AQUACULTURE & CLIMATE CHANGE: ADAPTATION & MITIGATION

Climate Change Workstream: MSS, SAIC and SSPO

Preliminary report to the FFHF Steering Group

Climate Change Challenges and Mitigations

To solve a problem, we need to understand the nature of the problem

Two topics considered:

1. Storms and weather
2. Harmful algal blooms and jellyfish

Current position:

1. What we know now (from a Government / MSS perspective)
2. What we know now (from an industry perspective)

Possible next steps:

1. Plug knowledge gaps around the nature of the PROBLEM
2. Propose options to develop verified SOLUTIONS

SAIC

Climate change – weather patterns and impacts

What we know now

Storms – further work is required for more detailed predictions

- Forecasting scales not granular enough for site management purposes
- Increased rainfall, FW & sediment run-off; increased wind events, higher waves, stresses on farm infrastructure

Current mitigation

- A Technical Standard for Scottish Finfish Aquaculture
- Best management practices for use and maintenance of equipment & regular staff training

Additional mitigation - suggestions

- Update the Technical Standard for more exposed locations and sites further offshore
- ‘SMART’ farms using connected ‘Internet of Things’ technologies to monitor, report and maybe even adjust equipment to conditions experienced on-farm

HABs and phytoplankton (MSS input)

What we know now

- There are 17 different types of HABs and gelatinous zooplankton (jellyfish) in Scottish waters
- Full phyto- and zooplankton communities (all species) are monitored weekly in 2 locations in Scotland: at L. Ewe and Stonehaven
- Large gelatinous zooplankton not currently monitored, although these can cause significant harm to fish
- Food Standards Scotland monitors shellfish toxin-related species in shellfish growing waters around Scotland's coastline from Mar to Sept (14 of 17 species)

What we don't know now

- The majority of phytoplankton (all but 3) are difficult to identify in routine samples
- The ecology of phytoplankton in Scottish waters is unknown
- What levels of HABs/GP produce lethal or sub-lethal effects? Lab and field trials required
- Where in the water column HABs and GP inhabit and thrive

HABs and phytoplankton (Industry input)

What we know now

- The industry experiences episodic occurrences of major harm to fish at individual sites due to phyto- or zooplankton blooms. Incidents may affect the whole farm site, or just some pens

What we don't know now

- If fish kills are happening, is the cause HABs or gelatinous zooplankton (GP); which ones?
- Are severe events encountered all year round or are they seasonal?
- Are there regional and/or locational differences?
- What level of HAB or GP pressure causes what effects?
- Are the effects lethal, and if so over what timeframe?
- Are there sub-lethal effects? Are some fish more resilient than others? And are there other confounding factors? (e.g. previous treatments)
- What are the financial costs and economic impact of HABs and GPs?

Techniques for detecting HABs and GPs

Molecular methods e.g. qPCR

- Being developed by several groups internationally (e.g. Norway) although no kits can be taken straight ‘off the shelf’
- Often developed to work in mono-species cultures. Possibility of false-positives in real mixed communities from different countries.

Traditional Monitoring (Taxonomist / Microscope)

- For 17 species of interest, time consuming to monitor as takes up to 2 days per plankton sample, issues with small size of samples, and preservation issues
- Separate analysis needed for small gelatinous zooplankton
- Early warning implies the need to detect species at low concentrations (i.e. BEFORE problems arise)

New Technology Monitoring

- FlowCam and IFCB (Imaging FlowCytoBot) are available technologies although both need 2-3 years development time and validation.
- SAMS have just purchased an IFCB; NAFC will be getting one during 2021 **so the kit is available – how do we use it do inform our understanding of the problem?**

Remote sensing and modelling - tools in mitigating HABs and GPs?

Remote sensing

- Can indicate areas of high biomass, but not species-specific; poor for GPs; also limitations due to cloud-cover

Modelling

- Physical models of bloom transport exist; biological models of bloom initiation by species very much in infancy

Current remote sensing capability (Plymouth Marine Laboratory - PML)

- Uses weekly mosaics to overcome cloud cover. April – Oct. 300m resolution.
- Uses ocean colour to predict probability of Karenia – add simplified ‘traffic light’ interpretation
- Four Scottish companies pay PML to receive weekly emailed alerts
- Linking physical models and remote sensing is next logical step
- Images ‘seed’ particle tracking models – these predict how blooms may move

Climate change sub-group conclusions and recommendations

1. Much work needs to be done to understand industry's challenges
2. A range of projects have been identified, at a high level
3. For industry to have early warning of HABs and GP threats, collective efforts are required to assess regional and site-specific risks
4. Solutions are also needed in terms of mitigation measures on farm
5. Once we have feedback on the project concepts recommended, the next stage is more detailed scoping :
    1. Project timeline: to start, and finish
    2. Costs: and how funded
    3. Delivery: vehicle, method, partners, contractors
    4. Reporting and accountabilities for project delivery

Options for developing our understanding of the problem leading to mitigation measures as partial solutions

1. **Survey of the Problem:** Where & when are problems occurring? Gather all existing data, plankton observations, field observations – all from industry. Use contractor. Anonymise results.
2. **High Risk Farm Case Study:** Study one or more farms intensively where fish kills have occurred. Monitor environment, plankton, fish health simultaneously through 2 years.
3. **Target Species Molecular methods e.g. q-PCR Development:** Develop and validate q-PCR in Scottish waters for 7 target species.
4. **Novel Monitoring Network:** Link SAMS and NAFC IFCB development. Perhaps add a third instrument with MSS? Develop associated IT and data analysis. Validate. Develop operational warning system.
5. **Build better remote sensing capability** (PML projects)
   (a) **increase sensing capability for relevant species** new work on the spectral signature of species of interest
   (b) **hyper-spectral satellites** track 100s of colours instead of current 7-8 colours. Different pigments / different species. Current timetable suggests this is due in 2023 – should this work be accelerated?

[Redacted – out of scope]

From: [Redacted under reg 11(2)]

Sent: Friday, February 23, 2024 7:47 AM
To: [Redacted under reg 11(2)] @gov.scot
Cc: [Redacted under reg 11(2)] @gov.scot; [Redacted under reg 11(2)] @gov.scot >; [Redacted under reg 11(2)] @gov.scot; [Redacted under reg 11(2)] @gov.scot
Subject: FW: Areas of Research Interest
Importance: High

Hi [Redacted under reg 11(2)]

You may have seen the ask from [Redacted under reg 11(2)] below in relation to the Areas of Research Interest for aquaculture and trying to get a sense of challenges, in advance of the workshop style meeting next week. Sorry I am late touching base with you, but we thought it might be worth sending [Redacted under reg 11(2)] a joint aquaculture response. As a starter for 10 we have a few answers below in relation to health and welfare (in italics), is there anything from your side that should be added, such as eDNA/environmental impact, offshore/engineering, or social licence?

1. What are some of the biggest challenges facing Scottish aquaculture policy (including all activities SG does for aquaculture) over the next 10 years? *Warming seas leading to increased challenges to fish health from algal bloom, disease, lice, deoxygenation and increased mortality; no strong pipeline of treatments in preparation. Application, adoption and demonstration of nature positive policies.*
   Thinking about those challenges, what knowledge gaps do we have? *Clarity about the way in which climate change (particularly warming seas) is impacting on fish health and productivity in aquaculture; how vaccine technology in agriculture and other sectors could be employed to support vaccines development in finfish aquaculture*

As one example, Key Question: How temperatures are expected to change in Scotland's inshore environment (particularly Scotland's West coast lochs, Shetland, WI and Orkney), where the majority of fish farming takes place, and the 'offshore environment'

Subsequent questions this informs:

- *How the temperatures will affect the biology of salmon, trout, mussels and oysters (noting they have their own temp stress ranges)*
- *How the temperatures will affect the phyto/ zoo plankton composition (increasing risk of jellyfish bloom in warmer months etc)*
- *How the temperatures will affect the sea lice life cycle (shorter cycles, more sea lice, more treatments?)*
- *How do all of these combined affect expected fish farm productivity and mortality over the next 10- 20 years?*

- *The risk of those temperatures and the emerging diseases and the spread of non-native species (what is the risk of pacific oysters establishing self-sustaining populations? What other INNS risks are there)*
- *What does this tell us about available/ possibly successful mitigation and adaptation strategies (don't farm in warm month/ reduce time at sea, closed containment, offshore, on land, new species etc). Does moving into further exposed locations and offshore further decrease these risks, for example, or will they see equally applicable changes in temps?)*

2. Are there broad topic areas in particular which you think are a priority for research? *Climate change impacts on aquaculture, [Redacted - out of scope]*

[Redacted under reg 11(2)], I am actually off today and will not be around when [Redacted under reg 11(2)] replies, so I have cc'd you in so that you might take our replies below and plug them into your preliminary analysis.

[Redacted under reg 11(2)], I am also cc'ing you as I realise you are not in the conversation and probably should be with relation innovation/research. I will forward the meeting invite to you.

Kind Regards,
[Redacted under reg 11(2)]

[Redacted under reg 11(2)]
Policy Adviser, Fish Health & Welfare/Innovation, Marine Directorate
Scottish Government, Victoria Quay, Edinburgh EH6 6QQ

E: [Redacted under reg 11(2)]
I work part time and I am available Monday-Thursdays

The Scottish Government

Marine Directorate | Marine Directorate Blog | @ScotGovMarine | Marine Directorate LinkedIn

From: [Redacted under reg 11(2)] @gov.scot>
Sent: Monday, February 19, 2024 11:12 AM
To: [Redacted under reg 11(2)] @gov.scot[Redacted under reg 11(2)] @gov.scot>
Subject: RE: Areas of Research Interest

[Redacted under reg 11(2)]

In relation to the ask below, I presume we should submit a coordinated response with [Redacted under reg 11(2)] side?

If you agree, I do suggest that we set out our own fish health stall as much as possible and share with [Redacted under reg 11(2)]. Do note that the research method will be used should consider all responses, so if we submit a separate response, it will be analysis in the round (this is effectively a questionnaire trying to capture different responses).

For info the questions being ask are:

- What are some of the biggest challenges facing Scottish aquaculture policy (including all activities SG does for aquaculture) over the next 10 years? Warming seas leading to increased challenges to fish health from algal bloom, disease, lice, deoxygenation (probably more) and increased mortality; no strong pipeline of medications in preparation (although I think we're better on the physical interventions via various innovation pipelines)
- Thinking about those challenges, what knowledge gaps do we have? Clarity about the way in which climate change (particularly warming seas) is impacting on fish health and productivity in aquaculture [Redacted - out of scope]
- Are there broad topic areas in particular which you think are a priority for research? Climate change impacts on aquaculture

We can speak about these Wed/Thursday but I will have a think about what we can add.

Kind Regards,
[Redacted under reg 11(2)]

[Redacted under reg 11(2)]
Policy Adviser, Fish Health & Welfare/Innovation, Marine Directorate
Scottish Government, Victoria Quay, Edinburgh EH6 6QQ

E: [Redacted under reg 11(2)]@gov.scot
I work part time and I am available Monday-Thursdays

The Scottish Government

Scottish Government
Riaghaltas na h-Alba

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[Redacted – out of scope]

DG Net Zero/Marine Scotland/Aquaculture and Recreational Fisheries
Donald Carmichael, Deputy Director

Scottish Government
Riaghaltas na h-Alba
gov.scot

T: [Redacted - reg 11(2) personal data]@
E: Donald.Carmichael@gov.scot

Heather Jones, CEO
Sustainable Aquaculture Innovation Centre (SAIC)
Unit 19
Scion House
Stirling University Innovation Park
Stirling
FK9 4NF

E: [Redacted - reg 11(2) personal data]@sustainableaquaculture.com

24/01/2022

Dear Heather

OFFER OF GRANT FOR the Farmed Fish Health Framework Climate Change and Mortality Causes Programme

The Scottish Ministers in exercise of their powers under section 37 of the Aquaculture and Fisheries (Scotland) Act 2007 hereby offer to give to the Sustainable Aquaculture Innovation Centre (SAIC) ("the Grantee") a grant of up to £150,000 STERLING, payable over the financial year 01/04/2021 to 31/03/2022 in connection with the Farmed Fish Health Framework Climate Change and Mortality Causes Programme, comprising of Project 1 to create a standardised set of guidelines and procedures for collecting water quality and other data relevant to tracking climate change impacts in Scottish aquaculture and Project 2 to identify data gaps in the measurement of dissolved oxygen in Scottish coastal waters and developing a proposal for filling those gaps, which are more particularly described in Part 1 of **SCHEDULE 1** ("the Programme") and subject to the following terms and conditions:

1. Definitions and Interpretation

1.1 In these Conditions, the words and expressions set out in **SCHEDULE 4** shall have the meanings ascribed to them in that Schedule.

1.2 In these Conditions unless the context otherwise requires, words denoting the singular shall include the plural and vice versa and words denoting any gender shall include all genders.

1.3 The headings in these Conditions are for convenience only and shall not be read as forming part of the Conditions or taken into account in their interpretation.

1.4 Except as otherwise provided in these Conditions, any reference to a clause, paragraph, sub-paragraph or schedule shall be a reference to a clause, paragraph, subparagraph or schedule of these Conditions. The schedules are intended to be contractual in nature. They form part of the Agreement and should be construed accordingly.

1.5 This Agreement shall not be varied except by an instrument in writing signed by both parties.

2. Purposes of the Grant

2.1 The Grant is made to enable the Grantee to carry out the Programme.

2.2 The Grant shall only be used for the purposes of the Programme and for no other purpose whatsoever.

2.3 No part of the Grant shall be used to fund any activity or material which is party political in intention, use, or presentation or appears to be designed to affect support for a political party.

2.4 The main objectives/expected outcomes of the Grant are:

- Project 1 - to deliver a standardised set of guidelines and procedures for collecting water quality and other data relevant to tracking climate change impacts in Scottish aquaculture.
- Project 2 - to deliver a report identifying data gaps in the measurement of dissolved oxygen in Scottish coastal waters and a proposal for options for filling those gaps.

2.5 The targets/milestones against which progress in achieving objectives/expected outcomes shall be monitored are:

- Verbal progress updates on delivery of the Programme for Project 1 and Project 2 to the Marine Scotland Fish Health and Welfare policy team on the 3rd Wednesday of each month starting on Wednesday 16 February 2022. The last verbal progress update must be given on Wednesday 20 April 2022. Updates to include expenditure and delivery against targets.
- Verbal progress updates on delivery of the Programme for Project 1 and Project 2 to the Farmed Fish Health Framework Steering Group on 31 January 2022, 24 February 2022 and 4 April 2022 providing an update on delivery against targets.
- Written report including expenditure and delivery against targets to be e-mailed by 17:00 on 31 March 2022 to the MS Fish Health and Welfare policy team at the address [Redacted - reg 11(2) personal data]@gov.scot

2.6 The eligible costs for which the Grant can be claimed are:

- Costs associated with the successful delivery of the Programme, including staffing costs where appropriate.
- Within the Programme, Project 1 costs of £96,000 and Project 2 costs of £54,000.

2.7 The eligible costs exclude:

- Any Value Added Tax (VAT) reclaimable by the Grantee

3. Payment of Grant

3.1 The Grant shall be paid by the Scottish Ministers to the Grantee in accordance with the terms of **SCHEDULE 1** attached.

3.2 The Grantee shall within 4 weeks following the end of the financial year 1 April 2021 to 31 March 2022 in respect of which the Grant has been paid submit to the Scottish Ministers a statement of

compliance with the Conditions of the Grant using the form of words provided in **SCHEDULE 3.** The statement shall be signed by the Grantee's authorised signatory.

3.3 In the event that the amount of the Grant paid by the Scottish Ministers to the Grantee at any point in time is found to exceed the amount of the expenses reasonably required by the Grantee in connection with the Programme, the Grantee shall repay to the Scottish Ministers the amount of such excess within 14 days of receiving a written demand for it from or on behalf of the Scottish Ministers. In the event that the Grantee fails to pay such amount within the 14 day period, the Scottish Ministers shall be entitled to interest on the sum at the rate of 2 per cent per annum above the Bank of England base lending rate prevailing at the time of the written demand from the date of the written demand until payment in full of both the sum and the interest.

3.4 The Scottish Ministers shall not be bound to pay to the Grantee, and the Grantee shall have no claim against the Scottish Ministers in respect of, any instalment of the Grant which has not been claimed by the Grantee by 31 March of the applicable financial year as set out in **SCHEDULE 1**, unless otherwise agreed in writing by the Scottish Ministers.

4. Inspection and Information

4.1 The Grantee shall keep the Scottish Ministers fully informed of the progress of the Programme. Details shall include actual expenditure and any change to estimated expenditure for the financial year and/or the Programme as a whole, the reasons for any such changes and progress in achieving objectives/outcomes.

4.2 Revisions to targets/milestones against which progress in achieving objectives/outcomes are monitored shall be subject to the written agreement of the Scottish Ministers.

4.3 The Grantee shall, on completion of the Project, submit report to the Scottish Ministers summarising the outcomes and performance of the Project. Such a report shall include such statistical and other information relating to the impact of the Project as shall be required by the Scottish Ministers. The completion report should include details relating to Project 1 and Project 2 and should be submitted by 28 April 2022 to [Redacted - reg 11(2) personal data] **@gov.scot**

4.4 The Grantee shall also provide any other information that the Scottish Ministers may reasonably require to satisfy themselves that the Programme is consistent with the Agreement. The Grantee shall provide the Scottish Ministers with prompt access to any information they reasonably require to ensure compliance with these Conditions.

4.5 The Grantee shall keep and maintain for a period of 5 years after the expenditure occurs, adequate and proper records and books of account recording all receipts and expenditure of monies paid to it by the Scottish Ministers by way of the Grant. The Grantee shall afford the Scottish Ministers, their representatives, the Auditor General for Scotland, his/her representatives and such other persons as the Scottish Ministers may reasonably specify from time to time, such access to those records and books of account as may be required by them at any reasonable time in response to a written request for such access from the person seeking it. The Grantee shall provide such reasonable assistance and explanation as the person carrying out the inspection may from time to time require.

4.6 In the event of the Grantee becoming aware of or suspecting any irregular or fraudulent activity that may have any impact on the Programme or on the use of the Grant, or any part of it, the

Grantee shall immediately notify the Scottish Ministers of such activity and provide such other information as the Scottish Ministers may reasonably require in relation to the impact on the Project and the use of the Grant.

4.7 The grantee shall immediately inform the Scottish Ministers of any change in its constitution for example, but not limited to, a change in status from one type of body corporate to another.

5. Confidentiality and Data Protection

5.1 The Grantee will respect the confidentiality of any commercially sensitive information that they have access to as a result of the Programme.

5.2 Notwithstanding the above, the Grantee may disclose any information as required by law or judicial order. All information submitted to the Scottish Ministers may need to be disclosed and/or published by the Scottish Ministers. Without prejudice to the foregoing generality, the Scottish Ministers may disclose information in compliance with the Freedom of Information (Scotland) Act 2002, any other law, or, as a consequence of judicial order, or order by any court or tribunal with the authority to order disclosure. Further, the Scottish Ministers may also disclose all information submitted to them to the Scottish or United Kingdom Parliament or any other department, office or agency of Her Majesty's Government in Scotland, in right of the Scottish Administration or the United Kingdom, and their servants or agents. When disclosing such information to either the Scottish Parliament or the United Kingdom Parliament it is recognised and agreed by both parties that the Scottish Ministers shall if they see fit disclose such information but are unable to impose any restriction upon the information that it provides to Members of the Scottish Parliament, or Members of the United Kingdom Parliament; such disclosure shall not be treated as a breach of this agreement.

5.3 The Grantee shall ensure that all requirements of the Data Protection Laws are fulfilled in relation to the Programme.

5.4 To comply with section 31(3) of the Public Services Reform (Scotland) Act 2010, the Scottish Ministers publish an annual statement of all payments over £25,000. In addition, in line with openness and transparency, the Scottish Government publishes a monthly report of all payments over £25,000. The Grantee should note that where a payment is made in excess of £25,000 there will be disclosure (in the form of the name of the payee, the date of the payment, the subject matter and the amount of grant) in both the monthly report and the annual Public Services Reform (Scotland) Act 2010 statement.

6. Disposal of Assets

No disposable assest swill be produced as part of the Programme.

7. Publicity

The Grantee shall where reasonably practicable acknowledge in all publicity material relating to the Programme the contribution of the Scottish Ministers to its costs. The Scottish Ministers may require to approve the form of such acknowledgement prior to its first publication.

8. Intellectual Property Rights

8.1 All Intellectual Property Rights are hereby assigned to and shall vest in the Crown or its assignees.

8.2 The Grantee shall ensure that nothing contained in any materials produced or submitted to the Scottish Ministers by the Grantee or anyone acting on its behalf nor the reproduction of such materials, shall constitute an infringement of any third party copyright or intellectual property right and shall indemnify the Scottish Ministers against all actions, proceedings, claim sand demands made by reason of any such infringement.

9. Default and Recovery etc. of Grant

9.1 The Scottish Ministers may re-assess, vary, make a deduction from, withhold, or require immediate repayment of the Grantor any part of it in the event that:

9.1.1 The Grantee commits a Default;

9.1.2 The Scottish Ministers consider that any change or departure from the purposes for which the Grant was awarded warrants an alteration in the amount of the Grant;

9.1.3 The Grantee fails to carry out the Programme;

9.1.4 In the Scottish Ministers' opinion, the progress on the Programme is not satisfactory; or

9.1.5 In the Scottish Ministers' opinion, the future of the Programme is in jeopardy.

9.2 If the Grant (or any part or condition thereof) does not comply with applicable Subsidy Control obligations, Scottish Ministers may require immediate repayment of the Grant or any part of it together with interest at such rate and on such basis as may be determined from time to time in accordance with law.

9.3 The Scottish Ministers may withhold the payment of the Grantif at any time within the duration of the Agreement:

9.3.1 The Grantee passes a resolution that it be wound up, or a court makes an order that the Grantee be wound up, in either case otherwise than for the purposes of reconstruction or amalgamation, or circumstances arise which would enable a court to make such an order or the Grantee is unable to pay its debts within the meaning of section 123 of the Insolvency Act 1986;

9.3.2 Where the Grantee is an individual, if a petition is presented for the Grantee's bankruptcy or the sequestration of his estate or a criminal bankruptcy order is made against the Grantee; or the Grantee makes any composition or arrangement with or for the benefit of creditors, or makes any conveyance or assignation for the benefit of creditors, or if an administrator or trustee is appointed to manage his affairs; or

9.3.3 A receiver, manager, administrator or administrative receiver is appointed to the Grantee, or over all or any part of the Grantee's property , or circumstances arise which would entitle a court or a creditor to appoint such a receiver, manager, administrator or administrative receiver.

9.4 In the event that the Grantee becomes bound to pay any sum to the Scottish Ministers in terms of clause 9.1, the Grantee shall pay the Scottish Ministers the appropriate sum within 14 days of a written demand for it being given by or on behalf of the Scottish Ministers to the Grantee. In the event that the Grantee fails to pay the sum within the 14 day period, the Scottish Ministers shall be entitled to interest on the sum at the rate of 2 per cent per annum above the Bank of England base lending rate prevailing at the time of the written demand, from the date of the written demand until payment in full of both the sum and interest.

9.5 Not withstanding the provisions of this clause 9, in the event that the Grantee is in breach of any of the Conditions, the Scottish Ministers may, provided that the breach is capable of a remedy, postpone the exercise of their rights to recover any sum from the Grantee in terms of clause 9 for such period as they see fit, and may give written notice to the Grantee requiring it to remedy the breach within such period as may be specified in the notice. In the event of the Grantee failing to remedy the breach within the period specified, the Grantee shall be bound to pay the sum to the Scottish Ministers in accordance with the foregoing provisions.

9.6 Any failure, omission or delay by the Scottish Ministers in exercising any right or remedy to which they are entitled by virtue of clauses 9.1 to 9.3 shall not be construed as a waiver of such right or remedy.

10. Assignation

The Grantee shall not be entitled to assign, sub-contract or otherwise transfer its rights or obligations under the Agreement without the prior written consent of the Scottish Ministers.

11. Termination

The Agreement may be terminated by the Scottish Ministers giving not less than 3 months' notice in writing from the date of the notice being sent.

12. Corrupt Gifts and Payments of Commission

The Grantee shall ensure that its employees shall not breach the terms of the Bribery Act 2010 in relation to this or any other grant. The Grantee shall ensure that adequate controls are in place to prevent bribery.

13. Continuation of Conditions

13.1 These Conditions, except for Condition 6, shall continue to apply for a period of 5 years after the end of the financial year in which the final instalment of the Grant was paid.

13.2 Condition 6 shall continue to apply until the end of the period referred to in that Condition.

14. Compliance with the Law

The Grantee shall ensure that in relation to the Programme, they and anyone acting on their behalf shall comply with the relevant law, for the time being in force in Scotland.

15. Governing Law

This contract is governed by the Law of Scotland and the parties hereby prorogate to the exclusive jurisdiction of the Scottish Courts

If you wish to accept the offer of this Grant on the whole terms and conditions as set out in the letter and annexed Schedules, you should sign and date both copies of the Grant Acceptance below and return one copy of the offer of Grant and Schedules to me at [Redacted - reg 11(2) personal data] @gov.scot. You should retain the second copy of the offer of Grant and Schedules for your own records.

Yours sincerely

[Redacted - reg

11(2) personal

data]

pp Donald Carmichael
24/01/2022

Donald.Carmichael@gov.scot

GRANT ACCEPTANCE

On behalf of the Sustainable Aquaculture Innovation Centre I accept the foregoing offer of Grant by the Scottish Ministers dated 24/01/2022 on the whole terms and conditions as set out in the letter and annexed Schedules. I confirm that the Sustainable Aquaculture Innovation Centre is solvent. I confirm that I hold the relevant signing authority.

Signed:

«Director/Company Secretary/Authorised Signatory»

Print Name:

Positionin Organisationof Person Signing:

Date: Click here to enter a date.

Place of Signing:

Signed:

«Witness»

Witness Name:

Address:

Date: Click here to enter a date.

Place of Signing:

SCHEDULE 1

PART 1: THE PROGRAMME

Farmed Fish Health Framework Climate Change and Mortality Causes Programme

Climate Change Project 1. Creating a standardised set of guidelines and procedures for collecting water quality and other data relevant to tracking climate change impacts in Scottish aquaculture.
This Programme will allow SAIC to facilitate the development of a standardised sampling protocol for the increasingly important monitoring for marine phytoplankton and micro-jellies of interest to the marine finfish sector, in conjunction with the sector and academic expertise. The outputs include a list of species of interest, procedure by which water samples should be collected and processed, and particulates identified, with indicative levels at which proposed management action should be triggered. A secondary output of the work will be the definition of a standard data format for the samples collected, which will provide the potential for it to be consumed and stored in a central location, such as the SAMS' developed HAB Reports web portal. As part of this workpackage, SAIC will facilitate a follow-on workshop between relevant industry partners, Salmon Scotland, British Trout Association, SEPA, and academic experts to build on the last FFHF HAB workshop hosted by SAIC in July 2021.

Project 2. Identifying data gaps in the measurement of dissolved oxygen in Scottish coastal waters and developing a proposal for filling those gaps.
SAIC will work with Marine Scotland, SEPA, the marine finfish sector, and academic researchers to identify and collate existing, routine dissolved oxygen monitoring location and procedures, informing where critical gaps currently exist. Working with the aforementioned group, alongside sector technology providers, the Programme will identify whether it is most appropriate to deploy long-term devices or develop regular point-sampling protocols within water bodies of interest, and this will inform suitable monitoring equipment recommendations. The intention would be to engage with Marine Scotland Science (drawing on their expertise in the use of cyotobots) and appropriate SMEs to build on existing methodologies. This work will measure background levels of environmental conditions at both a local scale to finfish marine sites, and more widely, in order to quantitatively assess variability and gather insights into patterns of change over both time and space.

PART 2: PAYMENT OF GRANT

1. The total Grant of up to £150,000 shall be payable by the Scottish Ministers to the Grantee. The payment will be paid in March 2022 on receipt of a completed claim for Grant in the form set out in **SCHEDULE 2** together with the associated monitoring information set out in paragraph 4.1 of the Offer of Grant. The payment will be made on completion of the agreed deliverables in Schedule 1.

Month of payment	**Amount**
March 2022 (subject to Programme completion)	£150,000 (Project 1 £96,000; Project 2 £54,000)
Total	**£150,000**

2. The total Grant shall be payable over the financial year 1 April 2021 to 31 March 2022. The Scottish Ministers shall not be bound to pay any instalment of the Grant which has not been claimed by the Grantee by 31 March of the applicable financial year, unless otherwise agreed in writing by the Scottish Ministers.

3. Any change to the overall costs of the Programme shall be notified to the Scottish Ministers at the earliest opportunity via the claims for Grant and monitoring reports.

4. The claim shall be for an amount equal to the estimated amount of the Grant required to meet the reasonable and proper costs and expenses of the Grantee in connection with the Programme until the next claim is due to be submitted.

5. The claim shall be submitted together with such explanatory or supplementary material as the Scottish Ministers may from time to time require whether before or after submission of the claim.

6. On receipt of the claim (and any required documentation and information), the Scottish Ministers shall determine the amount of expenditure which they consider the Grantee shall reasonably and properly incur in connection with the Programme having regard to that claim. The determination shall be based on the information provided by the Grantee in accordance with this Schedule. The Scottish Ministers shall use their best endeavours (but shall be under no obligation or duty) to pay the amount determined to the Grantee within 4 weeks of receiving a claim and any required documentation and information relevant to the claim.

7. In order to facilitate the accrual of expenditure of the Grant for the financial year the Grantee shall, where appropriate, advise the Scottish Ministers in writing by 15 April 2022 of the amount of the Grant actually expended up to and including 31 March.

SCHEDULE 2

This is the schedule referred toin the forgoing Offer of Grant dated: Click here to enter a date.

GRANT CLAIM FORM

Organisation: «Name and Address»

Bank details: «Name and address, sort code, account number»

Programme: Farmed Fish Health Framework Climate Change and Mortality Causes Programme

Total agreed grant for: 2021/2022 £150,000

Latest forecast of expenditure of grant for: «20XX-XX»: «Amount»

Grant claimed to date: «Amount»

«Unexpended grant»: «Amount» ***(where grant is paid in advance)***

«Claim for grant» or «Estimate of grant required» for the period from Click here to enter a date. **to** Click here to enter a date. ***or to*** Click here to enter a date.**:** «Amount»
We hereby claim «total» grant of «£XX» in respect of the above period in accordance with the terms and conditions of the offer of Grant dated Click here to enter a date. **and the Schedules attached thereto.**

Completed by:

Position:

Contact Details:

Date:

<u>Items of Expenditure</u>
Please list in the table below all discrete items of expenditure relevant to the above period and the type of documentary evidence that «X has been submitted» or «X will be made available on request» to substantiate each amount.

A	B	C	D
Item	**Amount (£)**	**Paid Invoice [Y/N]**	**Other (please specify, e.g. certificate of payment in kind)**
TOTAL*			

*** Note the total should add up to the total expenditure claimed for the period.**

SCHEDULE 3

STATEMENT OF COMPLIANCE WITH CONDITIONS OF GRANT

Farmed Fish Health Framework Climate Change and Mortality Causes Programme

This is to confirm that the grant claimed by the Sustainable Aquaculture Innovation Centre in relation to the above Programme during the financial year ended 31 March 2022 was properly due and was used for its intended purpose(s) in accordance with the terms and conditions of the Grant. This statement is supported by the records of the Sustainable Aquaculture Innovation Centre.

Signed:

Name in block capitals:

Position:

Date: Click here to enter a date.

SCHEDULE 4

DEFINITIONS

"**Agreement**" means the agreement constituted by the Scottish Ministers' invitation to apply for a grant, the Grantee's Application, these Conditions and the Grantee's acceptance of these Conditions;

"**Conditions**" means these grant conditions;

"Data Protection Laws" means any law, statute, subordinate legislation, regulation, order, mandatory guidance or code of practice, judgment of a relevant court of law, or directives or requirements of any regulatory body which relates to the protection of individuals with regard to the processing of Personal Data to which a Party is subject including the Data Protection Act 2018 and any statutory modification or re-enactment thereof and the UK GDPR.

"**Default**" means:

a) Any breach of the obligations of either party under this Agreement (including, but not limited to, any breach of any undertaking or warranty given under or in terms of this Agreement);
b) Any failure to perform or the negligent performance of any obligation under this Agreement;
c) Any breach of any legislation; or
d) Any negligence or negligent or fraudulent miss-statement or misappropriation of Grant, or any other default,

In all cases by either party, its employees, agents or representatives;

"**Financial Year**" means a period from 1 April in one year until 31 March in the next;

"**Grant**" means the grant offered by the Scottish Ministers to the Grantee as specified in the Award Letter, as varied from time to time in accordance with these Conditions;

"**Grantee**" means the person, organisation or body to which the Grant will be payable as specified in these Conditions. Where two or more persons, organisations or bodies are the Grantee, references to the "Grantee" are to those persons, organisations or bodies collectively and their obligations under the Agreement are undertaken jointly and severally;

"**Intellectual Property Rights**" means all copyright, patent, trademark, design right, database right and any other right in the nature of intellectual property whether or not registered, in any materials or works in whatever form (including but not limited to any materials stored in or made available by means of an information technology system and the computer software relating thereto) which are created, produced or generated as part of the Programme by or on behalf of the Grantee.

"Programme/Programme" means the purpose for which the Grant has been awarded as described in the Offer of Grant;

"Payment" means each of the payments specified in Schedule 1 hereto.

"Subsidy Control" means the United Kingdom's international commitments on subsidy control arising from, amongst others, the EU-UK Trade and Cooperation Agreement, World Trade Organisation Membership and commitments arising from international treaties and agreements to which the United Kingdom is a party.

"UK GDPR" means the retained EU law version of the General Data Protection Regulation ((EU) 2016/679) as it forms part of the law of England and Wales, Scotland and Northern Ireland by virtue of section 3 of the European Union (Withdrawal) Act 2018 and as amended by Schedule 1 to the Data Protection, Privacy and Electronic Communications (Amendments etc) (EU Exit) Regulations 2019 (SI 2019/419).

Farmed Fish Health Framework – progress October 2020 to October 2021

1. The Farmed Fish Health Framework was refreshed in October 2020 under the new chair of [Redacted - reg 11(2) personal data], Chief Veterinary Officer (Scotland), to focus on the three priority areas - mortality, climate change adaptation, and treatments, including medicines.

2. New additions to the streamlined steering group brought in by the chair include the Veterinary Medicines Directorate and Marine Scotland climate change experts, ensuring the most appropriate expertise is available to address issues collaboratively.

3. 2022 will see a continuation of current focus due to the complexity of issues, but the framework is open to addressing new challenges as they emerge.

4. [Redacted - out of scope]

Progress

Climate Change

5. Changing climatic conditions are altering the natural marine environment and this could introduce pressures on farmed fish which impact on fish health . There is a need to better understand and monitor climate change in terms of relevant current, and anticipated, impacts on the environment with an understanding of the consequences for health and welfare. Ultimately, there should be an ability to monitor relevant parameters, predict events, and respond by changing practices to minimise impacts on fish health. This should be understood in a global context and consider best practice and experience from elsewhere, where this exists.

Progress

6. Better understanding of climate change impacts on fish health is key and under the framework industry has contributed to workshops identifying available data which improve our knowledge of algal blooms and the species involved, linking to longer term projects supported by the Scottish Aquaculture Innovation Centre on real-time modelling and prediction of harmful algal blooms. Helping the industry better understand, and potentially predict, events will allow mitigation to reduce impacts to be developed in the longer term.

7. Work is ongoing to identify actions to help mitigate the impacts of climate change.

[Redacted - out of scope]

Annex A

[Redacted - out of scope]

Annex B

[Redacted - out of scope

Annex C

Climate Change Actions

14/12/2020	1	Collate available sources of relevant climate change and acidification information at a national and international scale - groups, networks and relevant initiatives .	Ongoing
	2	Upon completion of action (1) consider holding workshop to consider how best it can be used by the sector, identify data gaps and recommend next steps.	Ongoing
25/01/2021	3	To consider a common approach to surveillance aimed at predicting and mitigating plankton events, melding both satellite and regional data, and local data collected by companies.	
18/03/2021	4	Develop more in depth understanding of problems posed by climate change, leading to mitigation measures as partial solutions.	Note this slide pack is being released – see item 16
	5	Advise which species of plankton [Redacted - reg 11(2) personal data] have identified as impacting most on fish health.	
07/06/2021	6	Deliver workshops as outlined in paper presented.	One workshop delivered on 22 July. SAIC projects: **[Redacted - out of scope]** – the project concerned does not consider climate change **See item 23** Redaction of pers names required in doc below **FARMED FISH HEALTH FRAMEWORK – CLIMATE CHANGE WORKSTREAM UPDATE** see items 21 and 22

	7	Resend slide outlining potential costs of next steps	
23/08/2021	8	Provide an update on the second workshop and possible next steps	Option of hosting a second workshop discussed. No firm decisions made, see action 10. See Item 24
	9	Discuss funding options	Funding challenges discussed with no resolution or agreement.
06/10/2021	10	Following on from the first SAIC climate change workshop and the proposals put forward by SAIC at the meeting, all steering group members to provide solutions/ideas for projects which can be delivered this financial year.	
		[Redacted - out of scope]	

[Redacted - out of scope]

From: [Reg 11(2) personal information withheld]@gov.scot>
Sent: Tuesday, August 24, 2021 6:00 PM
To: [Reg 11(2) personal information withheld] @sustainableaquaculture.com>;[Reg 11(2) personal information withheld] @scottishseafarms.com>;[Reg 11(2) personal information withheld] @gov.scot>; [Reg 11(2) personal information withheld] @gov.scot>;[Reg 11(2) personal information withheld] @scottishsalmon.co.uk>; [Reg 11(2) personal information withheld] @britishtrout.co.uk; [Reg 11(2) personal information withheld] @btinternet.com; [Reg 11(2) personal information withheld] @scottishseafarms.com>; [Reg 11(2) personal information withheld] @dawnfresh.co.uk; [Reg 11(2) personal information withheld] @gov.scot>; [Reg 11(2) personal information withheld] @gov.scot>;[Reg 11(2) personal information withheld] @gov.scot>;[Reg 11(2) personal information withheld] @vmd.gov.uk; [Reg 11(2) personal information withheld] @SEPA.org.uk; [Reg 11(2) personal information withheld] @vmd.gov.uk; [Reg 11(2) personal information withheld] @mowi.com; [Reg 11(2) personal information withheld] @gov.scot>; [Reg 11(2) personal information withheld] @gov.scot>
Cc: [Reg 11(2) personal information withheld] @gov.scot>; [Reg 11(2) personal information withheld] @gov.scot>
Subject: RE: FFHF - Priority CC projects

Thanks [Reg 11(2) personal information withheld]. Sounds like a positive step forwards to me.
[Reg 11(2) personal information withheld] will be better able to answer on budgets, but to be aware that there are limited funds for all the FFHF work so we all need to make sure we prioritise their use appropriately. Im not suggesting that anyone doesn't already know that but always best to be upfront about the challenges

[Reg 11(2) personal information withheld]

From: [Reg 11(2) personal information withheld]@sustainableaquaculture.com>
Sent: 24 August 2021 17:39
To< Reg 11(2) personal information withheld > @scottishseafarms.com>;[Reg 11(2) personal information withheld] @gov.scot>; [Reg 11(2) personal information withheld] @gov.scot>;[Reg 11(2) personal information withheld] @scottishsalmon.co.uk>; [Reg 11(2) personal information withheld] @britishtrout.co.uk; [Reg 11(2) personal information withheld] @btinternet.com; [Reg 11(2) personal information withheld] @scottishseafarms.com>; [Reg 11(2) personal information withheld] @dawnfresh.co.uk; [Reg 11(2) personal information withheld] @gov.scot>; [Reg 11(2) personal information withheld] @gov.scot>;[Reg 11(2) personal information withheld] @gov.scot>;[Reg 11(2) personal information withheld] @vmd.gov.uk; [Reg 11(2) personal information withheld] @SEPA.org.uk; [Reg 11(2) personal information withheld] @vmd.gov.uk; [Reg 11(2) personal information withheld] @mowi.com; [Reg 11(2) personal information withheld] @gov.scot>; [Reg 11(2) personal information withheld] @gov.scot>
Cc: [Reg 11(2) personal information withheld] @gov.scot>; [Reg 11(2) personal information withheld] @gov.scot>
Subject: RE: FFHF - Priority CC projects

Dear All

Thanks to [Reg 11(2) personal information withheld] and [Reg 11(2) personal information withheld] for their comments.

We agreed at the meeting to follow up the HABs workshop 1 with a second HABS workshop at which all participants can contribute their ideas and indicate their willingness for industry data to be shared and used with full consent of contributing parties, and for SAIC and Marine Scotland to have further discussions on the possibility of funding to support approved projects.

I suggest we bring back an updated report to the whole FFHF once that second workshop has taken place, and once we know if – and if so how much – money Marine Scotland can contribute to this important work.

Kind regards,

[Reg 11(2) personal information withheld]

SAIC
Sustainable Aquaculture Innovation Centre

Reg 11(2) personal information withheld
sustainableaquaculture.com

From:
[Reg 11(2) personal information withheld] <@scottishseafarms.com>
Sent: 24 August 2021 16:23
To: [Reg 11(2) personal information withheld] **@gov.scot;** [Reg 11(2) personal information withheld] **@gov.scot;** [Reg 11(2) personal information withheld] **@scottishsalmon.co.uk>;** [Reg 11(2) personal information withheld] **@gov.scot;** [Reg 11(2) personal information withheld] **@britishtrout.co.uk;** [Reg 11(2) personal information withheld] **@btinternet.com;** [Reg 11(2) personal information withheld] **@scottishseafarms.com>;** [Reg 11(2) personal information withheld] **@dawnfresh.co.uk;** [Reg 11(2) personal information withheld] **@gov.scot;** [Reg 11(2) personal information withheld] **@gov.scot;** [Reg 11(2) personal information withheld] **@gov.scot;** [Reg 11(2) personal information withheld] **@vmd.gov.uk;** [Reg 11(2) personal information withheld] **@SEPA.org.uk;** [Reg 11(2) personal information withheld] **@vmd.gov.uk;** [Reg 11(2) personal information withheld] **@mowi.com;** [Reg 11(2) personal information withheld] **@gov.scot;** [Reg 11(2) personal information withheld] **@sustainableaquaculture.com>;** [Reg 11(2) personal information withheld] **@gov.scot**

Cc: [Reg 11(2) personal information withheld] @gov.scot>; [Reg 11(2) personal information withheld] @gov.scot>

Subject: RE: FFHF - Priority CC projects

I'm inclined to agree with that conclusion.

For me, the real issue is that we see, either from gross examination of fish or histopathology, evidence of damage to gills without clear identification of the culprit. We assume an environmental factor has caused damage but we often don't know what it is – "environmental insult" is the default diagnosis when no gill pathogen is identified. We therefore don't know when to introduce mitigation measures (leaving aside the fact that we have limited mitigation measures available).

I think an analysis of data which might show what was happening in the environment when negative gill health incidents occurred would potentially be of most immediate value. I think that's what [Reg 11(2) personal information withheld] is suggesting and therefore support the action, although I have my doubts that even the wider dataset will be adequate.

[Reg 11(2) personal information withheld]

From: [Reg 11(2) personal information withheld]@gov.scot>
Sent: 24 August 2021 15:27
To : [Reg 11(2) personal information withheld] @gov.scot; [Reg 11(2) personal information withheld]@scottishsalmon.co.uk>;[Reg 11(2) personal information withheld] @gov.scot; >;[Reg 11(2) personal information withheld] @britishtrout.co.uk; >;[Reg 11(2) personal information withheld] @btinternet.com; >;[Reg 11(2) personal information withheld] @scottishseafarms.com>; >;[Reg 11(2) personal information withheld] @dawnfresh.co.uk; >;[Reg 11(2) personal information withheld] @scottishseafarms.com>; >;[Reg 11(2) personal information withheld] @gov.scot; >;[Reg 11(2) personal information withheld] @gov.scot; >;[Reg 11(2) personal information withheld] @gov.scot; >;[Reg 11(2) personal information withheld] @vmd.gov.uk; >;[Reg 11(2) personal information withheld] @SEPA.org.uk; >;[Reg 11(2) personal information withheld] @vmd.gov.uk; [Reg 11(2) personal information withheld] @mowi.com; [Reg 11(2) personal information withheld] @gov.scot; [Reg 11(2) personal information withheld] @sustainableaquaculture.com; [Reg 11(2) personal information withheld]@gov.scot
Cc: [Reg 11(2) personal information withheld]@gov.scot; [Reg 11(2) personal information withheld]@gov.scot
Subject: FFHF - Priority CC projects

Dear SG member,

At the FFHF steering group, **[Reg 11(2) personal information withheld]** proposed one priority research topic could be to investigate trigger levels for specific plankton species, i.e. the plankton concentrations which result in lethal or sub-lethal effects in adult fish. My concerns are as follows:

- I am not so sure there is a one-to-one match between plankton concentrations and harmful effect in a simplistic way.

- At the Climate Change workshop we heard reports from the sector environmental experts of a complex picture, with temperature, salinity and DO varying alongside plankton concentrations. Lethal and sub-lethal effects resulted from what sounded like fairly normal concentrations of plankton, of species that would not normally be

associated with harmful effects. Thus we can hypothesise that in the Scottish context there are interactions between T, S, DO, multiple plankton species within the community and variable fish health that result in additional lethal or sub-lethal effects in farmed fish.

- For me the priority is to take the wealth of data that already exists (albeit collected using different protocols – but it is good enough probably to start with), along with the records of fish health, and examine the above hypothesis and try to pin down patterns in the data which will then inform future work.

- Lets consider going straight into challenge experiments using experimental fish. We might consider two temperatures (warm and cold), two salinities (salty and fresh), two DO values (good and not so good), and four plankton species at say 6 different concentrations, and for say 4 different levels of fish health. That gives a total of 768 combinations of conditions. For each one we will need say 20 fish in triplicate, with a control - say a bare minimum of 80 fish. For the 768 combinations that is 61,440 fish. I suspect they should all come from the same brood stock to eliminate biological variability, and I suspect fish age might be yet another variable to consider, as well as feeding status. I am also not too sure it would be ethical to manufacture fish with different degrees of gill ill-health. Even with this quite extensive experiment I think there would be challenges over the statistical validity, plus the fish will be in extremely unnatural conditions away from other stressors that fish in real farms experience. This is an expensive, resource heavy and time consuming study.

- Hence for me a fairly cheap desk study of real data is by far a better option at the moment than a challenge experiment to determine trigger levels of plankton. (and as an aside, I think the in situ data collected by the industry will be a much better dataset to use in order to analyse the SRUC dataset than satellite data).

[Reg 11(2) personal information withheld]