The Scottish Government
Riaghaltas na h-Alba

Scottish Marine and Freshwater Science

Volume 5 Number 6

Collation of Available Datasets on Smolt Populations in Scotland to Assess Migration Run Times

marinescotland

Scottish Marine and Freshwater Science Vol 5 No 6

COLLATION OF AVAILABLE DATASETS ON SMOLT POPULATIONS IN SCOTLAND TO ASSESS MIGRATION RUN TIMES

Published by Marine Scotland Science
ISSN: 2043-7722
ISBN: 978-1-78412-619-3

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This report presents the results of marine and freshwater scientific work carried out for Marine Scotland under external commission.

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Collation Of Available Datasets On Smolt Populations In Scotland To Assess Migration Run Times

March 18th 2014

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ACKNOWLEDGEMENTS

Fisheries Trusts and other organisations invested a number of hours and in many cases multiple days in preparing meta and raw data for this project. The SFCC wish to thank the following organisations for their direct involvement:

Ayrshire Rivers Trust
Cromarty Firth Fisheries Trust
Findhorn, Nairn & Lossie Fisheries Trust
Galloway Fisheries Trust
Heriot Watt University / Malcolm Thomson (Orkney)
Inverness College UHI (River Carron)
Kyle of Sutherland Fisheries Trust
Lochaber Fisheries Trust
Outer Hebrides Fisheries Trust
River Annan Trust
Spey Foundation
Tweed Foundation
West Sutherland Fisheries Trust
Wester Ross Fisheries Trust

The SFCC wish to thank Scottish and Southern Energy PLC for support provided to several trap installations reported within this project. In addition, Scottish Natural Heritage should be acknowledged here for their contribution to smolt monitoring activities.

The SFCC also wish to thank all further Fisheries Trusts and District Salmon Fishery Boards who do not currently collect smolt data for their involvement in this project. The contribution of these organisations in helping to achieve coverage and nil returns of all major river systems in Scotland is gratefully acknowledged.

In compiling this report I would like thank the SFCC Management Committee for their support and advice. I also wish to thank Donna-Claire Hunter and Iain Malcolm (Marine Scotland Science) for their on-going support, technical advice and patience.

DECLARATION

This report, meta-data spread sheet, raw data spread sheets and mapping data are to the best of my knowledge accurate. If you have questions regarding any of the information provided please contact the undersigned in the first instance.

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EXECUTIVE SUMMARY

- This project was undertaken in the context of the National Research and Monitoring Strategy for Diadromous Fish (NRMSD) to investigate the potential for interactions between diadromous fish and wind, wave and tidal renewable energy developments.

- By canvassing Scotland's geographical area, the SFCC believe that the absolute spatial coverage of smolt monitoring locations has been identified. Datasets identified from 13 organisations at 31 locations were requested, resulting in the provision of these datasets.

- During the project, the fish species scope was expanded to include trout after initially being focused on Atlantic salmon.

- A total of 126,368 individual fish length measurements and a further separate dataset featuring 292,427 smolt counts were provided.

- While the majority of smolt trapping was found to occur using rotary screw trap methods, a range of alternative strategies are deployed. Data recording procedures and resolutions were found to vary significantly between organisations and in some cases within organisations.

- Temporal coverage is also variable with information becoming increasingly limited before 2006. The largest dataset spans 37 years, that of Spey Dam currently operated by Spey Foundation.

- Out of 31 sites 16 featured individual fish length (1mm) measurements and 2 featured 5mm and 10mm categorical fish length measurements. The remaining 13 datasets were provided as total fish count level observations.

- 18 of 31 smolt monitoring sites are operated on river main stems, with the remainder on 2nd order tributary rivers.

- While data are provided in a standard format, considerations relating to cross-compatibility remain specifically around the means by which recordings are made where; fishing did not occur, fishing did occur without the trap being checked, and fishing did occur with the trap being checked resulting in a catch of 0. Strategies for recording the beginning and end of the trapping season also exhibited varied approaches, a caveat which should be considered during further analysis.

- Further work is recommended to fully quantify the availability of data collected on other fish species captured (while smolt monitoring) and that of river flow and water temperature.
- Pending analysis by Marine Scotland Science, this collaborative approach may have provided data collected at a local catchment scale, which is also capable of informing research of a national-scale.
- With 6 organisations reporting the installation of new smolt traps in 2014, the spatial coverage of this dataset will further increase.

1. Introduction

Smolt population monitoring is increasingly being used to underpin research and to inform salmonid management in Scottish rivers. The aim of this project was firstly to quantify the range of smolt monitoring efforts undertaken in Scotland, and subsequently to determine the availability of these raw datasets for the purposes of this project.

This work was undertaken in the context of the National Research and Monitoring Strategy for Diadromous Fish (NRMSD) to investigate the potential for interactions between diadromous fish and wind, wave and tidal renewable energy developments. Further information on this stakeholder led strategy is detailed in Hunter *et al*, 2014.

The Scottish Government has pledged to meet 100% of our electricity needs by 2020 through renewable energy sources, with offshore wave, tidal and wind devices set to provide a major contribution (Scottish Government, 2014). Relative to our understanding of salmonid ecology in freshwater, migration routes and life strategies in the coastal and marine zone are poorly understood (Friedland, 1998 and references therein). Specifically, Malcolm *et al*, (2013), identified that "*There is limited information available on the timing of migration for both juvenile and adult fish for specific locations on the Scottish coast.*" Construction of a number of offshore and marine renewable developments is proposed for initial construction phases to begin in 2014. The construction phases of these developments are often considered the period of highest risk due to the additional disturbance within the coastal environment (Malcolm *et al*, 2013). Thus the ability to identify smolt run timings could be used to design temporal mitigation measures if required.

The initial project specification focused only on Atlantic salmon. After discussion with MSS, the SFCC agreed to increase the scope to include trout, with limited information also presented on other species such as lamprey and eel. Data collected to the individual fish measurement level is provided where available, with count resolution data also supplied.

This report provides a detailed meta-data summary of the raw data supplied including maps, temporal resolution displays, and a description of the raw data formats provided. Further to this, questionnaire responses are presented revealing the research questions being addressed by the trap installations and how these relate to local fishery management plans. Photographs of trap installations are also provided for the majority of locations.

The meta-data summary provided to MSS constitutes an almost absolute coverage of Scotland in terms of the existence or otherwise of smolt monitoring installations. As far as the SFCC and its members are aware, the Shetland Islands is the only remaining region where confirmation or otherwise of smolt monitoring efforts is outstanding.

MSS will subsequent analyse the data supplied under this project to assess its potential for improving our understanding of smolt migration run timings at specific locations on the Scottish coast. A secondary aim will be to ascertain the potential of smolts in the locations provided to carry acoustic tags which can be deployed to track individual fish and are implantable dependent on fish weight and length.

2. Methods

At the project outset in December 2013, the aim, background, context, methodology and funding procedures were outlined in a notification letter detailed in appendix A,1. At this stage organisations were asked to notify the SFCC if they either did not collect smolt data, or did collect smolt data. If an organisation identified that it did collect smolt data it was requested to fill in a brief meta-data questionnaire for each monitoring site as detailed in Appendix A.1. At this initial stage it was made clear that all data provided should be considered to be in the public domain and subject to Freedom of Information Scotland Act (FOISA) and Environmental Information Regulations (EIR) considerations.

Table 1. Project timescales adapted from Appendix A.1. Initial Notification Letter.

Week 1	**Dec**	Notification letter sent: communication of the context and a clear statement of the entire process, proposed use of data, metadata requests and payment procedure.
Christmas & New Year		
2	**Jan**	Assessment of initial responses
3		Collation of metadata summaries
4		Progress discussion at the annual biologist's meeting **Milestone 1: Meeting with MSS and appraisal of metadata summary report** **Selection of datasets to be requested in full**
5	**Feb**	Formal requests for raw data from SFCC members Division of funds evenly between all data providers
6		Collation of agreed datasets into a standard format
7		
8		Preparation of final report and acknowledgment of all data providers
9	**Mar**	
10		**Milestone 2: Project completion**

All meta-data identified through this process was then collated into a standardised meta data format and presented to MSS. During January 2014 all outstanding regions were contacted and final metadata responses collated. The SFCC met with MSS on Monday the 3rd of February to discuss and agree the raw datasets which would be requested in full. A standard format for data submission was also discussed and agreed with MSS during the week of the 3rd of February. At this meeting an inventory of adult fish counters and traps in Scotland as detailed in Simpson (2003) was also provided by MSS whichdrew attention to a further two smolt monitoring locations that had not been identified in the original request process. On the 12th of February confirmation letters (Appendix A.2. Confirmation Letter) were sent out to 13 organisations with smolt data deemed to be relevant to the aims of this project. MSS also suggested that the SFCC circulate a second metadata questionnaire to provide additional information along with the provision of trap installation photographs.

Each organisation was subsequently contacted by phone to outline data format requirements as detailed in the standard data format spread sheet provided by the SFCC. A deadline of 14 days (February the 26th) was set for raw data submission with extensions awarded to several organisations due either to time constraints or to the scale of work involved to collate data from multiple sites and over long timescales. All raw data was provided to the SFCC by March the 7th. Each dataset was then audited to ensure continuity and compatibility within the standard format.

Count level datasets were identified as highly relevant in the context of assessing the potential to quantify migration run-timings, and in order to assess the capability of salmon and sea trout smolts to carry acoustic tags, MSS requested individual fish measurement data if available. 18 datasets were supplied featuring individual fish measurements at a resolution of either 1mm individual fish observation, 5mm category count or 10mm category count. Datasets were collated into the following 4 formats dependent upon the methodology applied by the data collector;

- Individual fish length (1mm)
- Individual fish length (5mm)
- Individual fish length (10mm)
- Fish count level data

It should be noted that multiple organisations collected length data as a subset of total fish counts. Thus, data in these cases was provided in both count and length formats. An extensive meta-data summary (Table 4) is included with the raw data provided and is detailed in the results section.

3. Results

3.1 Items Provided

Further to this report, a Microsoft Excel Document containing an extensive metadata summary and raw data for all sites and years available has been supplied to MSS. Full details of the spread sheet components and mapping data are provided in section 3.3. Thirdly, Geographical Information System (GIS) computer mapping data has been provided as an ESRI ArcMap Document.

3.2 Spatial Coverage and Trap Type

The SFCC has collated data from a total of 31 locations in Scotland where smolt monitoring has been, or is currently being undertaken. Of these 31 locations, 14 are operated on second order tributary rivers and 17 are operated on first order main-stems. There are additional installations managed by MSS on the rivers Girnock and Baddoch (not part of the scope of this project) and 3 further smolt monitoring locations where identified that were not included in the data collation aspect of this project as detailed in Table 2.

Table 2. Additional smolt monitoring locations identified.

Site	Organisation	Reason data was not requested
River Don	River Don Trust/ Glasgow University*	Sampling in 2013 was severely affected by extreme weather conditions rendering the data unsuitable for further analysis.
River Endrick	Loch Lomond Fisheries Trust*	Due to recent resourcing pressures the data was not able to be collated within the project timescales.
River Moffat	The River Annan Trust*	Data collected opportunistically from a fish farm intake was deemed not to be of sufficient resolution for the purposes of this project.
* All organisations were supportive of the project and willing to contribute raw data.		

The majority of smolt monitoring is carried out using rotary screw traps. In several long-term datasets alternative strategies are utilised. In addition to rotary screw traps, wolf, fixed, mobile and fyke strategies are used (Fig. 1). Clarification on the nomenclature used is provided in Fig. 2 A-F, and additional photographs are also provided in appendix B.

Confirmation that smolt trap monitoring does not currently take place was received in writing or by telephone communication from the following organisations:

- River Ythan Fisheries Trust
- Deveron, Bogie and Isla Fisheries Trust
- Tay District Salmon Fisheries Board
- Forth Fisheries Trust
- Nith Catchment Fisheries Trust
- Clyde River Foundation
- Argyll Fisheries Trust
- Skye Fisheries Trust
- Brora Fisheries
- Helmsdale District Salmon Fishery Board
- Caithness District Salmon Fishery Board
- Northern Board
- Ness & Beauly Fisheries Trust

A number of organisations informed the SFCC of future smolt monitoring efforts due to begin in 2014 (Table 3). Additional information on future aspirations is detailed in individual questionnaire responses provided in full in Appendix B.

Table 3. Organisations commencing smolt monitoring in Spring 2014.

Organisation	**River**	**Years Planned**
Argyll Fisheries Trust	Kinglass	2014 onwards
Ness & Beauly Fisheries Trust	2 locations t.b.c	2014 onwards
Deveron, Bogie & Isla Fisheries Trust	Blackwater	2014-2018
Spey Foundation	Avon	2014 onwards
Spey Foundation (Deveron managed)	Fiddich	2014-2018
Esk Rivers & Fisheries Trust	Rottal (South Esk)	2014 onwards

It should be noted that Shetland is the only outstanding region where the SFCC were unable to confirm the existence or otherwise of smolt monitoring efforts. To the best of the SFCC's knowledge we believe that this report provides a complete coverage of Scotland.

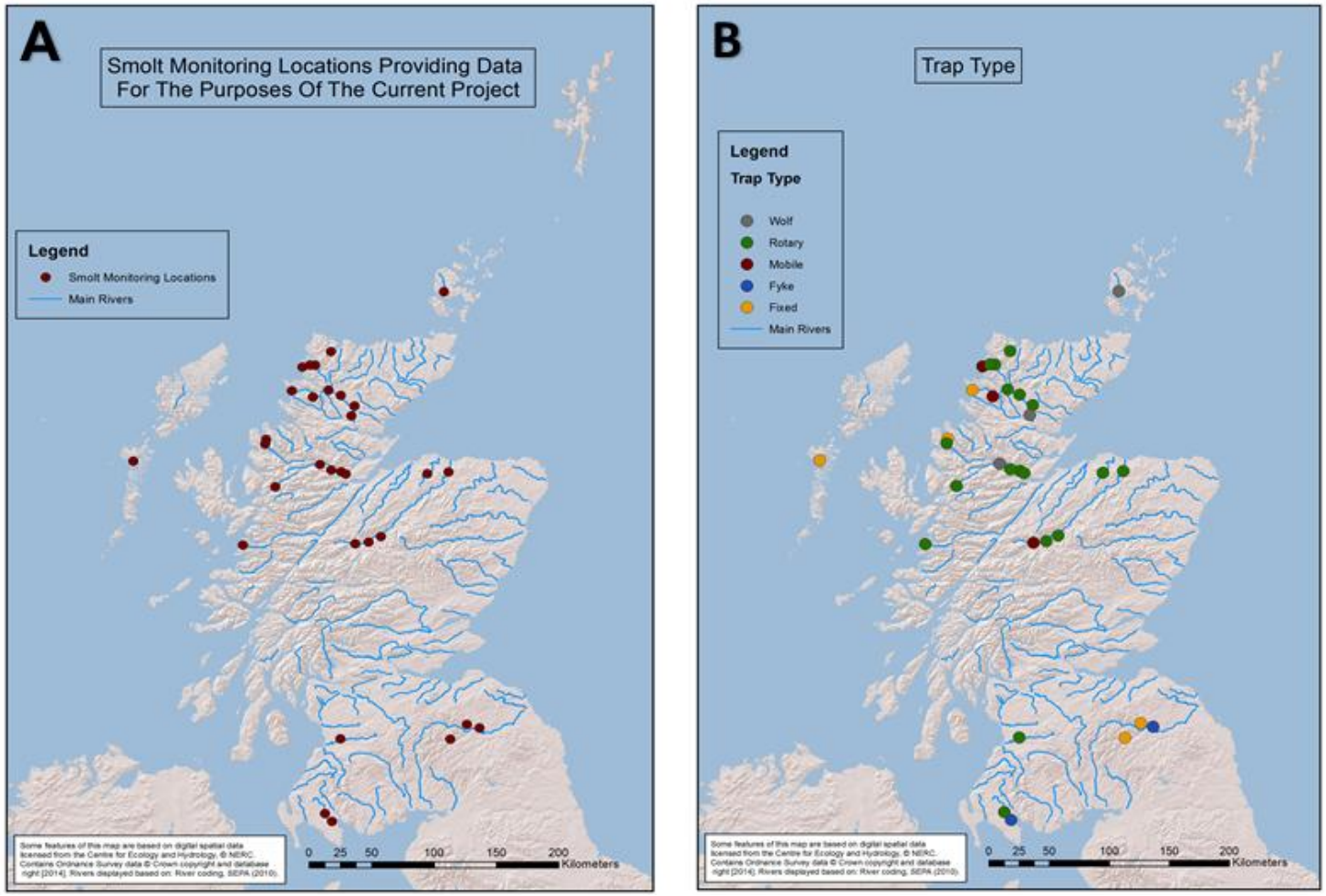

Figure 1. A: Smolt monitoring locations providing data for the purposes of the current project. Note: this is not an absolute map of locations as locations were identified that in eventuality were not part of the data provision aspect of this project. B: Map showing trap type including wolf, rotary [screw] mobile, fyke [net] and fixed methods. Nomenclature clarification and associated photographs are provided in Fig. 2.

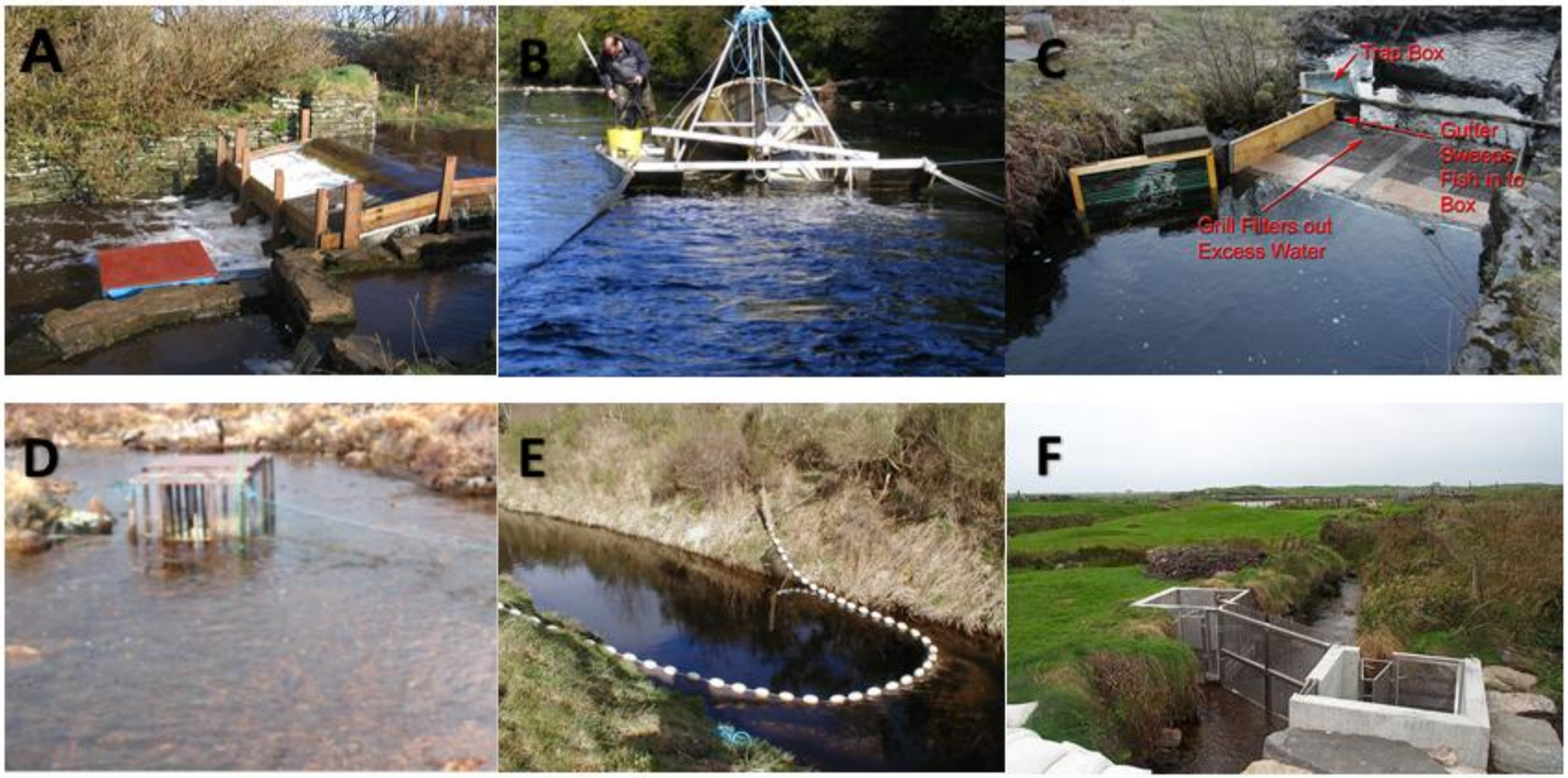

Figure 2. Smolt Trap Images

A: Wolf trap operated by Malcolm Thomson/Heriot Watt University on the Eyrland Burn in Orkney.
B: Rotary screw trap operated by Ayrshire Rivers Trust on the River Ayr. Photo credit: Gillian McIntyre.
C: Fixed trap operated on the Tournaig River by Wester Ross Fisheries Trust. Photo credit: Ben Rushbrook/Peter Cunningham.
D: Mobile smolt trap operated by West Sutherland Fisheries Trust at Badna Bay. Photo credit: Shona Marshall.
E: Fyke net operated on the river Bladnoch by Galloway Fisheries Trust. Photo credit: Jackie Graham.
F: Fixed trap operated near Loch Nan Struban, North Uist: Photo credit: Outer Hebrides Fisheries Trust.

3.3 Summary of data provided

The meta-data summary spread sheet provides a detailed account of each dataset. Raw data is supplied within 4 standard formats with the majority being supplied as count level or individual fish length measurement (1mm) (Fig.3). 2 further datasets were provided in the 5mm and 10mm fish length measurement format. Fish weights were recorded for a sub-set of the total sample in a limited number of locations.

Raw data is provided in a Microsoft Excel spread sheet containing 6 sheets labelled A-F:

A: Meta-data Summary.
B: Fishing Dates
C: Individual Fish Length (1mm)
D: Fish Count Level Data
E: Fish Length (5mm Counts)
F: Fish Length (10mm Counts)

The following Tables 4-9 provide information and attribute descriptions for the 6 works sheets contained in the excel spreadsheet.

Table 4. Explanation of columns A-W provided in spread sheet A: Meta-data Summary

Worksheet Column	Column Title	Attribute Description
A	ID	Column number. Numbers 1-31 refer to datasets provided for this project
B	Smolt Monitoring Present	Refers to whether or not the organisation collected smolt trapping data. (Yes/No)
C	Organisation	Fisheries Trust or organisation name contacted for information on smolt monitoring.
D	Site	Location of smolt trap on the river.
E	River Order	The classification of the river water body the trap is situated in either 1 indicating river main-stem or 2 indicating tributary river.
F	X co-ordinate	Trap location given as a 6 figure X British National Grid Co-ordinate
G	Y co-ordinate	Trap location given as a 6 figure Y British National Grid Co-ordinate

H	No. years data available	Total number of years in which data has been provided.
I	Start Year	Information on the First year for which data has been provided
J	End Year	Information on the Final year in which data has been provided. 'On-going' indicates traps that will continue in 2014.
K	Years Data Available	A list of years (YYYY) and year ranges (YYYY-YYYY) for which data has been provided.
L	Trap Type	Type of trap employed to capture smolts at site; Rotary screw trap/ fyke net / fixed trap / wolf trap/ mobile fish trap
M	Strategy	Information on the smolt trap capture strategy either indicating Partial or Total river trap coverage of the river.
N	Data format supplied	Information on the data supplied as either Count (C)/ Individual length 1mm (I)/ Individual length 5mm categories (IF)/ Individual 10mm categories (IT)
O	Lengths a subset of data	Are fish individual a subset of total data provided. Yes/No/NA (NA applies to datasets only provided as count level data).
P	Sampling Frequency	Information provides the seasonal sampling frequency for example daily or weekly.
Q	Species recorded	A list of species recorded as capture in the trap.
R	Weights recorded	Information on the collected fish weights from the capture fish given as Yes or No
S	Method for assessing capture efficiency	A description of the capture efficiency and related calibration techniques.
T	Additional Environmental Data	A description of any additional environmental variables collected.
U	Stocking	Information is provided on whether the river is stocked or not. Yes/No
V	Life Stage At Stocking	If it is identified that the river is stocked the stage at which stocking occurs is recorded here including Egg / alevin / un-fed fry / fry / parr / pre-smolt / smolt

W	Dataset Notes	General notes on the dataset and issues if identified

Table 5. Explanation of columns A-F provided in spread sheet B: Fishing Dates

Worksheet Column	Column Title	Attribute Description
A	Site	Location of smolt trap (river)
B	Year	YYYY Year in which the data was collected.
C	Start Date	First day each year when trap is in operation (DD/MM/YYYY)
D	End Date	Last day each year where trap is in operation (DD/MM/YYYY)
E	Dates within the season during which trap was not in operation	Information is recorded on non-operational periods of the trap within trapping season for example; 17/04/2003, 21/04/2003-24/04/2003.
F	Comments on reasons why trap was not in operation	Information is provided on the reasons for non-operational traps during smolt trapping season for example; high flows, malfunction.

Table 6. Explanation of columns A-L provided in spread sheet C, Individual fish length (1mm)

Worksheet Column	Column Title	Attribute Description
A	Site	Location of smolt trap (river)
B	Date	Date (DD/MM/YYYY) of fish capture
C	Species	Species of fish captured in smolt trap including Salmon (S), Sea Trout (ST), Trout (T), Hybrid (H).
D	Length	Measured Fish fork length (mm)
E	Weight	Weight of fish in Grams (g)
F	Capture Status	Captured (C), Captured and marked (M), Marked recapture (R)
G	Tag No.	Tag number or code if available of this specific fish.
H	Tag Type	Type of tag employed if marking the fish e.g. Passive Interference Transponder (PIT),

		elastomer
I	Water Temperature	Local river water temperature (◦C) recorded on the day of collecting data from the trap.
J	River level	River flow height standardised to mm recorded on the day of collecting data from the trap.
K	Other Species Captured	Other fish species that have been captured in a smolt trap are recorded here for example, pike, eel, lamprey, stickleback
L	Comments	Any additional comments on this individual fish observation

Table 7. Explanation of columns A-K provided in spread sheet D: Fish Count Level Data

Worksheet Column	**Column Title**	**Attribute Description**
A	Site	Location of smolt trap (river)
B	Date	(DD/MM/YYYY): Date of count entry for each species captured.
C	Trap in Operation	(Yes/No) Yes indicated if trap is effectively fishing.
D	Species	Species of fish captured in smolt trap including Species (Salmon (S), Sea Trout (ST), Trout (T))
E	No. Fish Captured (not marked)	Number of fish captures that were not marked or tagged in any way. (If no tagging was undertaken by respective organisation all fish captures are entered in this column only).
F	No. Captured and marked	Number of fish captured and marked
G	No. Marked Recaptures	Number of fish that were captured and found to be previously marked.
H	Water temp	Local river water temperature (◦C) recorded on the day of collecting data from the trap.
I	Flow	River flow height standardised to mm recorded on the day of collecting data from the trap.

J	Comments	Any additional comment on that respective fish count
K	Other Species Captured	In the smolt trap e.g. count of trout, eel, stickleback, lamprey

Table 8. Explanation of columns A-W provided in spread sheet E: Fish Length (5mm Counts)

Worksheet Column	**Column Title**	**Attribute Description**
A	Site	Location of smolt trap (river)
B	Length (mm)	5mm category counts supplied in intervals between 50mm and 200mm for each year.
C –E	2006	Separate counts of 'unsmolted', 'part' and 'smolted' salmon.
F –H	2007	Separate counts of 'unsmolted', 'part' and 'smolted' salmon.
I –K	2008	Separate counts of 'unsmolted', 'part' and 'smolted' salmon.
L - N	2009	Separate counts of 'unsmolted', 'part' and 'smolted' salmon.
O -Q	2010	Separate counts of 'unsmolted', 'part' and 'smolted' salmon.
R -T	2011	Separate counts of 'unsmolted', 'part' and 'smolted' salmon.
U -W	2012	Separate counts of 'unsmolted', 'part' and 'smolted' salmon.

Table 9. Explanation of columns A-D provided in spread sheet F: Fish Length (10mm Counts)

Worksheet Column	**Column Title**	**Attribute Description**
A	Site	River Location of smolt trap (river)
B	Length	10mm category counts between 100mm and 310mm for the single season supplied.
C	Trout	Count of trout captured in the smolt trap.
D	Salmon	Count of salmon captured in the smolt trap.

3.4 Dataset Observations

Questionnaire responses indicate that data from the 31 locations was collected predominantly for a range of locally driven research questions and purposes noted in Appendix B. In collating this data into a standard format a number of outstanding considerations have arisen. Firstly, methodology applied to record the aspect of; when fishing did not occur, fishing did occur without the trap being checked, and fishing did occur with the trap being checked resulting in a catch of 0 is not consistent across the dataset between all sites. Likewise, the specific manner in which an organisation records the beginning and end of their trapping season varies across the network. Thirdly, data on other fish species (including trout) was provided to the SFCC in a range of formats. This information has been aggregated into the 'other species' column where it was provided. It should also be noted that in certain cases, other fish species are entered as individual fish observations with blanks in the 'length' and 'species' column. In this case rather than remove these entries the SFCC has chosen to include them to ensure that all raw data is preserved. For a brief explanation of notes and considerations relevant to each dataset please see column W in spread sheet A.

Temporal coverage of data is variable (Fig. 3). Of particular note, annual coverage and dataset duration at multiple locations is further constrained when only individual fish measurement datasets are considered. While the first trap began recording in 1973 at the Spey Dam, 1994 provides the next year in which a further location commenced operation on the river Bran, a tributary of the Conon. Recent years from 2006 onwards provide the greatest number of sites sampled in any one year for both count level and individual fish length level datasets (Tables 6 and 7).

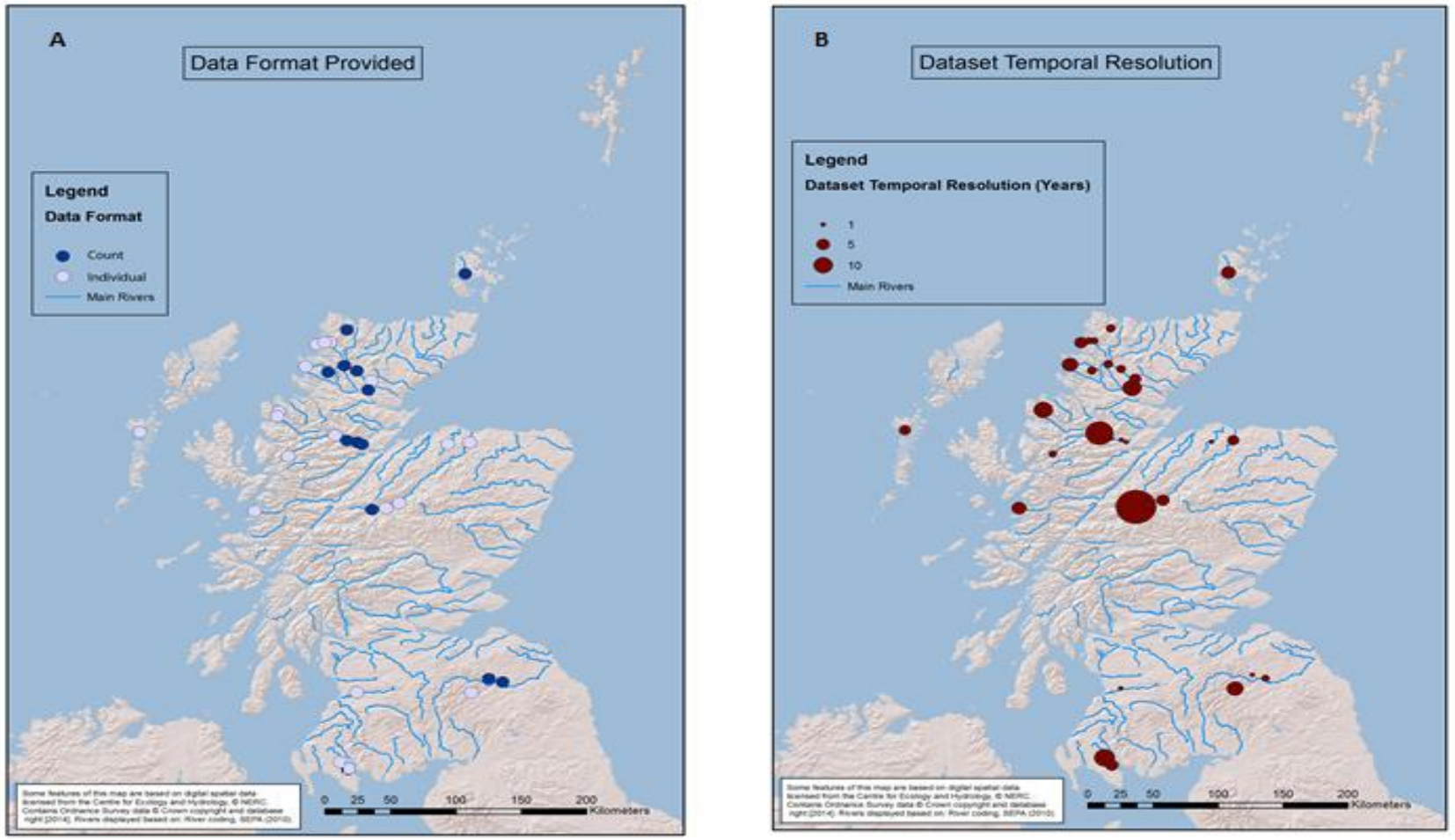

Figure 3. A: Map showing monitoring locations of fish count level (count) and individual fish length (individual) datasets. Please note that a number of these individual datasets represent a subset of fish sampled from the total count observed. B: Map showing total number of years in which data was provided from smolt monitoring locations for the current project as proportional symbols. The largest circle represents a 37 year count dataset provided by Spey Foundation.

Table 10. Temporal distribution of smolt monitoring data (all formats) as provided for this project. In some cases further years exist but it was not possible to provide the data within the project timescales.

Site	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Site
Stairaird																																						•				Stairaird
Carron																																				•	•					Carron
Blackwater																																					•					Blackwater
Bran																						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	Bran
Orrin																															•			•	•			•	•	•		Orrin
Meig																																		•									Meig
Bladnoch 1																															•							•	•	•	•	Bladnoch 1
Bladnoch 2																									•	•	•	•	•	•		•		•	•	•					•	Bladnoch 2
Loch nan Struban																														•	•				•	•						Loch nan Struban
Tirry																																							•	•	•	Tirry
Grudie																													•				•	•	•	•	•	•	•	•	•	Grudie
Corriekinloch																																							•	•	•	Corriekinloch
Fiag																																							•	•	•	Fiag
Merkland																																							•	•	•	Merkland
Morar																																	•	•	•	•	•	•				Morar
Lossie																																									•	Lossie
Eyrland																																•		•	•	•	•	•				Eyrland
Truim																																						•	•	•	•	Truim
Tromie																																					•	•	•	•	•	Tromie
Spey Dam	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•				Spey Dam
Spey Mainstem																																	•	•	•	•						Spey Mainstem
Yarrow																																		•	•	•	•	•	•	•	•	Yarrow
Leader																											•	•														Leader
Gala																									•																		Gala
Manse																											•	•	•	•	•	•	•									Manse
Loanan																												•	•	•													Loanan
Badaidh Daraich																																					•	•	•	•	•	Badaidh Daraich
Laxford																																					•	•				Laxford
Badna Bay																																								•	•	Badna Bay
Tournaig																																•	•	•	•	•	•	•	•	•	•	Tournaig
Ewe																																						•				Ewe
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	4	3	5	6	6	6	5	6	7	10	11	11	12	14	12	13	15	Count

Table 11. Temporal distribution of individual fish length format data as provided for this project. In a limited number of cases further years exist in paper format but it was not possible to provide the data within the project timescales.

Site	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Site
Stairaird																	•				Stairaird
Carron															•	•					Carron
Bran	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	Bran
Bladnoch 1													•								Bladnoch 1
Bladnoch 2				•	•	•	•	•	•		•		•	•	•					•	Bladnoch 2
Loch nan Struban									•	•				•	•						Loch nan Struban
Tirry																		•	•	•	Tirry
Morar												•	•	•	•	•	•				Morar
Lossie																				•	Lossie
Truim																	•	•	•	•	Truim
Tromie																•	•	•	•	•	Tromie
Spey Mainstem												•	•	•	•						Spey Mainstem
Yarrow													•	•	•	•	•	•	•	•	Yarrow
Manse						•	•	•	•	•	•	•									Manse
Badaidh Daraich																•	•	•	•	•	Badaidh Daraich
Laxford																•	•				Laxford
Badna Bay																			•	•	Badna Bay
Tournaig											•	•	•	•	•	•	•	•	•	•	Tournaig
Ewe																	•				Ewe
Count	2	2	2	4	3	5	6	6	6	5	6	7	11	11	11	12	14	12	13	15	Count

4. Discussion

To gain a national summary of smolt monitoring efforts the SFCC was able to canvass the fisheries network including non-SFCC member Fisheries Trusts and District Salmon Fishery Boards. The SFCC member network were also able to assist in identifying further smolt monitoring locations operated by external organisations or individuals. In total 30 different fisheries organisations or other bodies were contacted, resulting in the identification of 16 organisations collecting smolt trap monitoring data, and the remaining 14 confirming that they are not currently undertaking smolt trapping activities. Out of those collecting smolt monitoring data, 13 organisations were deemed to have data relevant to the project aims. Within the time frames, a total of 31 individual monitoring sites were identified and could be made available for collation.

River main-stem monitoring locations were identified in the project specification as being of particular importance in the context of national modelling of smolt emigration timings. The datasets provided feature around one half main-stem and one half 2nd order tributary level coverage.

Meta-data questionnaires were utilised to ascertain a range of information including the research question(s) targeted by the installation. The relationship of these efforts to each respective fisheries management plan has also been presented. Capture efficiency is quantified for the majority of locations using a range of methods and further work is recommended if MSS require a comprehensive assessment of these calibration methods. Data is provided firstly on Atlantic salmon and emigrating trout with some data also included on other fish species captures. Further work is required to fully collate data gathered during smolt trapping on other fish species. Several flow and temperature datasets are provided in the context of improving our understanding of the relationship between discharge, temperature and smolt migration run timings. Associated environmental data communicated in the meta-data questionnaire returns also indicated a significant data resource requiring further exploration.

Temporal resolution was found to vary with the longest being a 37 year count dataset. Individual fish length measurement data was not available for all 13 sites and temporal resolution of individual fish length datasets appeared to be limited before 2010. Trapping strategies vary with cost-effective solutions being utilised in several catchments and the hydro power sector also providing mobile and fixed strategies contained within hydro power infrastructure. While the SFCC believe that this project contains the absolute number of sites in Scotland, within the current sites

it is noted that there are datasets from certain years that were not able to be collated within the project timescales.

5. Conclusion

The Scottish wild fisheries network and further academic institutions were able to collate, and provide a range of datasets on smolt monitoring activities across Scotland. This coverage identified is further complemented by the installations managed by MSS in the River Dee catchment along with the proposed future smolt trap installations by Fisheries Trusts. Due to the support shown by all organisations this project has been able to identify notable regions in which smolt monitoring installations could be added to existing monitoring efforts in order to progress towards a more comprehensive national coverage. The process and results of this project have provided MSS, the SFCC and its members with a foundation on which to discuss and further a co-ordinated approach to smolt monitoring on a national scale.

The SFCC and MSS gratefully acknowledge all organisations and associated biologists for their support in compiling and providing the meta and raw data for this project.

6. References

Friedland, K. 1998. Ocean climate influences on critical Atlantic salmon (Salmo salar) life history events. *Can. J. Fish. Aquat. Sci.* 55(Suppl. 1): 119–130.

Hunter, D-C, Malcolm I.A. and Armstrong, J.D. 2014. Prioritisation of monitoring and research for diadromous fish in the context of Marine/Offshore Renewables: A summary of stakeholder engagement meetings between Marine Scotland, wild fisheries interests and wind, wave and tidal developers. *Scottish Marine and Freshwater Science*. Volume 5 Number 4. http://www.scotland.gov.uk/Publications/2014/03/5596.

Malcolm, I.A., Armstrong, J. D., Godfrey, J.D., Maclean, J.C. and Middlemas, S.J. 2013. The Scope of Research Requirements for Atlantic Salmon, Sea Trout and European Eel in the Context of Offshore Renewables. Marine Scotland Science Report 05/13. Scottish Government.

Otero, J., L'Abée-Lund, J. H., Castro-Santos, T., Leonardsson, K., Storvik, G. O., Jonsson, B., Dempson, B., Russell, I. C., Jensen, A. J., Baglinière, J.-L., Dionne, M., Armstrong, J. D., Romakkaniemi, A., Letcher, B. H., Kocik, J. F., Erkinaro, J.,

Poole, R., Rogan, G., Lundqvist, H., MacLean, J. C., Jokikokko, E., Arnekleiv, J. V., Kennedy, R. J., Niemelä, E., Caballero, P., Music, P. A., Antonsson, T., Gudjonsson, S., Veselov, A. E., Lamberg, A., Groom, S., Taylor, B. H., Taberner, M., Dillane, M., Arnason, F., Horton, G., Hvidsten, N. A., Jonsson, I. R., Jonsson, N., McKelvey, S., Næsje, T. F., Skaala, Ø., Smith, G. W., Sægrov, H., Stenseth, N. C. and Vøllestad, L. A. 2014. Basin-scale phenology and effects of climate variability on global timing of initial seaward migration of Atlantic salmon (Salmo salar). *Global Change Biology*, 20: 61–75. doi: 10.1111/gcb.12363

Scottish Government, 2014. *Offshore Renewable Energy* [Online] Available from: http://www.scotland.gov.uk/Topics/marine/MARINEENERGY [Accessed on 19/03/14].

Simpson, I 2003. Inventory of adult fish counters and traps in Scotland. Fisheries Research Services. Internal Report No 18/03.

7. Appendix A: Project Correspondence

7.1 Initial Notification letter (18.12.13)

Dear Sir/Madam

Collation of Datasets on Smolt Populations in Scotland to Assess Migration Run Times

The Scottish Fisheries Co-ordination Centre (SFCC) has today been awarded a contract from Marine Scotland Science (MSS) to facilitate the collation of smolt data in Scotland, the majority of which is held by members of The SFCC. Knowledge of migration run timings at a national scale is relevant in the context of imminent major developments in offshore renewables, and this provides a catalyst and unique opportunity to identify the available data on smolt migrations in Scotland. It is also an opportunity for The SFCC members to facilitate a partnership approach to fisheries data in Scotland.

Context

Fisheries proprietors, Trusts, Boards and others have expressed concern at the potential impacts that may arise from Scotland's planned offshore renewable developments. The Scottish Government has pledged to meet 100% of our electricity needs by 2020 through renewable energy sources, with offshore wave, tidal and wind devices set to provide a major contribution. Relative to our understanding of salmonid ecology in freshwater, migration routes and life strategies in the coastal and marine zone are poorly understood (e.g. Friedland, 1998). Specifically, Malcolm et al, 2013, identified that *"There is limited information available on the timing of migration for both juvenile and adult fish for specific locations on the Scottish coast."* The offshore renewables construction phase (due to commence in 2014) is often considered to have the greatest potential for harm. As such the value of this MSS project to is immediately apparent. Smolt run timings could be used to influence and design mitigation measures (if required); such as regulating construction and installation works during your respective local smolt emigration period.

At an international level some Scottish Fisheries Trusts have already successfully contributed smolt data for a comprehensive analysis across Europe and North America (Otero et al, 2013). By utilising the data collection expertise provided through the Trust and Board network, the SFCC encourages you to consider this MSS project as a microcosm of a collaborative fisheries data landscape in Scotland.

This project – what we are asking you to help with

The first stage of the project is to establish a basic understanding of the smolt data that has been collected to date by SFCC members in Scotland. To fulfil the first stage I have included a short questionnaire within the attached Annex A. To help with this project, please could you complete this questionnaire. Nil returns are also informative, and accordingly please notify us if you do not hold any smolt data. MSS will then assess the metadata provided to them, and subsequently select the raw smolt datasets they require for inclusion within the project. The SFCC will then communicate these requirements to respective members, before collating the available data into a standard format and supplying to MSS for further analysis. This analysis will focus on identifying run timings around the Scottish coast, while also assessing smolt sizes in relation to their potential for radio tagging using current technologies.

Thoughts for the future

The forthcoming review of fisheries management in Scotland will assess all active fisheries structures and how these may be improved to further advance evidence based fisheries management. This process will likely seek evidence of data collection and collaboration at both the local catchment and national scales. The SFCC aspires that through assistance from your organisation and other members, this project with MSS will provide a timely opportunity for a Scotland-wide assessment of smolt migrations while also providing evidence of streamlined and collaborative working relationships within the Scottish fisheries sector.

Further Information

Under Environmental Information Regulations (Scotland) Act 2004, and The Freedom of Information (Scotland) Act 2002 in the event that an acceptable request is made for raw data, MSS is duty-bound to publish these data. Therefore, for the purposes of this project data should be considered in the public domain.

For full details and the metadata questionnaire please see the attached annex A. The SFCC has been awarded funding to support the management of this project and the time taken by your organisation to collate and provide the data. Sean Dugan, the SFCC Manager will be your contact, with additional support from The SFCC Management Committee. Timescales, as ever, are tight, but we would appreciate if you can notify us if you are able to contribute to this project by January 10th 2014. If

you have any further questions please contact Sean using the details below. Thank you for your time and consideration.

Yours sincerely

Sean Dugan
SFCC Manager
On behalf of The SFCC Management Committee

01224 294408
s.dugan@marlab.ac.uk

* References attached in Annex A

Annex A - Supporting Information 18.12.13

Background

The objective of this project is *'To identify and collate the available datasets on smolt output across Scotland, in order to assess the potential of identifying migration run timings from these datasets'.* If you do not currently collect smolt data then this letter does still maintain relevance in that the outcomes of the following proposed national smolt data assessment may help identify gaps in the spatial coverage of data and thereby facilitate the deployment of smolt data collection facilities within your respective catchment.

Strategy and timeline

Week 3	**Dec**	Notification letter sent: communication of the context and a clear statement of the entire process, proposed use of data, metadata requests and time reimbursement procedure
Christmas & New Year		
2	**Jan**	Assessment of initial responses from SFCC members
3		Collation of metadata summaries (Stage 1)
4		Progress discussion at the annual biologists meeting
		Milestone 1: Meeting with MSS and appraisal of metadata summary report **Selection of datasets to be requested in full**
1	**Feb**	Formal requests for raw data from SFCC members (Stage 2) Division of funds evenly between all data providers
2		Collation of agreed datasets into a standard format
3		
4		Preparation of final report and acknowledgment of all data providers
1	**Mar**	
2		**Milestone 2: Project completion**

Stage 1. Initial Metadata Provision

Please complete the following for each smolt monitoring site(s).

Location of smolt monitoring site: River	
River order	
6 figure grid reference	E.g. 265 565
Annual resolution	E.g. 2008-2010, 2012
Survey period	E.g. March 1st- June 1st

Frequency	E.g. daily
Species recorded	
Fish weights recorded	(Yes/No)
Trap strategy	Total, partial
Trap type	Fixed, mobile, rotary screw
Method for assessing capture efficiency if applicable	
Any additional environmental data collected which you suggest may have relevance to the project aims	

*Please repeat this table for any additional locations.

Stage 2. Raw Data Provision

After selection of the required raw smolt datasets by MSS at the end of January 2014, The SFCC plans to request these datasets to the individual fish resolution, including species, length, and weight where available. If any further environmental data is collected that you suggest may be relevant to the aims of the project, we would appreciate the supply of these data if possible. The SFCC will then collate spread sheets from all data providers into a standard calibrated format and deliver this to MSS as a Microsoft Excel document. Final report submission will include a GIS map of locations, along with the metadata summary, and acknowledgements of your organisation as the data owner.

Funding

Within the project the SFCC has been awarded £4,500 towards management including collation of the data into a standard format and preparation of the aforementioned final report. This donation will be reinvested into our membership to develop the training provision programme. A sum of £5,450 has also been awarded through the project to fund the time taken by data holders for data retrieval and collation costs. After selection of the datasets which will be requested for further analysis, funding will be divided evenly among all participating organisations. Thereby if, for example, 10 Trusts or Boards provide smolt data, remuneration to each will be £540.00. This payment must be made within the current financial year and The SFCC will endeavour to process payment within 5 working days of data provision.

Considerations

As holders of the data after the project, under EIR and FOISA regulations in the event that an acceptable request is made for raw data, MSS are duty-bound to share these data. Prior to this eventuality, MSS will first publish its existing report in relation to smolt migration run timings, and will only consider releasing raw data if circumstances require. It should be noted that as a result of these stipulations, the purposes of this project all data submitted should be considered to be in the public domain.

Added value to the SFCC

MSS funding for this project will be invested directly into our member network. A core aim of the SFCC is to *facilitate cross-Scotland projects*, with the present specification providing a model opportunity to address these aims. The SFCC was established to facilitate evidence based fisheries management in Scotland, and provides a mechanism for local fisheries managers and biologists to standardise aspects of data collection and storage. Pending results of this project, we envisage the creation of a standard smolt data collection protocol.

Acknowledgements

Your organisation will be fully acknowledged as owners of your respective data at the outset, in the report provided by The SFCC, and in the analysis carried out by MSS. This project will accentuate the value of data collected by The River Don Trust, to inform both local and national scale management approaches.

References

Friedland, K. 1998. Ocean climate influences on critical Atlantic salmon (Salmo salar) life history events. Can. J. Fish. Aquat. Sci. 55(Suppl. 1): 119–130.

Malcolm, I.A., Armstrong, J. D., Godfrey, J.D., Maclean, J.C. and Middlemas, S.J. 2013. Marine Scotland Science Report 05/13 The Scope of Research Requirements for Atlantic Salmon, Sea Trout and European Eel in the Context of Offshore Renewables. Scottish Government.

Otero, J et al, 2013. Basin-scale phenology and effects of climate variability on global timing of initial seaward migration of Atlantic salmon (*Salmo salar*). Global Change Biology (2014) 20, 61-75.

7.2 Confirmation letter & second metadata questionnaire (12.02.14)

Dear Sir/Madam,

SFCC Smolt Data Collation Project - Confirmation Letter to Trusts

Thank you for providing the metadata information summarising your smolt monitoring sampling. Having presented your metadata to Marine Scotland Science (MSS), I am pleased to inform you that based on the summary you provided, these data have significant value to the aims of this project and I therefore wish to invite you to contribute the raw data.

With reference to the notification letter sent on 18.12.13, we require Smolt data down to the individual fish level, or if not recorded, total fish count data.

Metadata Summary

As a result of the good response from Trusts, Boards and academic interests, The SFCC believe there to be a minimum of 30 specific smolt monitoring locations in Scottish catchments (see attached map in appendix A). In addition, smolt monitoring locations are operated by MSS on the River Dee and Esk catchments. While the strategy, coverage and temporal resolution of deployment varies widely between sites, this data will provide an important resource for improving our understanding of salmon and sea trout smolt migration in Scotland and will have direct application in the context of offshore renewables developments.

Payment

A total of £5,450 has been allocated to fund data retrieval and collation by the various participating organisations. Data collected by 13 of these organisations across Scotland is deemed highly desirable and has been selected by MSS. Thus, a minimum of £419.23 will be offered to each member providing data. If the eventual number of participating organisations drops below 13, all remaining monies will be allocated evenly between contributing organisations.

Timescales

This project is required to be delivered by The SFCC within the current financial year. MSS require 2 weeks to process payments, therefore our deadline for submitting the report and data is Friday 14th March. In order to meet this deadline the SFCC require

all raw datasets to be supplied by Wednesday 26th February. Payment to you will then be allocated and processed within 10 working days of this date.

Data Format

Data collected to the individual fish resolution is highly desirable for this project. Data should be submitted in a standard format within Microsoft Excel in order to ensure that collation of all datasets is possible at a national level. Please see the attached spread sheet with separate requirements for data that has been collected at the individual fish level (*'smolt individual fish data'* sheet) and for sites where individual data is not available, please use the total fish count level (*'smolt count level data'* sheet). Please only submit one of these formats for each monitoring site. For data supplied at the individual fish resolution, sheet 3 ('*fishing dates' sheet*) must also be completed.

All other relevant variables that cannot be assigned to the columns should be inserted into free columns to the right. If you anticipate problems in converting your data into the standard template by the specified date then please contact me to discuss further. The SFCC and MSS appreciate that certain Trusts maintain large datasets covering multiple decades and we are therefore happy to discuss further options.

Supporting Information Required

MSS have requested some further information on your trap installations. Please fill in the questionnaire in Appendix B (page 4), and send one upstream facing and one downstream facing photograph of your trap(s) if at all possible. Also please provide any additional information on the trapping method used (such as a diagram).

We hope that you are able to contribute further and thank you for your time and consideration.

Yours sincerely

Sean Dugan
SFCC Manager

Appendix A. Smolt monitoring locations (current and past) as provided to The SFCC for the purposes of assessing migration run timings. Two further locations managed by Galloway Fisheries Trust and one installation on Orkney will subsequently be added to this map.

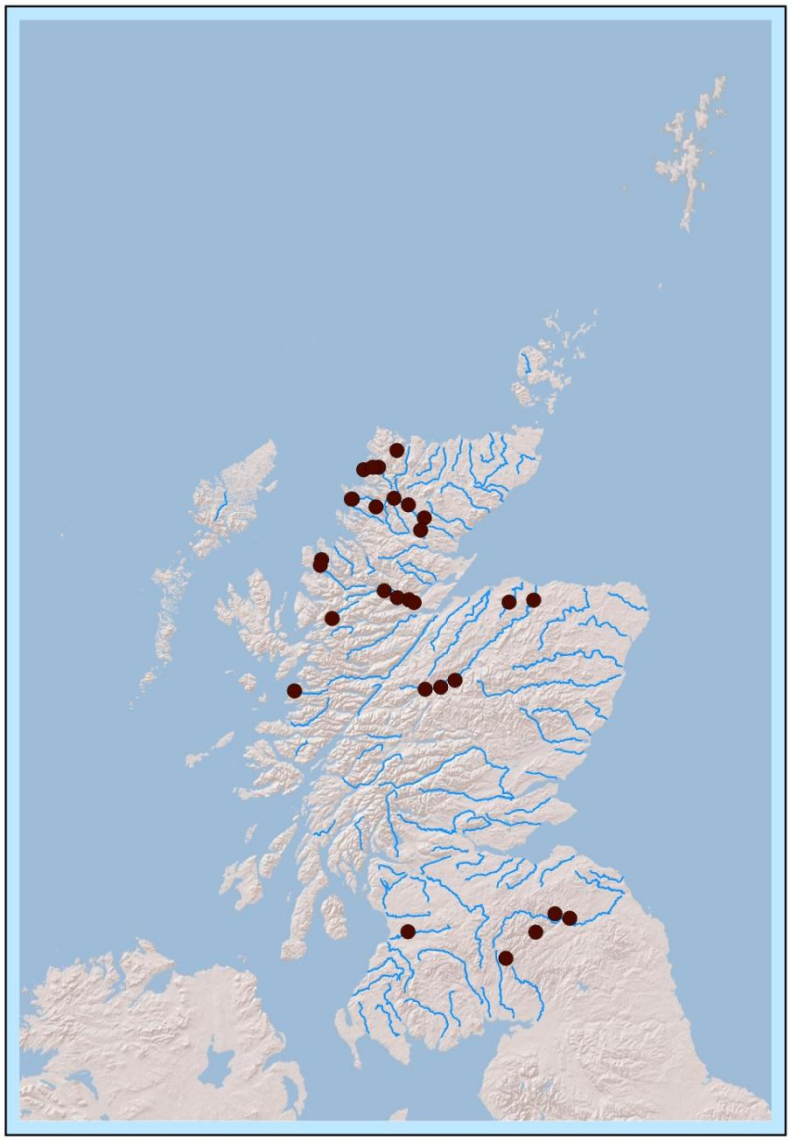

Figure 10: Smolt monitoring locations (current and past) as provided to The SFCC for the purposes of assessing migration run timings.

Appendix B. Please provide the following information in support of your dataset for each monitoring site(s).

Site/River:
1. **What is the purpose/research question(s) you wish to answer with this trap deployment?**
2. How do these objectives relate to your fishery management plan?
3. Does your deployment specifically target smolts?
4. Please note years when part of the smolt run may have been missed.
5. If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
6. **Are there any further locations at which you aspire to monitor smolt runs in future years?**

7.3 Thank you letter & payment (03.03.14)

Dear Sir/Madam

SFCC Smolt Data Collation Project - Thank you

On behalf of The Scottish Fisheries Co-ordination Centre I would like to thank you for your involvement in the smolt data collation project, firstly for the provision of the metadata summary, and secondly the supply of detailed raw data. Given that this data was supplied to a standard format, and delivered within such a short timescale, we appreciate the considerable time and effort undertaken by all involved.

Please find enclosed a cheque for £419.23 for the work that you have carried out. This payment has been equally applied to each of the eventual 14 organisations across Scotland who provided smolt data.

Datasets from all participants are currently being collated and will be shortly supplied to Marine Scotland Science (MSS) in a standard format, along with a metadata report, maps and a brief summary of your questionnaire responses. MSS will then analyse this data with the aim of improving our understanding of smolt migration run timings, and ascertaining the potential of these fish to carry acoustic tags based on fish length.

This research is undertaken in the context of the forth coming National Research and Monitoring Strategy for Diadromous Fish (NRMSD) to investigate the potential for interactions between diadromous fish and wind, wave and tidal renewable energy developments. Further information on this stakeholder led strategy will be imminently available on the Marine Scotland website. At future stakeholder group meetings metadata provided for the purposes of this project will be presented and considered for the above analysis.

MSS gratefully acknowledge all organisations involved in providing data for the purposes of this project.

Yours sincerely

Sean Dugan
SFCC Manager

8. Appendix B. Metadata questionnaire responses

Supporting information is provided for each organisation in alphabetical order. Organisations providing smolt data were required to fill in two metadata questionnaires to the best of their knowledge and to provide one upstream facing and one downstream facing photograph of each trap installation. In some cases it was not possible to provide all of the required information within the project timescales. It should also be noted that in some cases 'annual resolutions' provided in the below responses do not match the eventual coverage of raw data provided. Please refer to the temporal resolution section of the main report for the final annual coverage of all datasets.

8.1 Ayrshire Rivers Trust

Location of smolt monitoring site:	**River Ayr (Stairaird)**
River order	Main stem
6 figure grid reference	NS 465 262
Annual resolution	2010
Survey period	24th March – 28th May
Frequency	Twice daily
Species recorded	Salmon, trout, river and brook lamprey, perch, eel, minnow and stone loach
Fish weights recorded	Not all, but roughly 10% captured
Trap strategy	Main channel flow
Trap type	Rotary screw trap
Method for assessing capture efficiency if applicable	3 recapture trials were done whilst running the RST
Any additional environmental data collected which you suggest may have relevance to the project aims	Rainfall data

Site/River: Stairaird, River Ayr

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	One of the angling clubs on the River Ayr had been stocking the river with Sea Trout for numerous years and by implementing the RST it should show if the stocking was working or not. We also wanted to see the proportion of salmon against sea trout being caught and the difference on the recapture.

2.	How do these objectives relate to your fishery management plan?
	In our FMP one of our aims/objectives was to investigate the decline of Ayrshire's sea trout populations and to look into stocking.
3.	Does your deployment specifically target smolts?
	Yes as it was positioned in a main stream channel during the smolt run.
4.	Please note years when part of the smolt run may have been missed.
	This was only operated in 2010.
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	n/a
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes we would like to run a RST on all of the rivers in Ayrshire in future years.

8.2 Cromarty Firth Fisheries Trust

Location of smolt monitoring site:	**River Blackwater**
River order	2
6 figure grid reference	246900 855100
Annual resolution	2009
Survey period	09/04-30/05
Frequency	Daily
Species recorded	Sal, Trout, other
Fish weights recorded	No
Trap strategy	Partial
Trap type	Rotary
Method for assessing capture efficiency if applicable	Marked Recapture
Any additional environmental data collected which you suggest may have relevance to the project aims	

Site/River: Blackwater

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	Estimate smolt production of the River Blackwater
2.	How do these objectives relate to your fishery management plan?
	Identified in FMP as; RD2: Monitor smolt outputs RD11; Develop more sophisticated stock models
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Only run once to date, combination of controlled hydro flow and dry spring meant trapping effort constant and no outages
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	Not planned for 2014 but would like to repeat in the future
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes Trapping planned on Meig in 2014 and Orrin 2015. Would also like to run RST on other Cromarty rivers particularly the Alness, Sgitheach and Allt Graad.

Location of smolt monitoring site:	**River Bran**
River order	2
6 figure grid reference	230000 861500
Annual resolution	1994-ongoing
Survey period	1st April- variable (mid-June)
Frequency	Daily
Species recorded	Sal, Trout, other
Fish weights recorded	Yes
Trap strategy	Total
Trap type	Wolf
Method for assessing capture efficiency if applicable	Marked Recapture
Any additional environmental data collected which you suggest may have relevance to the project aims	Flow

Site/River: Bran

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	Smolt trapping and transport is part of the long term mitigation for hydro development of the Conon system. The tagging programme associated with this project allows monitoring of the impact of the management and also monitoring of entire catchment smolt production. PIT tag decoders downstream allow for monitoring of adult return rates.
2.	How do these objectives relate to your fishery management plan?
	Identified in FMP as; RD1 – Monitor smolt outputs RD2 – Monitor adult salmon return rates RD11- Develop more sophisticated stock model
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	The trap is in constant operation during the smolt run and periods recorded in spread sheet. The trap is attached to the Achanalt Barrage and in periods of high flow the Barrage gates may be partly opened although there is an agreed protocol to minimise this. When gates are open there is likely to be some loss of smolts under the gates although the extent of loss cannot be quantified.
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	Yes and for foreseeable future as part of on-going mitigation for hydro development
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	RST planned for Upper Meig in 2014 to study smolt passage through Loch Meig. New fixed trap planned below Orrin Dam 2015 to monitor smolt production upstream of Orrin Dam and optimise passage at Dam.

Location of smolt monitoring site:	**River Meig**
River order	2
6 figure grid reference	239000 856700
Annual resolution	2006
Survey period	1st April- variable (mid June)
Frequency	Daily
Species recorded	Sal, Trout, other
Fish weights recorded	No
Trap strategy	Partial
Trap type	Rotary
Method for assessing capture efficiency if applicable	Marked Recapture
Any additional environmental data collected which you suggest may have relevance to the project aims	

Site/River: Meig

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	Estimate smolt production of the River Meig
2.	How do these objectives relate to your fishery management plan?
	Identified in FMP as; RD2: Monitor smolt outputs RD11; Develop more sophisticated stock models
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Only run once to date, combination of controlled hydro flow and dry spring meant trapping effort constant and no outages
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	Not planned for 2014 but would like to repeat in the future
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes Trapping planned on Upper Meig in 2014 and Orrin 2015. Would also like to run RST on other Cromarty rivers particularly the Alness, Sgitheach and Allt Graad.

Location of smolt monitoring site:	**River Orrin**
River order	2
6 figure grid reference	250600 853400
Annual resolution	2007
Survey period	1st April- variable (mid June)
Frequency	Daily
Species recorded	Sal, Trout, other
Fish weights recorded	Yes
Trap strategy	Partial
Trap type	Rotary
Method for assessing capture efficiency if applicable	Marked Recapture
Any additional environmental data collected which you suggest may have relevance to the project aims	Flow

Site/River: Orrin

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	Estimate smolt production of the River Orrin
2.	How do these objectives relate to your fishery management plan?
	Identified in FMP as; RD2: Monitor smolt outputs RD11; Develop more sophisticated stock models
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Only run once to date, combination of controlled hydro flow and dry spring meant trapping effort constant and no outages
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	Not planned for 2014 but would like to repeat in the future
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes Trapping planned on Upper Meig in 2014 and Upper Orrin 2015. Would also like to run RST on other Cromarty rivers particularly the Alness, Sgitheach and Allt Graad.

8.3 Findhorn, Nairn & Lossie Fisheries Trust

Location of smolt monitoring site:	**River Lossie, Kellas Estate**
River order	1
6 figure grid reference	316119 853670
Annual resolution	2013
Survey period	15/04/2013 30/05/2013
Frequency	Daily
Species recorded	Salmon, trout, Brook Lamprey, 3 Spined Stickleback
Fish weights recorded	No
Trap strategy	Partial
Trap type	Rotary screw
Method for assessing capture efficiency if applicable	Mark recaptures. Portion of smolts tattooed with dye spots and re-released upstream from trap, recaptured recorded
Any additional environmental data collected which you suggest may have relevance to the project aims	Temperature data Flow data available from SEPA gauging station upstream

Site/River: Lossie

1. What is the purpose/research question(s) you wish to answer with this trap deployment?

   After several years of poor fish catches and little observations of salmon spawning in the upper Lossie are there any salmon and sea trout smolts emigrating from the upper Lossie?

2. How do these objectives relate to your fishery management plan?

   FMP 3.2: Salmon and Trout Smolt Production

   Currently No data smolt production is available for Lossie catchment. To provide better measure of the salmon and trout output from the River Lossie.

   Aim: Explore funding possibilities for establishing a smolts trap(s) within the catchment and identify suitable locations for establishing smolt traps throughout the Lossie.

3. Does your deployment specifically target smolts?

   Yes, both salmon and sea trout

4.	Please note years when part of the smolt run may have been missed.
	Rotary trap only installed for Spring 2013
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	None
6.	Are there any further locations at which you aspire to monitor smolt runs in future years
	Yes, Lower Lossie to provide full river estimate, similar for river Nairn, Larger tributary of the Findhorn also under consideration such as Dorback. Data used to test desktop estimations of smolt out and carry capacity

8.4 Galloway Fisheries Trust

Location of smolt monitoring site:	**River Bladnoch 2 (downstream of Site 1)**
River order	1
6 figure grid reference	(NX) 396 553 (239682 555381)
Annual resolution **NB: individual fish length/weight data is collected by GFT; count data is collected by the fish farm**	1997 - 07/04/97 to 04/06/97 (individual length data) 1998 – 17/03/98 to 16/06/98 (individual length data) 1999 – 20/03/99 to 18/06/99 (individual length data) 2000 – 26/03/00 to 26/05/00 (individual length data) 2001 – 27/03/01 to 06/06/01 (individual length data) 2002 – 10/04/02 to 04/06/02 (individual length data) 2003 – 25/03/03 to 29/05/03 (count data) 2004 – 04/04/04 to 09/05/04 (individual length data) 2005 – No data 2006 – 28/03/06 to 08/05/06 (individual length data) 2007 – 28/03/07 to 10/05/07 (individual length data)

	2008 – 28/03/08 to 11/05/08 (individual length data) 2009 – No data 2010 – 31/03/10 to 10/06/10 (count data) 2011 – 03/04/11 to 31/05/11 (count data) 2012 – 28/03/12 to 27/05/12 (count data) 2013 – 27/03/13 to 18/04/13 (count data) 19/04/13 (individual length data) 20/04/13 to 22/04/13 (count data) 23/04/13 (individual length data) 25/04/13 to 02/05/13 (count data) 03/05/13 (individual length data) 04/05/13 to 06/05/13 (count data) 07/05/13 (individual length data) 08/05/13 to 16/05/13 (count data) 17/05/13 (individual length data) 18/05/13 to 25/05/13 (count data)
Survey period	Varies between years, but approx. end of March to end of May
Frequency	Daily during salmon smolt run
Species recorded	All species caught but aim was for salmon smolts
Fish weights recorded	No, except in 2013 when only smolts were analysed 1 day/week
Trap strategy	Partial
Trap type	Fyke net in fish farm lade (intake from main river)
Method for assessing capture efficiency if applicable	None
Any additional environmental data collected which you suggest may have relevance to the project aims	May have access to river level records and water temp data

Site/River: Site 2, Bladnoch (fyke net)

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
2.	The smolts are caught by fkye net. The fyke net is installed in a lade which provides water to a fish farm from the main River Bladnoch. The farm is gravity fed therefore the lade takes water directly from the river at all times. When the river level is low, I believe there is a sluice gate which can be opened further so

that the farm takes sufficient amounts of water – meaning a greater percentage of water is going through the farm. Therefore during the smolt run there is a high chance of downstream migrating smolts being directed towards the fish farm and getting stuck at the screens which the farm doesn't want. Indeed, the farm has a legal obligation to run the net/trap so as to allow smolts to migrate downstream to sea. So every year the farm installs a fyke net and collects the smolts and puts them back in the river downstream of the lade's intake. In past years GFT has taken data from the smolts before they are put back into the river. In some years we have carried out mark recapture experiments on a proportion of the smolts in order to estimate the smolt run of the river. In years when we do not undertake mark recapture experiments, we do not have specific 'questions to answer' but we view it as an opportunity to collect data from this life stage that we would not normally have access to.

3. How do these objectives relate to your fishery management plan?

4. The objectives of collecting data from the smolts at this site does not relate directly to out FMP, but it helps up build the picture of smolts leaving the Bladnoch system.

5. Does your deployment specifically target smolts?

The fyke net deployment does specifically target the smolt run as they are numerous so there is potential for thousands to enter the fish farm. The fyke net is not run all year which means the odd pike or brown trout do get into the farm but this is not as big a problem as thousands of smolts. Legally the smolts have to be caught and put back in the river to be on their way. Although the fyke net does target the influx of smolts, many other fish species are caught when it is deployed (it is only installed in the lade just before until after the smolt run when catches radically tail off to zero).

6. Please note years when part of the smolt run may have been missed.

I am unaware of any years when part of the smolt run would have been missed by the fyke net. However in terms of holes in our data, we have not sampled smolts over the whole of the smolt run in each sampling year, and indeed have not taken data from the smolts every year. As this work has not been directly funded, we have spent time on smolts when time, manpower and funds have allowed.

7. If you are operating this trap in 2014, for how many subsequent years do you plan to operate?

This fyke net will be run by the fish farm every year regardless of what we choose to do in terms of smolt data collection. I plan to take a sub-sample of smolts to collect length/weight/age data in 2014 but we do not have the resources to collect data every day during the smolt run.

8.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	N/A for the fyke net as it is static and here for a specific purpose. But I would like to run the rotary screw trap on the nearby Water of Fleet in order to get some data on sea trout smolts (numbers heading to sea, age of smolting, location in the catchment they are coming from).

Location of smolt monitoring site:	**River Bladnoch 1 (upstream of Site 2)**
River order	1
6 figure grid reference	(NX) 338 621 (233881 562141)
Annual resolution	2005 – installed trap then a few days later caught a sheep which damaged trap enough to make it inoperable 2006 – 03/04/06 to 08/05/13 (individual length data) Only 2006 data available
Survey period	Start of April to end of May
Frequency	Daily during salmon smolt run, except on high water when screw was lifted up so not fishing
Species recorded	All species caught but aim was for salmon smolts
Fish weights recorded	No
Trap strategy	Partial
Trap type	Rotary screw trap
Method for assessing capture efficiency if applicable	None
Any additional environmental data collected which you suggest may have relevance to the project aims	May have access to river level records and water temp data from further down the river

Site/River: Site 1, Bladnoch (rotary screw trap)

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	This screw trap was used to try and ascertain if many smolts were being produced and coming down from the upper main River Bladnoch. It was installed upstream of where the river's largest tributary, the Tarf Water, joins, and from where we know many salmon are produced. The upper River

Bladnoch suffers from acidification and although some juvenile salmon are recorded during electrofishing surveys, we wanted to know if many smolts (and their age/size/condition) were being produced. The numbers could be compared to those caught further downstream at Site 1 – Torhouse Trout Farm lade.

2. How do these objectives relate to your fishery management plan?

In our FMP we aim to try and address acidification (it is one of the main limiting factors in the Bladnoch). We need as much data as we can to back up and support our cause, especially with forestry interests. Smolt data helps fill the picture as we can show egg box experiment results, numbers of juvenile salmon either stocked there, and/or recorded in juvenile electrofishing surveys, and if we have smolt information we can complete the freshwater picture for the upper Bladnoch.

3. Does your deployment specifically target smolts

Yes, the deployment specifically targets smolts, but other species have been caught as well. The screw trap only catches a proportion of the smolts leaving the upper Bladnoch because of the width of the river and the size/nature of the trap.

4. Please note years when part of the smolt run may have been missed.

The trap was only run for a few years, and only put in when we thought the smolts were running. In order to protect the screw trap from damage we have to crank up the catching part of the trap (the cone) in times of high water – one year about mid-way through the smolt run we caught a sheep in the trap that came down in a flood and this caused a lot of internal damage to the trap. Because of this we couldn't use the trap for the remainder of that year and it was very costly to fix. Plus the traps get battered around a lot in a flood and they're not that strong. So it is likely that in times of flood many more smolts will run past the trap which is not 'fishing'.

5. If you are operating this trap in 2014, for how many subsequent years do you plan to operate?

We do not plan to run the screw trap in this location on the Bladnoch in 2014, or for the foreseeable future. We (hopefully) plan to deploy the trap elsewhere as we have no data on smolts from other rivers (e.g. Luce, Fleet, Urr).

6. Are there any further locations at which you aspire to monitor smolt runs in future years?

I would like to get data on smolts, particularly sea trout, from the Water of Fleet. I'd plan on using the rotary screw trap for this purpose.

8.5 Heriot Watt University / Malcolm Thomson (Orkney)

Location of smolt monitoring site:	River Eyrland
River order	1
6 figure grid reference	
Annual resolution	2007-2010
Survey period	
Frequency	Daily
Species recorded	Salmon, trout, other
Fish weights recorded	Yes
Trap strategy	Total
Trap type	Wolf
Method for assessing capture efficiency if applicable	Marked Recapture
Any additional environmental data collected which you suggest may have relevance to the project aims	Temperature, flow,

Site/River: Eyrland Burn, Orkney

1. What is the purpose/research question(s) you wish to answer with this trap deployment?

- Estimate smolt productivity in an Orkney burn which had not previously been done.
- Use the data to study migration cues, smolt growth rates and other aspects of migration.
- Tag smolts to study movement at sea.
- Use smolt data to compliment data from upstream trap surveys in the same burn carried out in 2007 & 2009.

2. How do these objectives relate to your fishery management plan?

- Orkney currently has no formal fisheries management plan.
- The data was collected as part of my PhD thesis, but also used by the local trout fishing association (of which I am a member) to provide summary information on sea trout which was submitted to local regulatory authorities, e.g. Orkney Islands Council, SEPA, SNH, to aid in the local development plan and planning process.

3. Does your deployment specifically target smolts?

- Yes

4. Please note years when part of the smolt run may have been missed.

- Part of the smolt run was probably missed in 2004 & 2006, when only partial samples were obtained.
- The Wolf trap (2007 – 2010) was certainly more effective and I think caught the

majority of the run, but it was still possible that some smolts were missed during high water events.

- Attempts to estimate trap efficiency were confounded by the tendency for some marked fishes to de-smolt and remain in the burn.

5. If you are operating this trap in 2014, for how many subsequent years do you plan to operate?

- No.
- I would like to operate the trap again in the future in a primarily monitoring sense, but it would require funding to do so.

6. Are there any further locations at which you aspire to monitor smolt runs in future years?

- Yes there are other areas in Orkney where smolt data would be useful, if the Eyrland data is a sentinel site for the Scapa Flow area, then a complimentary site on the north of the mainland would be good. There are some sites where this might be possible, i.e. burns with dams/fish ladders, like the Eyrland burn.
- As with the Eyrland burn however this would require proper funding to execute.

8.6 Inverness College UHI (River Carron)

Location of smolt monitoring site: River Carron, Lochcarron, Wester Ross	**The smolt trap is positioned at the neck of Brabourne's Pool approximately 300 metres above the road bridge at Strathcarron**
River order	The Carron is one of the biggest river systems in Wester Ross.
6 figure grid reference	194100 842400
Annual resolution	The trap has been in operation since 2008
Survey period	The trap is positioned at the beginning of April and is operated until the end of the smolt run (sometime in June)
Frequency	The trap is checked and emptied daily
Species recorded	All fish are recorded and include salmon fry, parr and smolts, sea trout fry, parr, smolts, finnock and kelts, eels, sticklebacks, minnows, flounders and on a couple of occasions sea lampreys.
Fish weights recorded	Weights are not recorded, but lengths of the first 50 salmon smolts are taken daily as well as the lengths of all sea trout smolts, finnock and kelts.

Trap strategy	The trap is used to monitor smolt output from the river and operates best when the river is low. In 2011 and 2012, low conditions prevailed throughout most of the smolt run resulting in good numbers of smolts being caught (more than 6,500 in 2011). The trap has also enabled an assessment to be made of the smolt output from salmon stocked out as tagged fry.
Trap type	Rotary screw
Method for assessing capture efficiency if applicable	In 2011 and 2013, identifiable salmon smolts were released from a release pond in known numbers at a time of low water when the trap was operating at its most efficient. These fish were monitored through the trap giving an indication of trap efficiency. The results for the 2 releases were very similar.
Any additional environmental data collected which you suggest may have relevance to the project aims	All the fish going through the trap are carefully examined and any incidence of scale loss is noted either as a few missing scales or severe scale loss where mortality would occur. This gives an indication of bird damage on migrating smolts which at times can be very high.

Site/River: River Carron

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	As part of the River Carron Restoration Project the trap is being used to assess the health of the salmon population in the river. This data forms part of the overall picture of the health of the River Carron stock and helps answer the question of whether it is improving or not.
2.	How do these objectives relate to your fishery management plan?
	N/A
3.	Does your deployment specifically target smolts?
	Essentially yes, but any fish in the trap regardless of age or species is recorded.
4.	Please note years when part of the smolt run may have been missed.
	In both 2008 and 2009 the trap was raised to allow stocked smolts ease of movement to the estuary

5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	Screw trap surveys in the River Carron are likely to be on-going
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	No

Additional note: In 2008 salmon were stocked out as unfed fry, fry, pre-smolts and smolts while trout were stocked out as ova and fry. In 2009 salmon were stocked out as fry, pre-smolts/ parr and smolts while trout were stocked out ova, fry, "yearlings" and smolts.

8.7 Kyle of Sutherland Fisheries Trust

Location of smolt monitoring site:	**1. Tirry** **2. Grudie** **3. Corriekinloch** **4. Fiag** **5. Loch Ghriama (Loch Shin)**
River order	?
grid reference	1. NC 576 116 2. NC 552 031 3. NC 369 253 4. NC 466206 5. NC 389 581
Annual resolution	Annually since 2011
Survey period	March 1st- June 1st
Frequency	Daily
Species recorded	Salmon, Trout, Eels
Fish weights recorded	No
Trap strategy	1. Partial 2. Total 3. Partial 4. Partial 5. Partial
Trap type	1. Rotary Screw 2. Wolf Trap 3. Rotary Screw 4. Rotary Screw 5. Rotary Screw
Method for assessing capture efficiency if applicable	None

Any additional environmental data collected which you suggest may have relevance to the project aims	None

Site/River: Fiag/Corriekinloch/Merkland/Tirry (Kyle Fisheries)

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	The success (or otherwise) of smolt migration through Loch Shin and the SSE Hydro Dams at Lairg. The approximate density of smolts in the main tributaries (Fiag/Corriekinloch/Merkland/Tirry)
2.	How do these objectives relate to your fishery management plan?
	Shin Smolt Migration Research – Re-establishing a viable migratory population in the tributaries of Loch Shin
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	As long as funding will allow, or until a viable migratory population is established
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes, on the River Oykel.

8.8 Lochaber Fisheries Trust

Location of smolt monitoring site:	**River Morar**
River order	1
6 figure grid reference	NM684 923
Annual resolution	2005-2012 (but trap has had to be removed for periods during the run in some years due to high water)
Survey period	Varies usually beginning May to early June
Frequency	daily
Species recorded	Salmon and sea trout

Fish weights recorded	No - lengths recorded
Trap strategy	partial
Trap type	rotary screw
Method for assessing capture efficiency if applicable	Mark and recapture. Recapture rates for salmon approx. 6-19%, too low for sea trout (0-7%)
Any additional environmental data collected which you suggest may have relevance to the project aims	Vaki counter at hydro dam on river records numbers of salmon, grilse and sea trout ascending the river. In conjunction with smolt output data can be used to estimate smolt survival. BUT number of years when counter not working and gaps in trap deployment through smolt run mean that data aren't that robust.

8.9 Outer Hebrides Fisheries Trust

Location of smolt monitoring site:	**Outflow of Loch nan Struban**
River order	n/a
6 figure grid reference	NF 807643
Annual resolution	E.g. 2008-2010, 2012
Survey period	March to June data supplied
Frequency	Daily
Species recorded	Trout
Fish weights recorded	No
Trap strategy	Total
Trap type	Fixed
Method for assessing capture efficiency if applicable	
Any additional environmental data collected which you suggest may have relevance to the project aims	Trap is not located on the best possible system.

8.10 Spey Foundation

Location of smolt monitoring site:	River Truim, Spey catchment
River order	2
6 figure grid reference	268900/794957
Annual resolution	2010-2013
Survey period	Early March to about 25th May (varied from year to year
Frequency	Daily
Species recorded	Salmon/Trout
Fish weights recorded	No
Trap strategy	Partial
Trap type	rotary screw
Method for assessing capture efficiency if applicable	Proportion of catch mark and released
Any additional environmental data collected which you suggest may have relevance to the project aims	Temperature, river height or flow, cumulative spring air temperature

Site/River: River Truim

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	Assessment of smolt production in tributary subject to SEPA CAR licence variation
2.	How do these objectives relate to your fishery management plan?
	FMP Action 3.2: To provide better measurements of the salmon and trout smolt output of the River Spey
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Described in spread sheet
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	This RST will not operate in 2014 but may operate in future years depending on outcome of SEPA CAR licence review
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes – a RST will be operated in the Lower River Avon in 2014

Location of smolt monitoring site:	**River Tromie, Spey catchment**
River order	2
6 figure grid reference	278912/799585
Annual resolution	2009 -2013
Survey period	Early March to about 25th May (varied from year to year
Frequency	Daily
Species recorded	Salmon/Trout
Fish weights recorded	No
Trap strategy	Partial
Trap type	rotary screw
Method for assessing capture efficiency if applicable	Proportion of catch mark and released
Any additional environmental data collected which you suggest may have relevance to the project aims	Temperature, river height or flow, cumulative spring air temperature

Site/River: River Tromie

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	Assessment of smolt production in tributary subject to SEPA CAR licence variation
2.	How do these objectives relate to your fishery management plan?
	FMP Action 3.2: To provide better measurements of the salmon and trout smolt output of the River Spey
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Described in spread sheet
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	This RST will not operate in 2014 but may operate in future years depending on outcome of SEPA CAR licence review
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes – a RST will be operated in the Lower River Avon in 2014

Location of smolt monitoring site:	**River Spey Dam**
River order	1
6 figure grid reference	258207/793540
Annual resolution	1973 – 1994, 1995 to 2010
Survey period	Varied, generally April to June, occasionally earlier, and later
Frequency	Daily
Species recorded	Salmon/trout
Fish weights recorded	No
Trap strategy	Total, although trap can be bypassed if dam spills
Trap type	Mobile
Method for assessing capture efficiency if applicable	n/a
Any additional environmental data collected which you suggest may have relevance to the project aims	River/loch levels available, possibly water temperature

Site/River: River Spey at Spey Dam

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	Assessment of smolt production upstream of hydro impoundment
2.	How do these objectives relate to your fishery management plan?
	FMP Action 3.2: To provide better measurements of the salmon and trout smolt output of the River Spey
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Described in spread sheet
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	No plans to operate in 2014
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes a RST will be operated in the Lower River Avon in 2014

Location of smolt monitoring site:	**River Spey Main stem**
River order	1
6 figure grid reference	332910/855027
Annual resolution	2005 – 2008
Survey period	Varied : Start March to end May or early June
Frequency	Daily
Species recorded	Salmon/trout and OFS
Fish weights recorded	No
Trap strategy	Partial
Trap type	Rotary screw
Method for assessing capture efficiency if applicable	Mark and recapture
Any additional environmental data collected which you suggest may have relevance to the project aims	River levels/water temperature

Site/River: River Spey lower main stem

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	Assessment of smolt production in Spey catchment: biological characteristics, run timing and size
2.	How do these objectives relate to your fishery management plan?
	FMP Action 3.2: To provide better measurements of the salmon and trout smolt output of the River Spey
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Described in spread sheet
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	This RST will not operate in 2014.
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes – a RST will be operated in the Lower River Avon in 2014

8.11 Tweed Foundation

Location of smolt monitoring site:	**River Yarrow**
River order	Comes out of a loch
6 figure grid reference	NT 343 259
Annual resolution	2006-13
Survey period	Late March to when algae makes trapping impossible.
Frequency	At present, three days per week.
Species recorded	Salmon & Trout
Fish weights recorded	No, lengths and damage types only recorded
Trap strategy	Partial
Trap type	Fixed, in outwash of screening for a trout farm.
Method for assessing capture efficiency if applicable	n/a
Any additional environmental data collected which you suggest may have relevance to the project aims	Temperature data logger permanently at site, hourly readings.

Note: 1) This trap was the source of the Sea-trout smolts tagged for: N.R. Gauld, R.N.B. Campbell, M.C. Lucas 2013: *Reduced flow impacts salmonid smolt emigration in a river with low-head weirs*. Science of the Total Environment.

2) There are also Smolt samples from the Leader Water (1999 & 2000) and the Gala Water (1997).

3) The Environment Agency catch smolts during their fyke-net fish surveys of the Tweed estuary each year.

4) Seine net samples of smolts in the Tweed estuary were taken by the Faskally laboratory in the late 1950s and early 1960s, though most of this data has apparently been lost.

Site/River: Yarrow Water at Tinnis Fish Farm

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	(1) To find the start dates for smolt runs. Temperature is also recorded. (2) General information on the size distribution of smolts (3) Rates of predator or other damage to smolts
2.	How do these objectives relate to your fishery management plan?
	Study of Goosander and other predation is part of the management plan work (FMP Input 2C.2c) as is work on environmental variables and salmon catches (Input 2D.2b)
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Sampling is qualitative, not quantitative; no attempt is made cover the whole of the run. The trap is in the off wash of the smolt screen of the fish farm, so when algae levels become too high in early May, trapping has to stop. It is not run at weekends either, as it is for qualitative data rather than quantitative.
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	Annually
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	Yes, on the Gala Water, to provide smolt data to go with the adult fish counter there.

Site/River: Leader Water at Drygrange

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	This was a first attempt to get (1) some general data on the size distribution of Tweed smolts and (2) to see how these sizes related to the prey size preferences of Goosanders
2.	How do these objectives relate to your fishery management plan?
	Study of Goosander predation is part of the management plan work
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Sampling was qualitative, not quantitative. No attempt to cover the whole of the run

5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	N/A
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	See the reply for the Yarrow site.

Site/River: Gala Water at Torwoodlee Fish Farm

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	There was no trap deployment, there was an accidental catch of smolts in the fish farm after a screen failure
2.	How do these objectives relate to your fishery management plan?
	N/A
3.	Does your deployment specifically target smolts?
	N/A
4.	Please note years when part of the smolt run may have been missed.
	N/A
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?
	See the reply for the Yarrow site.

8.12 West Sutherland Fisheries Trust

Location of smolt monitoring site:	**River Manse**
River order	1
6 figure grid reference	NC080 247
Annual resolution	1999-2000
Survey period	Annual
Frequency	daily

Species recorded	Salmon and trout
Fish weights recorded	No, length only
Trap strategy	total
Trap type	Fixed
Method for assessing capture efficiency if applicable	n/a Fish missed if they went over mid net
Any additional environmental data collected which you suggest may have relevance to the project aims	Water temperature

Site/River: Manse

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	The size of the migratory population within the system and the return rate.
2.	Subsequently the trap was also used as part of a PhD project looking at the effects of sea lice on returning sea trout
	How do these objectives relate to your fishery management plan?
3.	Increased knowledge of the migratory populations for improved management
	Does your deployment specifically target smolts?
4.	No
	Please note years when part of the smolt run may have been missed.
5.	Potentially each as the trap can be avoided in high water
	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?

Location of smolt monitoring site:	**River Loanan**
River order	1
6 figure grid reference	NC244 193
Annual resolution	2000- 2001
Survey period	April - May
Frequency	Daily
Species recorded	Salmon and trout
Fish weights recorded	No
Trap strategy	Total
Trap type	Mobile
Method for assessing capture efficiency if applicable	n/a Fish missed if they went over mid net

Any additional environmental data collected which you suggest may have relevance to the project aims	

Loanan

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	What proportion of the smolts from the river return as adults
2.	How do these objectives relate to your fishery management plan?
	Knowledge of stock recruitment
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Each year deployed
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?

Location of smolt monitoring site:	**Badaidh Daraich**
River order	1
6 figure grid reference	NC159 448
Annual resolution	2009 - 2013
Survey period	April - May
Frequency	Daily
Species recorded	Salmon, trout and eels
Fish weights recorded	No
Trap strategy	Total
Trap type	Mobile
Method for assessing capture efficiency if applicable	n/a
Any additional environmental data collected which you suggest may have relevance to the project aims	Temperature data in 2011 & 2013

Site/River: Bhadaidh Daraich

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	Have migratory fish returned to the system?
2.	How do these objectives relate to your fishery management plan?
	Assess the effectiveness of habitat restoration
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Each year operated
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
6.	Are there any further locations at which you aspire to monitor smolt runs in future years?

Location of smolt monitoring site:	**River Laxford**
River order	1
6 figure grid reference	NC260 467
Annual resolution	2009-2010
Survey period	May
Frequency	daily
Species recorded	Salmon and trout
Fish weights recorded	yes
Trap strategy	partial
Trap type	Rotary screw trap
Method for assessing capture efficiency if applicable	Mark - recapture
Any additional environmental data collected which you suggest may have relevance to the project aims	

Site/River: Laxford

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	The size of the smolt run within the system
2.	How do these objectives relate to your fishery management plan?
	Knowledge of the smolt runs and population dynamics

3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Each year deployed, not a suitable location
5.	If you are operating this trap in 2014, for how many subsequent years do you plan to operate?

Location of smolt monitoring site:	**River Badna Bay**
River order	1
6 figure grid reference	NC220 467
Annual resolution	2012 - 2013
Survey period	April - May
Frequency	daily
Species recorded	Salmon and trout
Fish weights recorded	Yes for some, not all
Trap strategy	total
Trap type	mobile
Method for assessing capture efficiency if applicable	n/a
Any additional environmental data collected which you suggest may have relevance to the project aims	Temp data in 2013

Site/River: Badna Bay

1.	What is the purpose/research question(s) you wish to answer with this trap deployment?
	What proportion of the smolts in the estuary netting come from the Badna Bay catchment?
2.	How do these objectives relate to your fishery management plan?
	Additional knowledge on the sea trout populations within the 2 systems
3.	Does your deployment specifically target smolts?
	Yes
4.	Please note years when part of the smolt run may have been missed.
	Each year deployed
5.	23. If you are operating this trap in 2014, for how many subsequent years do you plan to operate?
	Unknown, at least 3
6.	24. Are there any further locations at which you aspire to monitor smolt runs in future years?

8.13 Wester Ross Fisheries Trust

Location of smolt monitoring site:	**Tournaig River, Wester Ross. Trap located in fish ladder ~50m above mouth of river.**
River order	1 (a relatively small coastal stream)
6 figure grid reference	187 883
Annual resolution	1999 - 2013
Survey period	Typically 1st April (or earlier) to end July or later (and upstream trap to October or later)
Frequency	Trap checked daily each morning.
Species recorded	Salmon and sea trout smolts; occasional brown trout, minnow, and in some years silver eels in September – October.
Fish weights recorded	No. Just lengths to nearest 5mm.
Trap strategy	Partial (1999- 2002), Total (2003-2013) – smolt screens direct fish into trap; however in 2011, 2012 and 2013 some fish were missed due to very high water levels during smolt migration period and water levels over-topped screens. Smolt runs were typically of between 0 and 600 salmon smolts per year, and 50 – 200+ sea trout smolts, reflecting changes in the performance of respective populations. The Tournaig system has been unstocked: the aim has been to monitor the performance of wild trout and salmon populations. Scale and DNA samples have been taken from typically every 5th smolt. Many photographs.
Trap type	Fixed. Trap decommissioned during winter months.
Method for assessing capture efficiency if applicable	VI tags were used to assess capture efficiency in earlier years (before smolt screens were fitted).
Any additional environmental data collected which you suggest may have relevance to the project aims	Water level (always) and usually water temperature. In some years smolt migration has been delayed by low flows.

Site/River: Tournaig, By Loch Ewe

1. What is the purpose/research question(s) you wish to answer with this trap deployment?

The Tournaig trap project was set up to monitor 'natural' salmon and sea trout populations in a small, un-stocked river system by Loch Ewe. In addition to operation of upstream and downstream traps, an annual electro-fishing survey is carried out to assess the distribution and relative abundance of juvenile salmon and trout in the principle spawning stream.

2. How do these objectives relate to your fishery management plan?

The project informs local fisheries management about freshwater and marine production & performance of both salmon and sea trout. We have information about growth rates of juvenile salmon, and trout, smolt age, composition of adult runs, sex ratios of adult fish, information about seal predation; and DNA samples (all adult salmon and sea trout; 1 in 5 smolts). Ben has also taken photographs of almost every adult fish in the upstream trap over past (?10) years, and many smolts heading out..

3. Does your deployment specifically target smolts?

No. We also operate an upstream trap to record adult salmon and sea trout entering the system.

4. Please note years when part of the smolt run may have been missed.

In the past three years (2011, 2012, 2013) water levels over topped the smolt diversion screens for one or more days during the smolt migration period and some smolts may have been missed. During the years 2003-2010 (inclusive), we believe that the trap recorded close to 100% of the smolt runs.

5. If you are operating this trap in 2014, for how many subsequent years do you plan to operate?

Yes, pending funding agreement. We have some minor repairs to carry out to prepare the downstream trap for operation (from late March). The trap is operated by Ben Rushbrooke who lives nearby and has been able to check the trap and process fish every morning. Without Ben, who has much knowledge and experience, operation of the trap would not have been possible.

6. Are there any further locations at which you aspire to monitor smolt runs in future years?

Other river systems where information on smolt runs would be interesting and useful include the Little Gruinard (SAC), Ewe and tributaries (esp. sea trout), Kerry; and on Skye, Strath More system (near Torrin). We also remain very interested in data from the MSS Shieldaig Project by Loch Torridon.

Location of smolt monitoring site:	**River Ewe, below Loch Maree, in 'T' Pool**
River order	1
6 figure grid reference	186 879
Annual resolution	2010 (attempts to operate the screw trap in 2011 were unsuccessful due to exceptionally high flows and other difficulties).
Survey period	29th April to 6th June 2010
Frequency	Daily
Species recorded	Salmon and sea trout
Fish weights recorded	Some. Lengths to nearest 10mm
Trap strategy	Initial trial to sample smolts emigrating from the River Ewe system
Trap type	Rotary screw trap.
Method for assessing capture efficiency if applicable	Not assessed. The trap was considered to be inefficient: it failed to rotate at low flows, and at high flows had to be decommissioned (due to threat of being washed away). However, some useful information for the timing, size of smolts migration and relative proportions of trout vs. salmon was obtained in 2010.
Any additional environmental data collected which you suggest may have relevance to the project aims	(Predator damage of smolts.) SEPA gauging station nearby.

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ISSN: 2043-7722 ISBN: 978-1-78412-619-3 (web only)

Published by the Scottish Government, June 2014

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St Andrew's House
Edinburgh
EH1 3DG

Produced for the Scottish Government by APS Group Scotland, 21 Tennant Street, Edinburgh EH6 5NA
DPPAS32367 (06/14)

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