for protection due to the economic and other benefits they provide.

The basis of the calculation and analysis is set out below:

1. Calculate 5 year average for the last 5 years;
2. Calculate average catch for the last 15, 25 and 50 years;
3. Calculate ratios of 5 year average against each of the 15, 25 and 50 year average figures;

I.   For each ratio if the current average is <0.9 then the output result is HIGH indicating that over the comparison period the fishery has underperformed / declined compared to the current 5 year average.

II.   For each ratio if the current average is between 0.9 and 1.1 then the output result is MODERATE indicating that over the comparison period the fishery has been stable compared to the current 5 year average.

III.   For each ratio if the current average is >1.1 then the output result is LOW indicating that over the comparison period the fishery has outperformed / improved compared to the current 5 year average.

These x3 ratios in themselves could be used by fishery managers to help to describe the fishery now when compared to historic periods of catch and it may be appropriate to simply generate these figures alone. However, it may be useful to combine these ratios together to allow an overall fishery performance statement to be provided. This could be generated using average figures of the ratios calculated and stating a level of performance which we ascribe to be "over-performing / improving", "stable / consistent" or "under-performing / declining". A proposal of this sort of system is set out below.

Take an average of the x3 calculated ratios.

I.   If that average is <0.9 then fishery is under-performing / declining around long term averages.
II.   If that average is 0.9 – 1.1 then fishery is showing stable / consistent performance around long term averages.
III. If that average is >1.1 then fishery is currently over performing / improving around long term averages.

Table 1 sets out how the analysis described in **Section 2.3** could be presented.

Table 1: Summary of Average Catch Statistics Ratio Analysis and Overall Fishery Performance (Loch Roag)

Loch Roag Fishery District						
Time Sensitive Averages				Ratio	**Time sensitive Output**	**Overall Fishery Output**
Salmon 5 Year Average	1019	15 Year Average	877	1.16	LOW	**Over-performing / Improving**
		25 Year Average	803	1.27	LOW	
		50 Year Average	997	1.02	MODERATE	
Sea Trout 5 Year Average	605.4	15 Year Average	689	0.88	HIGH	**Under-performing / Declining**
		25 Year Average	652	0.93	MODERATE	
		50 Year Average	691	0.88	HIGH	

3.   Application of NASCO Rod Catch Assessment Tool and the Ranking Seasonal Catches

It has been established that trends in the rod catch of salmon can be used as an index of the trends in salmon abundance. This methodology is published by the Scottish Government (Fisheries Management Focus Area Report EU-UK Scotland NASCO IP (08) 02). It should be noted that the NASCO Rod Catch Tool- Salmon Catch Data is divided up into Spring, Summer and Autumn run time components (see **Table 2**).

Figure 4 and **Table 3** demonstrates the process for applying this tool and generating assessments. **Table 4** and **Figure 5, 6 and 7** set out the results complied from this process for Loch Roag.

Note: **Figures 5, 6 and 7** show plot of 1952-Present catch sequence. The final version supporting the NASCO rod catch assessment analysis may show only the last 20 years of data.

Table 2: Periods of Seasons Applied in NASCO Rod Catch Assessment Tool

STOCK COMPONENT	PERIOD
SPRING	FEBRUARY – MAY INCLUSIVE
SUMMER	JUNE – AUGUST INCLUSIVE
AUTUMN	SEPTEMBER – OCTOBER INCLUSIVE

Figure 4: Summary Process of Application of NASCO Rod Catch Assessment Tool
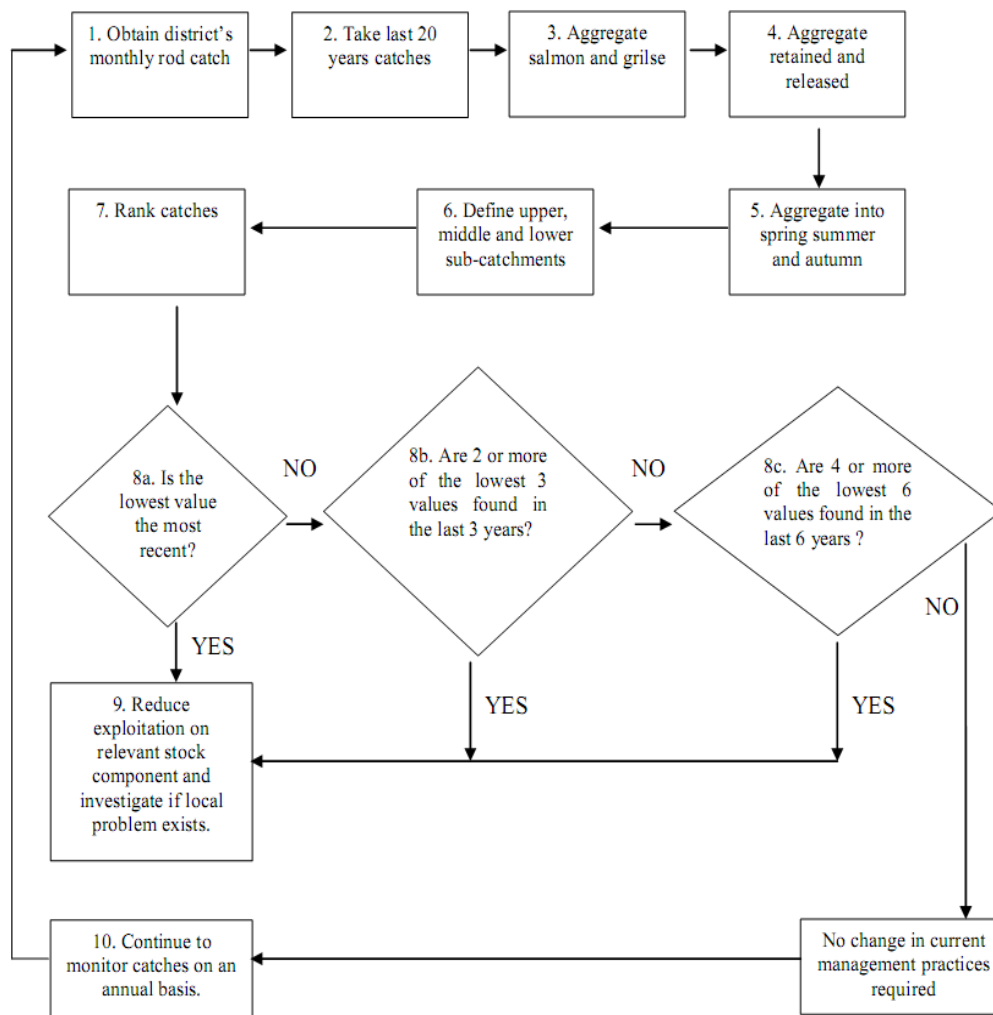
Table 3: Demonstrating how the assessments in Tables 4 and 5 are compiled

QUESTIONS FOR EACH SEASONAL CATCH		PROBABILITIES		INTERPRETATION
		With no trend the probability of answering "yes" to each question	With no trend the probability of answering "yes" to one or more question	Interpretation of probability where a "yes" is triggered.
Test A	Is the lowest catch the most recent catch?	5%	11%	The conventional probability level is 5%. A level of 11% is justified by the precautionary principle
Test B	Do the 2 lowest catches occur within the last 3 years catches?	4.5%	11%	
Test C	Do the 4 lowest catches occur within the last 6 years catches?)	4.0%	11%	

Figure 5:   **Loch Roag Spring Salmon Catches**
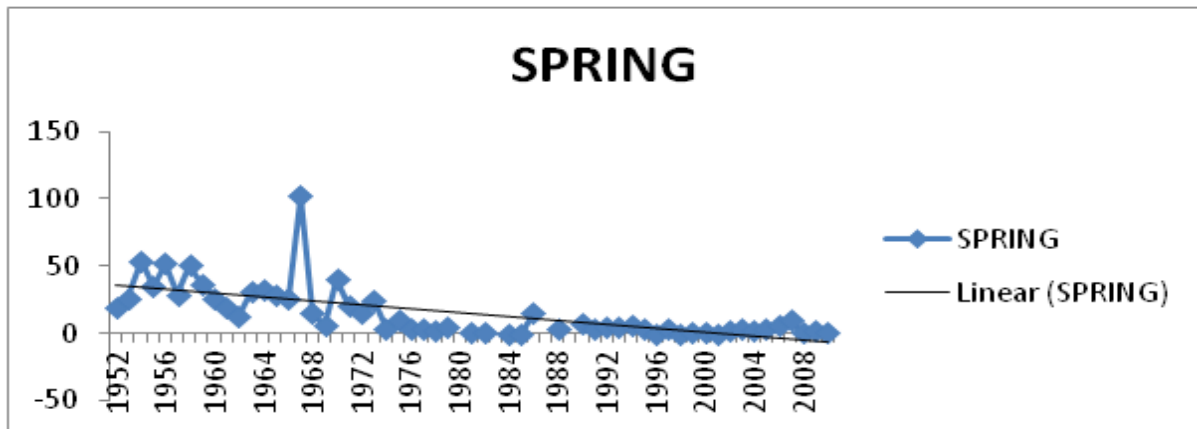
Figure 6:   **Loch Roag Summer Salmon Catches**
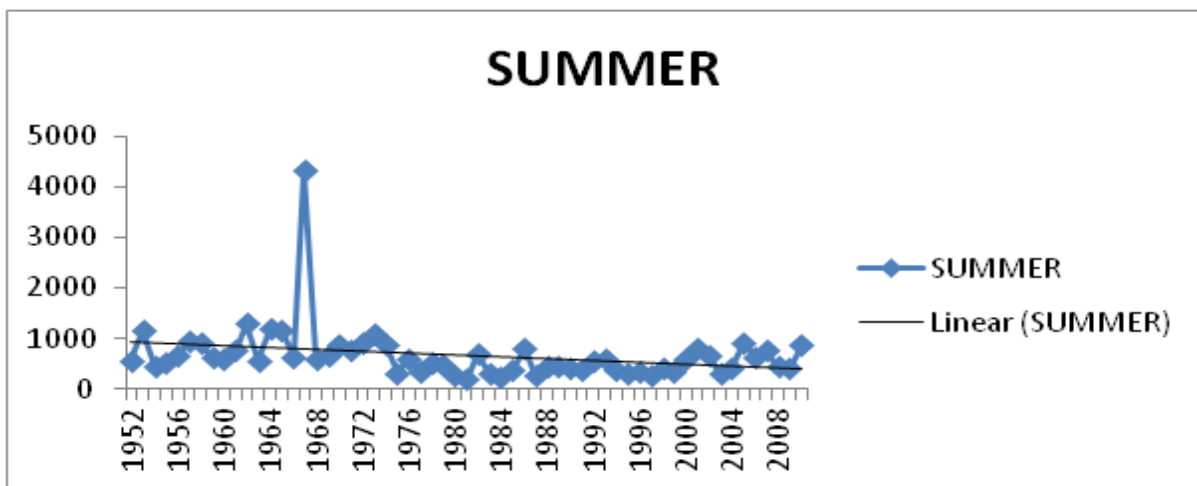
Figure 7: Loch Roag Autumn Salmon Catches
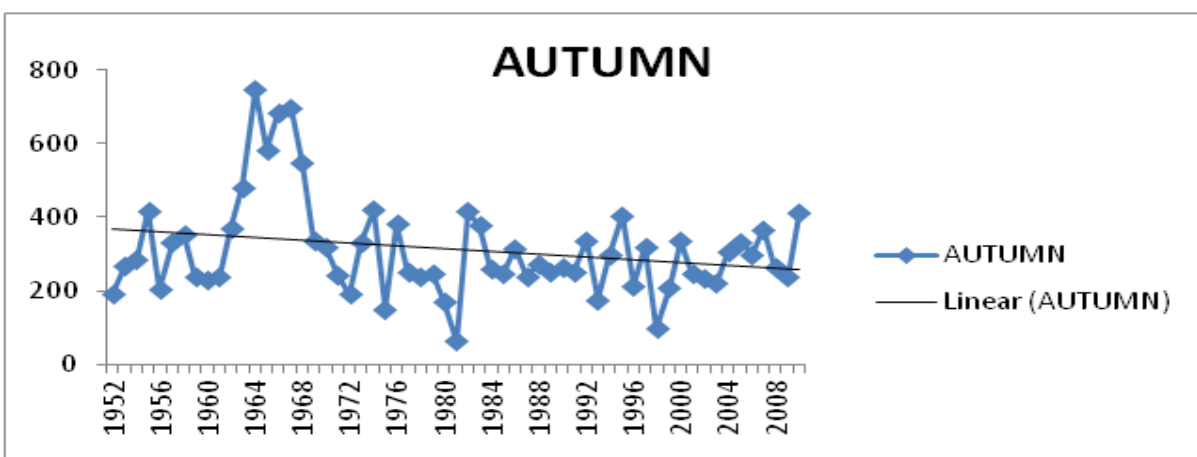
Table 4: Salmon Seasonal Catch Ranking

TEST	SPRING	SUMMER	AUTUMN
TEST A (Is the 2010 catch the lowest?)	YES	NO	NO
TEST B (Do the 2 lowest catches occur within the last 3 years catches?)	YES	YES	NO
TEST C (Do the 4 lowest catches occur within the last 6 years catches?)	YES	YES	YES

From **Figure 4** the results of **Table 4** would suggest that management action is required in each of the run-time components to reduce exploitation and investigate if problems exist.

It is proposed that summary analysis and figures as shown in **Section 3** are prepared for salmon catches in each analysed District (or river / catchment).

4. Loch Roag Total Catchment Salmon and Sea Trout Analysis Assessment

4.1 Loch Roag Total Salmon Analysis Conclusion

The overall trend is on the decrease although the trend lines for 15 and 25 year averages show signs of stabilising. The catch numbers have shown signs of recovery over the last two years and are on the increase. The five year average for Loch Roag is 1019.2. The total catches have been above the five year average for the last two years.

The NASCO catch assessment tool shows that the spring portion of the analysis is of most concern with the grillse numbers declining dramatically over the last six years. The summer portion shows that the downward trend is mostly influenced by the catches from the last three years. The autumn portion also shows that the downward trend is mostly influenced by the catches from the last six years. This means that the fishery has to reduce exploitation on relevant stock component and investigate if local problems exists.

Somewhat contrary to the NASCO assessment , the ratio analysis indicates that the fishery is **Over-performing / Improving overall** and that the current 5 year average is greater than both the 15 and 25 year averages by comparison. This may be a function of the currently proposed bands of fishery performance being unsafe or that the overall validity of the overall assessment is not certain.

4.2 Loch Roag Total Sea trout Analysis Conclusion

The overall trend is on the decrease although the trend lines for 15 and 25 year averages show signs of stabilising. The five year average for Loch Roag is 605.4. The total catches have been above the five year average for the last four years.

The NASCO catch assessment tool was not analysed for Sea trout due to the season breakdown of the catch data being unavailable at this time.

The ratio analysis indicates that the fishery is under-performing / declining overall and that the 5 year average shows an underperformance against both the 15 and 50 year averages.

5.   Placement of catch statistics in overall Locational Guidance
In **Sections 1-4** we have set out a proposed set of standard analyses and figures to be made available for each District in the study area. This can be replicated in more local areas where robust data exists on a case by case basis.

It is not clear, however, how to include this work within the River and Fisheries Prioritisation Scoring system. The prioritisation matrix requires criterion which can be scored and where a range of scores are possible to distinguish importance across rivers for each criterion. It is not clear how or whether there is any reason to consider any fishery as of greater priority to another based upon its overall catch per se or based upon current performance when set against historic past performance. It is not thought that support from the partners would be provided to a system which sought to give different priorities to rivers where current catch / performance is:

- Less than historic performance: OR
  Such fisheries could be presented as capable of recovery, currently damaged and worthy of restoration and protection to reinstate past performance.
- About the same as historic performance: OR
  Such fisheries are performing much as they have always done and could be presented as worthy of protection to maintain functional fisheries.
- Better than historic performance: OR
  Such fisheries could be presented as delivering increasing economic, social and natural heritage benefits and worthy of protection to secure these benefits for the future.

Therefore, the proposal for discussion and consideration by the Steering Group is that the catch statistics analysis proposed is provided for each District but is not included in the River and Fisheries Prioritisation itself. Instead, this analysis would provide appropriate context for the fishery manager to help inform representation to planning or other relevant processes and support these representations with information to better describe the catches of the system the current performance against past performance and also provide the NASCO rod catch assessment for use and assessment.

6.   Recommendations:
The Steering Group is invited to consider the contents of this paper and:

I.   Approve or revise the proposal for standard analysis of catch statistics of salmon and sea trout (**Sections 2.1 and 2.2**);

II.   Approve or revise the proposal to develop a system to consider current fishery performance against past performance via the use of 5, 15, 25 and 50 year average catch statistics and ratios of these (**Section 2.3**);

III.   Approve the proposal to complete the NASCO Rod Catch Assessment Tool analysis for salmon in the Districts of the project (**Section 3**); and

IV.   Approve the placement of the total catch statistics assessments proposal outside of the River and Fisheries Prioritisation part of the project but instead to have it provided as context information for users of the system (**Section 5**).

Diane Kennedy / Callum Sinclair
RAFTS
19 June 2012

Rivers and Fisheries Trusts of Scotland

Managing Interactions Aquaculture Project

Steering Group Meeting 22/06/12

Paper 3: MIASG Prioritisation and Criteria Weightings

Purpose

This paper summarises the current work activities on the Locational and Sensitivity Guidance part of the Managing Interactions Aquaculture Project (to be considered alongside a presentation at the Steering Group meeting on 22/06/12), proposes a system to weight prioritisation criterion and sets out how the work may progress in year 2.

1.   Introduction

Work to date on the Locational and Sensitivity Guidance project has:

- Identified and developed appropriate prioritisation criteria;
- Collected data from trusts and other relevant sources which have now been collated and analysed in excel;
- Created a GIS criteria base data layers for the decision-making process. These data layers have been geo-referenced in a standardised format.

From this work both a "Rivers and Fisheries Prioritisation" (from a wild fish perspective) and a "Coastal/Transitional Water Bodies Prioritisation" can be generated. It was originally intended that these prioritisations could be combined (see **Figure 1**) to form a model of overall coastal "Zones of Sensitivity" as a project output. However, the presentation to the Steering Group will, hopefully, show that this combined output may not be necessary.

Figure 1: Proposed Combination of River and Fisheries and Coastal Water Body Prioritisations

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Rivers and Fisheries Prioritisation x Coastal Water bodies Prioritisation

= Zones of Sensitivity

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2.   River and Fisheries Prioritisation, Weightings and Next Steps

2.1   Prioritisation

We have developed a set of criteria to generate a prioritisation of Rivers and Fisheries within the study area and a range of data has been collated, analysed and evaluated against these. These criterion are;

- Designations and Features
- WFD Classification (Catchment Summary)
- WFD Classification (Coastal Catchment)
- Value of fisheries (by fishery district in study area)
- Nature and Type of fishery (by fishery/catchment in database)

- Genetics (Introgression)
- Genetics (Population structure and uniqueness)
- Catchment Accessibility and Usability
- Juvenile salmonid populations (by catchment summary)
- Other fish Species Present
- Habitat Quality (By Catchment Summary)
- Biosecurity and INNS

All 12 criteria have now been combined through summation overlay to create an initial prioritisation of River and Fisheries. An example GIS output will be presented at the Steering Group meeting to show the output of this.

As noted at the meeting on the 19th of December action point 3.1 it was requested that the project considered how to present the prioritisation of River and Fisheries in relation to the coastal zone and so as not to run the risk of being described as generating a" river ranking" as a major project output. Work in this area will be presented at the meeting to show how such an output can be achieved.

2.2   Weightings

Currently this analysis assumes that all of the 12 criteria above are equally important in the prioritisation of rivers and fisheries. This is not likely to be the case and it is proposed that the criteria should be weighted to identify "high", "moderate" and "low" (relatively) importance criteria. The project team have proposed a weighting of criterion for Steering Group review and discussion (See **Appendix 1, Table 1** and **Table 2**).

To demonstrate the impact of weightings to the prioritisation that may be generated a hypothetical list of x50 rivers have been scored for all criteria and the prioritisation of these run using both an un-weighted and linear weighted multi criteria evaluation. This exercise will be presented to the Steering Group. This exercise has been completed for a generated list of rivers as the real data set was found to hold insufficient data and information for all criterion to show the impact of the weightings on the prioritisation.

The Steering Group is invited to review the weightings proposed in Table 1 and Table 2 and to suggest where and how these might be revised.

Once weightings have been agreed for initial use these can be deployed within each run of the Rivers and Fisheries Prioritisation to refine this analysis. When the full model is run the weightings can be revisited if required for further refinement and adjustment.

2.3   Next Steps

There are a number of issues and next steps to consider including:

- The confirmation of an initial weighting system to be applied to the Rivers and Fisheries Criterion;
- The management of data and information gaps in the river prioritisation model;
- The identification of a minimum number of criterion scores required to make the prioritisation legitimate; and

- The application of a correction factor to allow rivers with more or less scored criterion, but which are legitimately included in the prioritisation, to be considered fairly.

These issues will be introduced in the presentation to the Steering Group.

3.   Coastal/Transitional Water Body Prioritisation

We have developed a set of criteria to generate a prioritisation of Coastal/Transitional Water Bodies within the study area and a range of data has been collated, analysed and evaluated against these. These criterion are;

- Water Body Characterisation (MSS for Aquaculture Development)
- WFD Classifications
- Designation and Features
- Topography and Type

All 4 criteria identified above have been combined through summation overlay to create prioritisation of coastal and transitional water bodies. An example GIS output will be presented at the Steering Group meeting to show the output of this.

Similarly to the River and Fisheries Prioritisation (see **Section 2**) weightings for initial use and resolution of a number of issues and next steps (see **Section 2.3**) are required for the Coastal Water Body Prioritisation.

4.   Combined Prioritisation Sub models for the identification of Zones of Sensitivity

To date there has been an intention to combine the Rivers and Fisheries Prioritisation and the Coastal Water Bodies Prioritisation together (see **Figure 1**). However the presentation to the Steering Group will show the nature of these respective individual outputs and how they might be presented and made available as distinct units. In generating these, the project team are of the developing view that combining these outputs may not be required, desirable or justified.

The individual outputs would appear to offer legitimate and distinct outputs which can be utilised by fishery groups, within development planning for example, and the project need and technical justification to seek to combine 2 separate generated and modelled outputs is not clear.

5.   Year 2

A number of areas of work have been identified in this paper and Steering Group presentation (including those below) will require significant work to realise in Year 2 of the project.

- Rivers and Fisheries Prioritisation (weightings, data and information, scoring rules);
- Coastal/Transitional Water Body Prioritisation (weightings)
- Presentation options to show the prioritisation of Rivers and Fisheries can be related to areas of coastal water and zones of influence combined; and
- Developing an approach to smolt migration routes (where these can be safely assumed).

In many areas technical and specialist work by project staff (particularly in GIS and data input and structuring) will be needed and additional information and data from trusts will be required to further populate the agreed criterion in order to make the model and its prioritisations more extensive and ready for use. For this to happen the project will require to continue in Year 2 and individual trusts will need to consider their ongoing involvement and commitment to the work.

A key area of future work will also be an essential consultative phase with fishery trusts and boards to present the developing model and how it might support their work as well as presenting the potential outputs to others with an interest in this work, notably SNH, SEPA, Crown Estate, Marine Scotland and Local Authority Planners.

These 2 areas of work: 1. technical development and data / information input; and 2. consultation and advocacy, must be progressed in the remainder of 2012/13 before a project output that can be used and supported can be released.

In addition it is essential that the methodology, model and decision support tools and outputs that can be generated from this work are recognised as being developed in order to support and not replace decision making in respect of wild fish views on aquaculture development.

6.   Recommendations

The Steering Group is requested to:

  i.   Review the developing outputs of the Rivers and Fisheries and Coastal/Transitional Water Body Prioritisations;
 ii.   Review and discuss the draft weightings of criterion in each table in Appendix 1;
iii.   Review and consider how the prioritisation outputs might best be presented and whether the separate outputs for Rivers and Fisheries and Coastal Water Bodies should be combined;
 iv.   Note the need for significant technical, data and information and consultative input and work to be completed in 2012/13 to produce a supported and consolidated output from this project over the coming months.

Donna-Claire Hunter, Diane Kennedy, Callum Sinclair

RAFTS

18 June 2012

Appendix 1: Criterion priority weighting (Draft)

Table 1:   River and Fisheries criterion priority weighting (Draft)

River and Fishery Criterion	Criterion Attributes	Criterion Priority Weighting	
		Draft Weighting	Steering Group Weighting
Designations and Features	SAC (Atlantic Salmon or Pearl Mussel) (H)	H	
	SAC other (M)		
	SSSI Freshwater (M)		
WFD Classification (Catchment Summary)	Majority of sites/length High or Good Sites (H)	H	
	Majority of sites/length Moderate Sites (M)		
	Majority of sites/length poor or bad Sites (L)		
	Unclassified (L)		
WFD Classification (Coastal Catchment)	High/Good (H)	H	
	Mod (M)		
	Poor/Bad (L)		
	Other Catchments from Trusts (M)		
Value of fisheries (by fishery district in study area)	In top 3rd of rv by district (H)	M	
	In middle 3rd of rv by district (M)		
	In bottom 3rd of rv by district (L)		
Nature and Type of fishery (by fishery/catchment in database)	High value angling, opportunities and rentals with limited availability (H)	M	
	Readily accessible angling opportunities via clubs, associations, day and weekly tickets (M or H?)		
	Low cost or free angling opportunities to local communities/residents/visitors (L or M?)		
	Fishery Protection Order: accessible brown trout fisheries (L)		
	Rarely or never fished or no history of angling or economic benefit (L)		
Genetics (Introgression)	Introgression detected by genetic survey (H)	H	
	Introgression not detected by genetic survey (L)		
	Not Surveyed (L)		

Genetics (Population structure and uniqueness)	Rare/Unique population structure in catchment (H)	H	
	Population structure in catchment 'similar neighbouring or near catchments (L)		
	Not Surveyed (L)		
Catchment Accessibility and Usability	Natural Catchment fully accessible or natural catchment accessible via fish pass mitigation (H)	H	
	Natural catchment access (<50%) restricted by barrier (man-made). (M)		
	Natural catchment >50% accessible due to manmade structures. (L)		
Juvenile salmonid populations (by catchment summary)	Juvenile salmonid densities and age classes present/ as expected (H)	H	
	Juvenile salmonid densities and age classes depressed and/or missing age classes (M)		
	Juvenile salmonid population totally absent or absent from majority of catchment(L)		
	Not Surveyed (L)		
Other fish Species Present	Eels (M)	L	
	Lamprey (M)		
	Charr (M)		
Habitat Quality (By Catchment Summary)	Natural/unmodified riparian/instream habitats (75%) (H)	M	
	Modified riparian/instream habitats (75%) (M)		
	Modified damaged riparian/instream habitats subject to restoration actions. (M/L)		
	No Data/Information (L)		
Biosecurity and INNS	INNS present requires current management action(L)	M	
	INNS present but no impact or management action (M)		
	No INNS known in catchment (H)		

Table 2: Coastal Water Bodies (Transitional & Coastal) criterion priority weighting

Water Bodies (Transitional & Coastal) Criterion	Criterion Attributes	Criterion Priority Weighting	
		Example Weighting	Steering group Weighting
Water Body Characterisation (MSS for Aquaculture Development)	Category 1 (H)	L	
	Category 2 (M)		
	Category 3 (L)		
WFD Classifications	High/Good (H)	H	
	Moderate (M)		
	Poor/Low (L)		
Designation and Features	SAC (H)	H	
	MPA (H)		
	SSSI(M)		
	No take zones/local reserves (M)		
	Shellfish (M)		
Topography and Type	South West Facing (M)	M	
	Other Orientation (L)		
	Fjord (M)		
	Other Inlet (L)		
Migration Routes and Identification of pinch points	To be confirmed	Currently N/A	

Scottish Government: Managing Interactions
RAFTS Locational Guidance and Zones of Sensitivity Project
Report December 2011
Risk Assessment Development Summary

1. Background

This briefing paper aims to demonstrate the development stages of the scoring and weighting matrix for the risk assessment of wild fisheries, aquaculture sites and water bodies in preparation for prioritisation of the fisheries.

2. Data Collected

Data collected so far include
- SEPA benthic surveys to date
- WFD classifications
- SEPA aquaculture site 2010 classifications
- MS catch returns
- FOI dossier from MSS site inspections
- Escape and containment information from Scottish Government,
- Distance analysis from fishery to aquaculture site
- West coast stocking information by site from SEPA
- Fishing effort information from Trusts
- Five year average statistics for catches
- Water body physical properties from Scottish Government Locational Guidance documents
- Water body topography
- Environmental designations of water bodies from SNH, JNCC and MarLIN

3. Software Requirements

The software required to run the risk assessment spreadsheet is MS Excel 2007 or better.

4. Local Knowledge

At present each Trust's dataset contains identical information. As a Steering Group we need to come up with ways of incorporating local knowledge, quirks of the fisheries and catchments and extra information that each Trust may feel is. The Project Coordinators have organised visits to see Trusts to discuss any issues arising from this steering group meeting.

5. Database

At present there is a separate database for each Trust area. The database has not had any further development carried out. The Trusts need to agree on the information it must contain, risk assessment threshold criteria, risk scoring matrix and weighting mechanisms if required.

6. Risk Assessment

Risk assessment threshold criteria have been developed for the water body, aquaculture site and each individual fishery. Each of the hazards have been identified and nominally scored and divided up by Trust area. No weightings or categorisations have been carried out at this stage. We would ask that our Trust representatives look at the outputs from the assessment and decide if they are required. The score will fall into one of three categories, low risk, medium risk and high risk. For the development of the supporting risk models the low, moderate and high categories have been scored 1, 2, and 3 respectively.

6.1 Hazard Identification

The first stage in risk assessment is the hazard identification. Below is a list of the primary hazards identified. Consideration must be given towards assigning weightings to the assessment scores. Each Trust will be supplied with their data at the steering group meeting.

6.1.1 Wild Fishery Hazard Identification and Scoring

River and Fishery (Freshwater)	Factor	Risk	Risk Score	Notes/Comments
Designations and Features (Freshwater)	SAC (Atlantic Salmon or Pearl Mussel)	H	3	* Large number of SSSI sites, information from SNH is required to populate)
	SAC (other) eg Lamprey, rannuncules	M	2	
	SSSI (Freshwater features) *(See notes)	M	2	
	Drinking Water Supply Zones	M	2	
Designations and Features (Non-Freshwater (but not marine/estuary))	SAC	M	2	
	RAMSAR	M	2	
	SPA	M	2	
	National/local nature reserved	L	1	
WFD Classification (Catchment Summary)	Majority of sites/length High or Good Sites	H	3	
	Majority of sites/length high, good or moderate	M	2	
	Majority of sites/length moderate, poor or bad	L	1	
	Unclassified	L	1	
WFD Classification (Coastal Catchment)	High/Good	H	3	
	High/Good/Mod	M	2	
	Mod/Poor/Bad	L	1	
	Other Catchments from Trusts	*Suggested that this grouping will be risk categorised into the High/Good/Mod until SEPA surveys them and they are given a categorisation		
Value of fisheries (by fishery district in study area)	In top 3rd of r.v. by district	H	3	
	In middle 3rd of r.v. by district	M	2	
	In bottom 3rd of r.v. by district	L	1	
a)Genetics (Introgression)	Introgression detected by genetic survey	H	3	
	Introgression not detected by genetic survey	L	1	

	Not Surveyed	L	1	
b) Genetics (Population structure and uniqueness)	Rare/unique population structure in catchment	H	3	
	Population structure in catchment 'similar' neighbouring or near catchment	L	1	
	Not surveyed	M	2	
Biosecurity and INNS	INNS present requires current management action	L	1	
	INNS present but no impact or management action	M	2	
	No INNS known in catchment	H	3	
Catchment Accessibility and Availability	Natural catchment fully accessible	H	3	
	Natural catchment accessible via fish pass mitigation	H	3	
	Natural catchment access (<50%) restricted by barrier (man made)	M	2	
	Natural catchment >50% inaccessible due to manmade structures	L	1	
Distance to nearest Aquaculture	0 – 15km	H	3	
	15- 25km	M	2	
	>25km	L	1	
Biomass of aquaculture Production	Production at or 90% of available capacity	H	3	
	Production 50 – 90% of available capacity	M	2	
	Production <50% of available capacity	L	1	
Juvenile salmonid populations (by catchment summary)	Juvenile salmonid densities and age classes present/ as expected	H	3	
	Juvenile salmonid densities depressed and/or missing age classes	M	2	
	Juvenile salmonid population totally absent or absent from majority of catchment	L	1	
	No Data	L	3	
Other Fish species present	Eels	M	2	**To be discussed and refined further**
	Lamprey	M	1	
	Charr	M	1	
Habitat Quality (by catchment summary)	Natural/unmodified riparian/instream habitats (75%)	H	3	**To be discussed and refined further**
	Modified riparian/instream habitats (75%)	M	2	
	Modified damaged riparian/instream habitats subject to restoration actions	Yes = M	2	
		No = L	1	
	No data/information	L	1	
Nature and type of fishery (by fishery/catchment in	High value angling, opportunities and rentals with limited availability.	H	3	**To be discussed and refined further**

database)	Readily accessible angling opportunities via clubs, associations, day and weekly tickets.	M or H?	2/3	
	Low cost or free angling opportunities to local communities/residents/visitors.	L or M?	1-2	
	Fishery Protection Order accessible brown trout fisheries	L?	1	
	Rarely or never fished or no history of angling or economic benefit.	L	1	

6.1.1.1 Topics for Further Discussion in Fishery Risk Assessment

Catches for Fishery District

1) Salmon and Sea Trout analysed separately

2) 1952 – x Scottish Government catch stats (with Trend line)

3) 5 year rolling average or 5 year block average (with Trend line). Need to determine which category to use not using both.

4) NASCO Rod Catch Assessment tool plots (applied to last 20 years by season)

5) Summary of results from 3) by year/season and apply:
a. Test A: is lowest catch in the present year
b. Test B: do 2 lowest catches shown in last 3 years
c. Test C: do 4 lowest catches show in last 6 years

6) Need to review SAC selection criteria and include as appropriate.

7) Marine Scotland regional analysis result

Catches for Individual catchments or fisheries (Optional dependant on data availability)

1) Salmon and Sea Trout analysed separately

2) Total plot of time sequence (with trend line)

3) 5 year average ((With trend line)Rolling or block to be determined)

4) NASCO Tool (Data dependant?)

5) SAC Selection criteria relating catch to wider context.

6.1.2 Aquaculture Hazard Identification and Scoring

Aquaculture	Group	Factor	Risk	Risk Score	Notes/Comments
Containment	Extent	<500	L	1	
		500 – 2500	M	2	
		2500 – 10000	M	2	
		>10000	H	3	
	Type	<100g	H	3	
		100g – 1500g	M	2	
		1500g – 3500g	H	3	
	Reason	Weather	M	2	
		Human Error/Operational	H	3	
		Predator	M	2	
		Malicious Damage	L	1	
	Frequency	<2yrs	H	3	
		2 – 5yrs	M	2	
		>5yrs	L	1	
Distance	To nearest river	0 – 15km	H	3	
		15 – 25km	M	2	
		>25km	L	1	
	Fishery	Name			To be discussed and refined further
		Risk (from fishery Score			
Farm Site Information	SSPO Member	Yes	L	1	
		No	M	2	
	Area Management Agreements (AMA)	Signed and Operational	L	1	
		Signed and not functional	M	2	
		No AMA	M	2	
	Farming Practice	Conventional	M	2	
		Freedom Foods (RSPCA)	L	1	
		Organic (Soil Association)	L	1	
	Biomass (tonnes)	<500	L	1	
		500 - 1500	M	2	
		>1500	H	3	
Fish Health Inspectorate Audits	Compliance at inspection (last 2yrs)	A) Code of good practice breach (Sea lice levels)	Yes = L	1	
			No = M	2	
		B)Site and equipment maintenance (records and inspect)	Yes = L	1	
			No = M	2	
		C)Paper work and record keeping (lice counts)	Yes = L	1	
			No = M	2	
		D)Containment Plan	Yes = L	1	
			No = M	2	
	Response to non-compliance (next inspection)	A)Appropriate (y) Inappropriate (n)	Y = L	1	
			N = M	2	
		B)Appropriate (y) Inappropriate (n)	Y = L	1	
			N = M	2	
		C)Appropriate (y)	Y = L	1	

		Inappropriate (n)	N = M	2	
		D)Appropriate (y) Inappropriate (n)	Y = L	1	
			N = M	2	
SEPA Benthic Survey Results	Classification Results	Unsatisfactory	Last 2 or more = H	3	
			Last 1 = M	2	
		Borderline	M	2	
		Satisfactory	L	1	
		Unclassified	M	2	
		Baseline	New Site = L	1	
			Existing Site = Review past surveys and classify as above.		
	Date of last survey (should be every 2 years)	<2yrs	L	1	
		2 – 3yrs	M	2	
		> 3yrs	H	3	

6.1.3 Water Body Hazard Identification and Scoring

| Water Bodies Coastal/Transitional (Marine/estuary)	Factor	Risk	Risk Score	Notes/Comments
Water Body Characterisation (For aquaculture development)	Category 1: New development only in exceptional circumstances	H	3	
	Category 2: New development only if recategorisation to Cat 1 does not result	M	2	
	Category 3: new development likely to be possible subject to local detailed assessment	L	1	
WFD Classifications	High/Good	H	3	
	Moderate	M	2	
	Poor/Low	L	1	
Topography and Type	South West facing	M	2	To be discussed and defined
	Other Orientation	L	1	
	Fjord	M	2	
	Other Inlet	L	1	
Designations and Features	SAC	H	3	
	Marine Protected Areas	H	3	
	SSSI	M	2	
	No take zones/local reserves	M	2	
	Shellfish	M	2	
Marine Spatial Plan (Features?)				To be discussed and defined
Local Authority Development plans, zoning or exclusions				To be discussed and defined

6.1.4 Hazard Risk Scoring

The risk scoring workbook supplied has a separate tab for each identified hazard. Each hazard is assessed and scored as LOW, MODERATE or HIGH (1, 2 or 3) and there is a total risk score column to calculate the total score for the identified hazard. At present all totals have been ADDED.

6.1.5 Risk Assessment Weighting

This is a technique of assigning the order of relative importance of a particular hazard and risk threshold criteria and applying a multiplier to reflect this importance.
To ensure that the 'highest value' or 'most important' hazards influence the final risk score a multiplier called a weighting must be added. This requires discussion with the steering group to decide if this is required or not.

6.1.6 Final Score

The database will calculate a final score for each water body, fishery and aquaculture site in the project area. This final score requires validation by the steering group. Notionally the final score could appear as a traffic light configuration where

<div align="center">

LOW RISK

MODERATE RISK

HIGH RISK

</div>
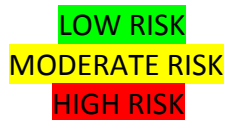
The steering group are required to decide how each of the final scores for each of the water body, fishery and aquaculture site will be interpreted and used in the database.

6.1.7 Risk assessment Output

The database has the capacity to produce a report type document. The report can contain anything from a catchment map, the risk assessment and the final risk score and any supporting information that maybe out with the scope of the database and the risk assessment.