Scottish Environment Protection Agency
Buidheann Dìon Àrainneachd na h-Alba

For the future of our environment

Measurement Assurance and Certification Scotland

Performance Standard | Finfish Aquaculture

Sampling of soft substrate



Version 2 | July 2023

Record of amendments

Version	Date	Amendment(s)
1	March 2022	First issue
2	July 2023	7.1.1 – briefing note amended to include the option of using a single 0.045 m^2 grab.

Contents

1 Introduction 1

2 Scope 2

3 References and bibliography 3

3.1 Text references 3

3.2 Bibliography 3

4 Terms and definitions 4

5 Resource requirements 6

5.1 Personnel 6

5.2 Equipment 6

5.3 Control of documents 7

5.4 Control of records 7

6 Survey procedure 8

6.1 Field notes 8

6.2 Position fixing 8

6.3 Choice of sampling equipment 8

6.4 Operation of sampling equipment 8

6.5 Rejection of grabs 9

7 Sample collection for biological surveys 10

7.1 Benthic macrofauna 10

7.2 Supporting parameters 11

8 Sample collection for chemical surveys 12

8.1 Chemical residues 12

8.2 Supporting parameters 12

9 Control of non-conforming work 14

10 MACS document review and control 15

1 Introduction

Every day SEPA works to protect and enhance Scotland's environment, helping communities and businesses thrive within the resources of our planet. We call this One Planet Prosperity. If everyone in the world lived as we do in Scotland, we would need three planets. There is only one.

We're changing today, creating a world-class 21st Century EPA fit for the challenges of tomorrow by grounding our regulatory activity across whole sectors.

A fundamental principle of our sector approach is that environmental compliance is non-negotiable. In every sector, we will ensure that all regulated businesses fully meet their environmental compliance obligations.

In certain sectors, this means that operators performing authorised activities have an obligation to monitor and report back to us in support of the regulation of those activities. We will determine compliance from the data and evidence submitted to us.

In order to maintain confidence in our regulatory decision making, all operator monitoring data must meet our minimum quality requirements. To help operators meet those requirements, we have established Measurement Assurance and Certification Scotland (MACS) – our quality assurance certification scheme.

MACS comprises a range of performance standards and technical guidance documents, each designed to ensure that operator monitoring data is fit for regulatory assessment. Its remit extends across the entire monitoring process; from planning and scheduling of monitoring activity to sampling, analysis and data reporting.

Where an organisation conforms with the requirements of MACS, the operator monitoring data they produce will be of a standard that meets our minimum quality requirements. To ensure that this remains the case, those organisations will be routinely audited.

Further information on MACS, operator monitoring, and our sector approach may be found on the SEPA website:

www.sepa.org.uk

2 Scope

2.1 This MACS performance standard is applicable to organisations carrying out sampling of soft substrate for the assessment of chemical and biological seabed standards relating to marine pen fish farms (MPFFs).

2.2 Sections 5 to 9 lay out the detailed requirements that those organisations **must** adhere to when carrying out that activity.

2.3 In conjunction with this document, international standard ISO 16665 (ref. 3.1 a) and complementary technical guide MACS-FFA-TG-01 (ref. 3.1 d) may be consulted for guidance.

3 References and bibliography

3.1 Text references

a. BS EN ISO 16665:2013 – Water quality – Guidelines for quantitative sampling and sample processing of marine soft-bottom macrofauna, ISBN 978 0 580 85761 4.

b. BS ISO 3310-1:2016 – Test sieves. Technical requirements and testing. Test sieves of metal wire cloth, ISBN 978 0 580 83347 2.

c. BS ISO 3310-2:2013 – Test sieves. Technical requirements and testing. Test sieves of perforated metal plate, ISBN 978 0 580 82112 7.

d. MACS Technical Guide MACS-FFA-TG-01, Finfish Aquaculture – Dealing with non-conformance, Scottish Environment Protection Agency, 2022.

e. MPFF Environmental Monitoring Survey Results Template, Scottish Environment Protection Agency, 2020.

3.2 Bibliography

a. BS EN ISO 5667-15:2009 – Water quality – Sampling. Part 15: Guidance on the preservation and handling of sludge and sediment samples, ISBN 978 0 580 55615 9.

b. BS EN ISO 5667-19:2004 – Water quality – Sampling. Part 19: Guidance on sampling in marine sediments, ISBN 0 580 43945 3.

c. BS EN ISO/IEC 17025:2017 – General requirements for the competence of testing and calibration laboratories, ISBN 978 0 539 01414 3.

d. MACS Performance Standard – MACS-FFA-PS-02, Finfish Aquaculture – Physical and chemical testing. Scottish Environment Protection Agency, 2022.

e. MACS Performance Standard – MACS-FFA-PS-03, Finfish Aquaculture – Biological testing, Scottish Environment Protection Agency, 2022.

4 Terms and definitions

For the purpose of this MACS performance standard, and unless the context requires otherwise, the following definitions apply:

benthic macrofauna – bottom dwelling animals retained on a mesh screen of 0.5 mm or 1 mm aperture size.

concession – a written approval, granted to release a non-conforming product or service for use or delivery. For example, a written agreement from SEPA explicitly permitting the submission of data associated with a quality control failure.

formosaline (4%) – a solution of formalin in seawater with a concentration of formaldehyde at 4% v/v.

marine pen fish farm (MPFF) – a fish farm based upon a system of pens, constructed as floating collars with net bags suspended in the water column.

metrological traceability – the property of a measurement result whereby the result can be related to a reference through a documented, unbroken chain of calibrations, each contributing to the measurement uncertainty.

operator – an individual or company responsible for the operation of an existing or proposed marine pen fish farm that will be subject to operator monitoring activities.

organisation – an entity performing an activity or activities required under operator monitoring. In the context of this performance standard, this term encompasses an operator, or a body appointed by that operator to undertake sampling activity on their behalf.

replicate samples – a series of samples collected at the same sampling station, on the same date, in order to assess environmental variability at that sampling station.

sample – a volume of water or soft substrate collected from a sampling station and identified for the assessment or measurement of specific determinand(s).

sampling station – a precise location within the water environment from which a sample is collected. It may be discrete or form part of a transect.

soft substrate – areas of sea floor consisting of loose deposited particles including clay, mud, sand and gravel, and shells. Also includes mixed substrata with gravels, small stones and pebbles scattered on a bed of finer material, but excluding cobbles.

sub-sample – a representative portion removed from a sample for separate analysis.

transect – a line across the water environment along which multiple observations are made or multiple samples are collected.

5 Resource requirements

5.1 Personnel

5.1.1 Organisations must ensure that all personnel performing activities relating to the requirements of this performance standard have been deemed competent in, and are authorised to undertake, those activities.

5.1.2 Organisations must document and implement procedure(s) for:

- determining competence requirements;
- the training and supervision of personnel;
- assessing the initial competence of personnel;
- ongoing monitoring of the competence of personnel; and
- the authorisation of personnel

5.2 Equipment

5.2.1 Equipment must be suitable for the activities being undertaken and must not affect the validity of reported result(s).

5.2.2 Organisations must document the equipment necessary for the correct performance of their sampling activities.

5.2.3 Organisations must have documented procedure(s) in place for the handling, transport, storage, use and planned maintenance of equipment in order to ensure its proper functioning and to prevent its contamination and deterioration.

5.2.4 Organisations must verify that all equipment is functioning properly before placing or returning it into use.

5.2.5 Measuring equipment used during sampling must be calibrated when:

- the measurement accuracy or uncertainty will affect the validity of reported result(s); and/or
- calibration is required to establish the metrological traceability of reported result(s).

5.2.6 For all calibrated measuring equipment, organisations must implement an ongoing calibration programme to maintain confidence in the calibration status of that equipment.

5.2.7 All measuring equipment requiring calibration must be clearly labelled, such that the user of the equipment can readily identify its calibration status.

5.3 Control of documents

5.3.1 Organisations must implement a management system for the control of documents.

5.3.2 Such a system must ensure that all documents are:

- uniquely identified;
- suitably marked to indicate their current revision status;
- approved by authorised personnel prior to their issue; and
- periodically reviewed and updated where necessary.

5.3.3 Where obsolete documents are retained for any purpose, they must be clearly marked so as to prevent their unintended use

5.3.4 Copies of any documents relating to the requirements of this performance standard must be provided to SEPA upon request.

5.4 Control of records

5.4.1 Organisations must establish and retain records to demonstrate fulfilment of the requirements of this MACS performance standard.

5.4.2 Such records must be retained for a minimum period of five years.

5.4.3 Copies of these records must be provided to SEPA upon request.

6 Survey procedure

6.1 Field notes

6.1.1 Field notes must be recorded at the time of sampling and must include all information required to complete the relevant parts of the MPFF Environmental Monitoring Survey Results Template (ref. 3.1 e).

6.2 Position fixing

6.2.1 All sampling stations must have their positions recorded using geographic coordinates, to a minimum accuracy of 10 metres.

6.2.2 Station positions must be supplied to SEPA as decimal degrees latitude and longitude (i.e.lat/long WGS84).

6.2.3 Position fixing must occur as near as possible to the exact time the first sample is collected at a sampling station (i.e. when the first grab hits the seabed).

6.2.4 Survey vessels must be on position at a sampling station's recorded coordinates prior to deploying grab(s) for each subsequent sample collection.

6.3 Choice of sampling equipment

6.3.1 When sampling the seabed, a 0.1 m^2 Day or van Veen grab, a 0.045 m^2 van Veen grab, or an equivalent grab with top opening doors or hatches must be used.

6.3.2 When sub-sampling from grabs for chemistry analyses (see 8.1 and 8.2), a metal corer that can be sealed at the bottom must be used. The corer's capacity must allow for the collection of a quantity of sediment sufficient for the analysis required.

6.4 Operation of sampling equipment

6.4.1 Sampling must be undertaken using grabs deployed from a suitable platform.

6.4.2 Grabs must be free of any residues resulting from prior deployments at other monitoring stations before being redeployed.

6.4.3 Immediately upon retrieval on deck, the grab's top doors must be opened, excess water drained, and the sample inspected for approval (see 6.5).

6.5 Rejection of grabs

6.5.1 Grabs must be rejected when:

- the grab does not fully close; or
- the volume of sample collected is insufficient for the analyses required (see Table 1).

Table 1 - Conditions requiring the rejection of grabs

Sediment description	Volume of grab filled with sediment	
	0.1 m^2 grab (1)	0.045 m^2 grab (2)
Soft sediments (mud)	< 1/3	< 1/2
Hard packed (sands/gravel)	< 1/4	< 1/3
All sediment types	Any grab found to be incomplete (3)	
	Any sample volume that is noticeably smaller than the volume of other grabs collected at that station (4)	

1. Grab bite depth is approximated and given a descriptor: < ¼, ¼, < ⅓, ⅓, ½, ⅔, ¾, Full.
2. Grab bite depth is approximated and given a descriptor: < ⅓, ⅓, < ½, ½, ¾, Full.
3. For example, where the grab jaws are held open by a stone or shell.
4. Based on approximated grab bite depth.

6.5.2 All samples required at a sampling station must be collected from the same location. Where a move to an alternative location is necessary, all required samples must be collected from that alternative location.

7 Sample collection for biological surveys

7.1 Benthic macrofauna

7.1.1 At each sampling station, one sample must be collected exclusively for the analysis of benthic macrofauna.

NOTE: Depending on the grab size used, the benthic macrofauna sample may constitute either the contents of one 0.1 m^2 grab, one 0.045 m^2 grab or two replicate 0.045 m^2 grabs. Where replicate 0.045 m^2 grabs are collected they may either be combined and processed as a single composite sample, or processed separately before the data is combined for reporting purposes.

7.1.2 Samples must be washed with seawater through a 1 mm metal mesh screen sieve. Sieves used must conform to BS ISO 3310 (refs. 3.1 c & 3.1 d).

7.1.3 The presence of any accumulations of algae, fish bones, fish faeces or feed pellets in the sample residue must be recorded.

7.1.4 All sample material retained on the sieve after washing (including any large shells or stones, which may have encrusting animals attached), must be transferred to airtight container(s) that are clearly labelled with a unique identifier linking the sample material to the date of sampling and the specific sampling station.

NOTE 1: Care must be taken throughout sample processing to preserve sample integrity and avoid loss of material or damage to fauna. Objects which could cause damage to sample material during transport (e.g. large stones, shells, sticks etc.) must be removed and kept in separately labelled container(s).

NOTE 2: Large or protected fauna may be removed from the sample and returned to the water environment (i.e. to avoid unnecessary killing of those fauna). If doing so, the fauna must be identified in-situ before being returned. Identification notes for that fauna must be made in the field; marked with a unique identifier, and subsequently combined with the list of fauna recorded during biological testing of the sample.

7.1.5 To prevent decomposition, samples must be preserved within 12 hours of sampling using borax-buffered formosaline (min. 4% v/v). Containers must then be sealed and mixed by gentle inversion.

NOTE: If the sample is not preserved immediately after collection, visible predators must be separated from the rest of the sample and kept in separately labelled container(s).

7.1.6 To allow fixing to occur, preserved samples must be left for a minimum of 2 hours before sorting commences.

7.2 Supporting parameters

7.2.1 A separate grab sample must be collected at each sampling station and sub-sampled for the analysis of particle size (PSA) to support biological assessment.

7.2.2 To reflect the distribution of fauna in the sample, sub-samples must be collected by pushing a corer through the sediment within the grab to the full depth of the grab.

7.2.3 Sub-samples must then be placed in a plastic container, clearly labelled with a unique identifier, and sealed.

7.2.4 Corers must be rinsed with seawater between the collection of each sub-sample to ensure there is no visible cross contamination.

8 Sample collection for chemical surveys

8.1 Chemical residues

8.1.1 At each sampling station, three replicate 0.045 m^2 soft-substrate samples must be collected and sub-sampled for the analysis of sea lice medicine residues.

NOTE: Where a 0.045 m^2 grab is used for sample collection, it may provide only one residue sub-sample. Where a 0.1 m^2 grab is used, it may provide a maximum of two residue sub-samples.

8.1.2 Residue sub-samples must be collected by pushing a corer (see 6.3.2) vertically through the sediment within the grab to a depth of 5 cm. So that the deepest part of the grab is sub-sampled, cores must be collected from as close to each scoop's central hinge line as possible.

NOTE: To allow for potential repeat analysis, the quantity of sub-sample collected must be sufficient to allow a minimum of two residue analyses to be completed for each replicate. If a single core does not provide enough sediment, two cores from the same grab may be combined to ensure the required quantity is available.

8.1.3 Sub-samples must then be placed in a clearly labelled, hexane rinsed, aluminium container (unless the analysing laboratory's method requires otherwise) and sealed.

8.1.4 Sealed sample containers must be stored at a temperature of 5 ± 3°C while in the field and frozen at ≤ -18°C within 48 hours of collection.

8.1.5 Corers must be rinsed with seawater between the collection of each sub-sample to ensure that there is no visible cross contamination.

8.2 Supporting parameters

8.2.1 At sampling stations where the analysis of particle size (PSA) and Total Organic Carbon (TOC) is undertaken in addition to that of sea lice medicine residues, paired sets of sub-samples for all three parameters must be collected from each individual 0.045 m^2 soft-substrate sample.

NOTE: Where a 0.045 m2 grab is used for sample collection, it may provide only one set of paired sub-samples (i.e. 1x residue, 1x PSA and 1x TOC). Where a 0.1 m^2 grab is used, it may provide a maximum of two sets of paired sub-samples (i.e. 2x residue, 2x PSA and 2x TOC).

8.2.2 PSA and TOC sub-samples must be collected by pushing a corer vertically through the sediment within the grab to a depth of 5 cm. So that the deepest part of the grab is sub-sampled, cores must be collected from as close to each scoop's central hinge line as possible.

8.2.3 Sub-samples must then be placed in a clearly labelled plastic container and sealed.

8.2.4 Sealed sample containers must be stored at a temperature of 5 ± 3°C while in the field and frozen at ≤ -18°C within 48 hours of collection.

8.2.5 Corers must be rinsed with seawater between the collection of each sub-sample to ensure that there is no visible cross contamination.

9 Control of non-conforming work

9.1 Organisations must have documented procedure(s) which are implemented when any aspect of their sampling activity does not conform with the requirements of this performance standard.

9.2 As a minimum, these procedure(s) must provide for incidences of non-conforming work to be recorded, investigated, and evaluated for their significance; and require that a determination is made as to whether the results of that work remain valid.

9.3 Where such an evaluation indicates that a non-conformance could recur, or that there is doubt around the conformity of an activity with either the organisation's own procedure(s) or the requirements of this performance standard, then appropriate corrective action must be implemented.

9.4 SEPA may accept submission of analytical results associated with sampling that has not been undertaken according to an organisation's own procedure(s) or the requirements of this performance standard. In each case, a concession to report the affected results must be requested from SEPA.

9.5 Concession requests must include a full assessment of the circumstances of the non-conformance and its potential impacts, and justification as to how the submitted data remains fit for its intended purpose. Where it is not possible to provide a suitable justification, then the non-conforming data will not be accepted by SEPA.

NOTE: For additional guidance on dealing with non-conformance, please refer to complementary technical guide MACS-FFA-TG-01 (ref. 3.1.d).

10 MACS document review and control

10.1 All MACS documentation will be subject to periodic review and may occasionally be amended. For the latest versions of all MACS performance standards, please refer to the SEPA website:

www.sepa.org.uk

For information on accessing this document in an alternative format or language, please contact SEPA by emailing equalities@sepa.org.uk

If you are a user of British Sign Language (BSL), the Contact Scotland BSL service gives you access to an online interpreter, enabling you to communicate with us using sign language.

contactscotland-bsl.org

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