

Measurement Assurance and Certification Scotland

INTERIM PERFORMANCE STANDARD MACS-FFA-02

Finfish Aquaculture Sector

Sampling of soft-substrate

Version 0.1
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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**

The following interim MACS performance standard has been produced in order to support the implementation of our updated and strengthened regulatory framework for the Finfish Aquaculture sector.

Its content will evolve over the course of the phased transition period and beyond; as we continue to work closely with operators, partner organisations and other interested stakeholders to further develop and refine aspects of the new framework.

For the latest versions of all MACS documentation applicable to activities in this sector, please refer to the [SEPA website](#).

Contents

1	Introduction	1
2	Scope	2
3	References	2
4	Terms and definitions	2
5	Resource requirements	4
5.1	Personnel	4
5.2	Survey vessels.....	4
5.3	Equipment	4
6	Sample collection	5
6.1	Weather conditions	5
6.2	Sampling requirements	5
6.3	Defining the position of sampling stations.....	5
6.4	Choice of sampling equipment	6
6.5	Sampling procedure.....	6
6.6	Rejection of samples	7
7	Sample processing in the field	7
7.1	Benthic macrofauna.....	7
7.2	Physical and chemical parameters	8
8	MACS document review and control	10

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, and moving away from a site by site approach.

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 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 complies with the requirements of MACS, they will be considered competent to supply operator monitoring data to us. To ensure they remain compliant, certified organisations will be routinely audited - either by SEPA or an appropriate external accrediting body.

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

www.sepa.org.uk

2 Scope

- 2.1 This interim MACS performance standard is applicable to organisations undertaking the sampling of soft-substrate for biological and chemical analysis related to marine pen fish farms.
- 2.2 Sections 5, 6 and 7 lay out the detailed requirements that those organisations must adhere to when producing information intended for submission to SEPA in relation to that activity.
- 2.3 In conjunction with this document, international standard ISO 16665 (ref. 3b) may be consulted for further guidance.

3 References

- a. BS EN ISO 5667-19:2004 - Water quality - Sampling. Part 19: Guidance on sampling in marine sediments, ISBN 0 580 43945 3.
- b. 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.
- c. BS EN ISO/IEC 17025:2017 - General requirements for the competence of testing and calibration laboratories, ISBN 978 0 539 01414 3.
- d. BS ISO 3310-1:2016 - Test sieves. Technical requirements and testing. Test sieves of metal wire cloth, ISBN 978 0 580 83347 2.
- e. BS ISO 3310-2:2013 - Test sieves. Technical requirements and testing. Test sieves of perforated metal plate, ISBN 978 0 580 82112 7.
- f. Interim MACS Performance Standard: Baseline survey & seabed and water quality monitoring plan design, Scottish Environment Protection Agency, MACS-FFA-01, 2019.

4 Terms and definitions

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

baseline survey – a survey with emphasis on characterisation and description of conditions in the survey area, which forms the basis for future monitoring and/or follow-up surveys.

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

environmental monitoring survey – a survey with emphasis on measuring the impacts from a MPFF in order to assess compliance with relevant environmental quality standards and permit conditions.

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 beneath.

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.

NOTE: With respect to the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR), the operator is the 'Authorised Person' defined and identified as such in the CAR authorisation.

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.

production cycle – a period of time beginning when fish are introduced at a MPFF, and ending once all fish have been removed (either through slaughtering operations or by being relocated).

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 sediment 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 All personnel performing activities relating to the requirements of this performance standard must be competent in and authorised to undertake those activities.
- 5.1.2 Organisations must have procedure(s) and processes in place and retain records for:
- determining competence requirements;
 - training and supervision of personnel;
 - assessing competence of personnel;
 - monitoring ongoing competence of personnel.

5.2 Survey vessels

- 5.2.1 Survey vessels must be suitable for the sampling activities being undertaken, and must not adversely influence the validity of results.

For further guidance on vessel requirements, refer to ISO 16665:2013

5.3 Equipment

- 5.3.1 Equipment must be appropriate for the activities being undertaken, and must not adversely influence the validity of results.
- 5.3.2 Organisations must document the equipment necessary for the correct performance of sampling activities.
- 5.3.3 Organisations must have procedure(s) in place for the handling, transport, storage, use and planned maintenance of equipment in order to ensure proper functioning and to prevent contamination and deterioration.
- 5.3.4 Equipment must be calibrated when:
- the measurement accuracy or uncertainty will affect the validity of the reported result(s), and/or
 - calibration is required to establish the metrological traceability of the reported result(s).
- 5.3.5 For all calibrated equipment, organisations must establish a calibration programme to maintain confidence in the status of that calibration.
- 5.3.6 All equipment requiring calibration must be clearly labelled, such that the user of the equipment can readily identify its calibration status.

6 Sample collection

6.1 Weather conditions

- 6.1.1 Weather conditions must be suitable for the sampling activities being undertaken, and must not adversely influence the validity of results.

6.2 Sampling requirements

- 6.2.1 Sampling must be carried out in accordance with the operator's pre-agreed survey plan.

NOTE: For details on survey planning requirements, and the timings of different survey types, consult interim performance standard MACS-FFA-01 (ref. 3f).

- 6.2.2 At each sampling station, the sampling required will be determined by the purpose of the survey work being undertaken (see Table 1 below).

Table 1: Samples required during specific survey types

Survey type	Samples required
Baseline survey	Benthic macrofauna Particle Size Analysis (PSA) Total Organic Carbon (TOC) Chemical residues (where necessary)
Environmental monitoring survey	Benthic macrofauna PSA TOC Chemical residues (where necessary)
Additional residue survey	PSA TOC Chemical residues

NOTE: Chemical residue sampling is required during baseline surveys where previous use of in-feed medicines has been identified; and during environmental monitoring surveys where in-feed medicines have been used during the current production cycle. For further detail consult interim performance standard MACS-FFA-01.

- 6.2.3 A field log must be kept for recording all information relating to sampling activity, sample stations and individual samples. Copies shall be made available and provided to SEPA upon request.

6.3 Defining the position of sampling stations

- 6.3.1 All sampling stations must have their positions recorded using geographic coordinates. The system used must be explicitly stated in the operator's survey plan and agreed by SEPA prior to any survey work commencing.

NOTE: For surveys based upon multiple transects, the distance of sampling stations along a transect may be measured from the pen edge using a marked distance rope - providing that exact positions are then recorded as per 6.3.1 above.

- 6.3.2 Positions must be defined unambiguously, such that they can be relocated in successive years irrespective of pen position and orientation.
- 6.3.3 During sampling, positions must be held, or repeatedly returned to, until all samples required from a sampling station have been collected.
- 6.3.4 Sampling positions must be defined as near to the exact time the sample is taken, i.e. when the grab hits the bottom.

For further guidance on defining sampling positions, refer to ISO 16665:2013

6.4 Choice of sampling equipment

- 6.4.1 Samples must be collected using a Day or van Veen grab (or similar), ensuring that whichever device is chosen has top opening doors for access and visual inspection.
- 6.4.2 Grab size must be either 0.1 m² or 0.045 m².

NOTE: For the sampling of benthic macrofauna, a grab size of 0.1 m² is highly recommended and, where possible, should be used in the majority of surveys.

- 6.4.3 Sampling devices must be constructed of rust-free material.

For further guidance on the choice of sampling equipment, refer to ISO 16665:2013

6.5 Sampling procedure

For guidance on best practice sampling approaches, refer to ISO 16665:2013

- 6.5.1 Immediately upon retrieval on deck, the grab's top doors must be opened, excess water drained and the sample inspected for approval.
- 6.5.2 All samples must have the following field data recorded:

- Weather conditions.
- Sampling station co-ordinates.
- Time of collection.
- Surface sediment characteristics (visual description).
- Bite depth of grab (cm).
- Grab fullness (e.g. $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$ full).

- Water depth (to the nearest metre).
- Purpose of sample (e.g. fauna, chemistry).

NOTE: Where weather conditions and time allow, samples should also be photographed (time stamped).

6.5.3 Grabs must be thoroughly rinsed with seawater between sample collections.

6.6 Rejection of samples

6.6.1 Sample quality and volume of sediment collected must be assessed to determine whether a grab sample should be rejected.

6.6.2 Grabs must be rejected when:

- Sampling apparatus has not closed properly.
- A sample has an obviously uneven bite.
- Grab fullness is less than:
 - $\frac{1}{2}$ full for muddy sediments.
 - $\frac{1}{3}$ full for hard packed sands.

6.6.3 Rejected samples must have the reason for rejection recorded in the field log before being discarded.

6.6.4 In the event of an unsuccessful grabbing attempt, several repeat attempts must be made. Where no acceptable grab is recovered within five attempts then sampling of that location may be abandoned.

NOTE 1: During baseline surveys, if sediment characteristics make it impossible to collect an acceptable sample, then the best available sample should be retained, and the circumstances recorded in the field log.

NOTE 2: During environmental monitoring surveys and additional residue surveys, if sediment characteristics make it impossible to collect an acceptable sample, then further advice must be sought from SEPA.

7 Sample processing in the field

7.1 Benthic macrofauna

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

NOTE: It is anticipated that faunal sampling will normally be carried out using a grab size of 0.1 m². In situations where a 0.045 m² grab is used (e.g. at sampling stations which are inaccessible using larger equipment) then two replicate grab samples must be collected for faunal analysis. Each replicate must be processed separately.

- 7.1.2 Samples collected for faunal analysis **must not** be sub-sampled for any other parameter.
- 7.1.3 Care must be taken to preserve the integrity of the sample and to avoid loss of material or damage to fauna throughout sample processing.
- 7.1.4 Samples must be washed with seawater through a 1 mm metal mesh screen sieve. Sieves used must conform to BS ISO 3310 (refs. 3d & 3e).
- 7.1.5 Material retained on the sieve (including any large shells or stones which may have encrusting animals attached) must be transferred to a suitable air tight container.
- 7.1.6 Containers must be uniquely labelled so that samples remain easily identifiable throughout the entire analytical process.
- 7.1.7 Samples must be fixed with formalin and buffered as soon as possible after sieving. The time of preservation must be recorded. Sample containers must then be sealed and shaken to ensure mixing, before being stored for a minimum of 2 hours prior to analysis.

7.2 Physical and chemical parameters

- 7.2.1 At each sampling station, grab sample(s) must be collected and sub-sampled for the analysis of particle size (PSA), total organic carbon (TOC) and chemical residues (where necessary).
- 7.2.2 The number of replicate grabs/sub-samples required will be determined by the purpose of the survey work being undertaken and the analyses required (see Table 2 below).

Table 2: Number of replicate samples required during specific survey types

Survey type	Analyses required	No of replicates
Baseline survey	PSA TOC Chemical residues (where necessary)	1
Environmental monitoring survey (In-feed medicines not used)	PSA TOC	1
Environmental monitoring survey (In-feed medicines used)	PSA TOC Chemical residues	3
Additional residue survey	PSA TOC Chemical residues	3

NOTE: During environmental monitoring surveys where multiple PSA replicates are required, the first replicate collected **must** be designated and used to support biological assessment.

7.2.3 Associated sets of sub-samples for PSA, TOC and chemical residue analysis **must** be collected from the same grab.

NOTE: A 0.045 m² grab must only provide one set of associated sub-samples. Where a 0.1 m² grab is used, it may only provide a maximum of two sets of associated sub-samples.

7.2.4 It must be ensured that sub-samples are collected from the deepest part of a grab.

7.2.5 Particle Size Analysis (PSA)

a. PSA sub-samples collected during baseline and environmental monitoring surveys must be taken by pushing a plastic or metal corer vertically through the sediment to the full depth of the grab.

NOTE: During additional residue surveys (where no sampling of benthic macrofauna is carried out) then a full depth core is not required. Instead, PSA cores need only be taken to a depth of 5 cm.

- b. Sediment cores must be retrieved and placed into a suitable, sealed plastic container.
- c. Containers must be uniquely labelled so that samples remain easily identifiable throughout the entire analytical process.
- d. Samples must be frozen as soon as is practicable, and at least within 24 hours of collection.
- e. Corers must be thoroughly rinsed with seawater between sub-sample collections.

7.2.6 Total Organic Carbon (TOC)

- a. All TOC sub-samples must be taken by pushing a plastic or metal corer vertically through the sediment to a depth of 5 cm.
- b. Subsequent sample processing is as per clauses 7.2.5b to 7.2.5e above.

7.2.7 Chemical residues

- a. All chemical residue sub-samples must be taken by pushing a metal corer vertically through the sediment to a depth of 5 cm.
- b. Sediment cores must be retrieved and placed into a specially pre-prepared glass or aluminium sample container.

NOTE: Depending on the type of container used, pre-preparation must involve cleaning with either organic solvents (i.e. hexane rinsing) or high-temperature combustion.

- c. Subsequent sample processing is as per clauses 7.2.5c to 7.2.5e above.

8 MACS document review and control

- 8.1 All MACS documentation will be subject to review and amendment. For the latest versions of all MACS performance standards, please refer to the SEPA website:

www.sepa.org.uk

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