




FISHNISH B, SOUND OF MULL

NEWDEPOMOD REPORT

Report To	Scottish Environment Protection Agency
Report ID	0223-1
Status	V1
Date	06/02/2023

Scottish Sea Farms Ltd
South Shian
Benderloch
Argyll & Bute
Tel 01631 574000



EXECUTIVE SUMMARY

Modelling has been carried out by Scottish Sea farms Ltd (SSF) to recover the historical biomass consent of 1300 tonnes at the recently reconfigured marine cage fish farm Fishnish B (CAR/L/1003494).

This site has been subject to cuts in the past due to the high bed speeds at the site being poorly represented in the previous modelling tool AutoDEPOMOD. This report will show that a biomass of 1300 tonnes comfortably meets SEPA standards using the Standard Default Approach as outlined in the current SEPA guidance (SEPA 2019).

A maximum consented biomass of **1300 tonnes** with a stocking density of **17.952 kg m⁻³** is applied for this configuration. Marine modelling has been carried out with regards to Bath Medicine modelling and has been provided with this application in the report *Fishnish B Bath Medicine Dispersion Report*. New transects and sample stations, in line with current SEPA regulation, have been identified.

We do not intend to change the cage layout or increase the authorised total allowable quantity (TAQ) at this site and therefore no change to the footprint is expected. For that reason, Slice modelling has not been presented in this report, however we do request that the maximum treatment quantity (MTQ) is amended to 455 g to reflect the proposed change in maximum biomass.

Table 1: Consent limits for Biomass and treatment chemicals at Fishnish B

Treatment	Recommended consent mass
Biomass	A maximum consent biomass of 1300 t and stocking density of 17.952 kg m⁻³ is recommended for this site.
SLICE (Emamectin Benzoate)	A maximum treatment quantity (MTQ) of 455 g and a total allowable quantity (TAQ) of 1305 g. This is enough chemical to treat the maximum biomass 2.87 times

1. Introduction

1.1 Site Details

The MCFF Fishnish B is located to the east of Fishnish Bay, Sound of Mull. The site is sheltered from the wind from most southerly directions with the greatest exposure to the wind from northerly directions, and in particular the northwest.

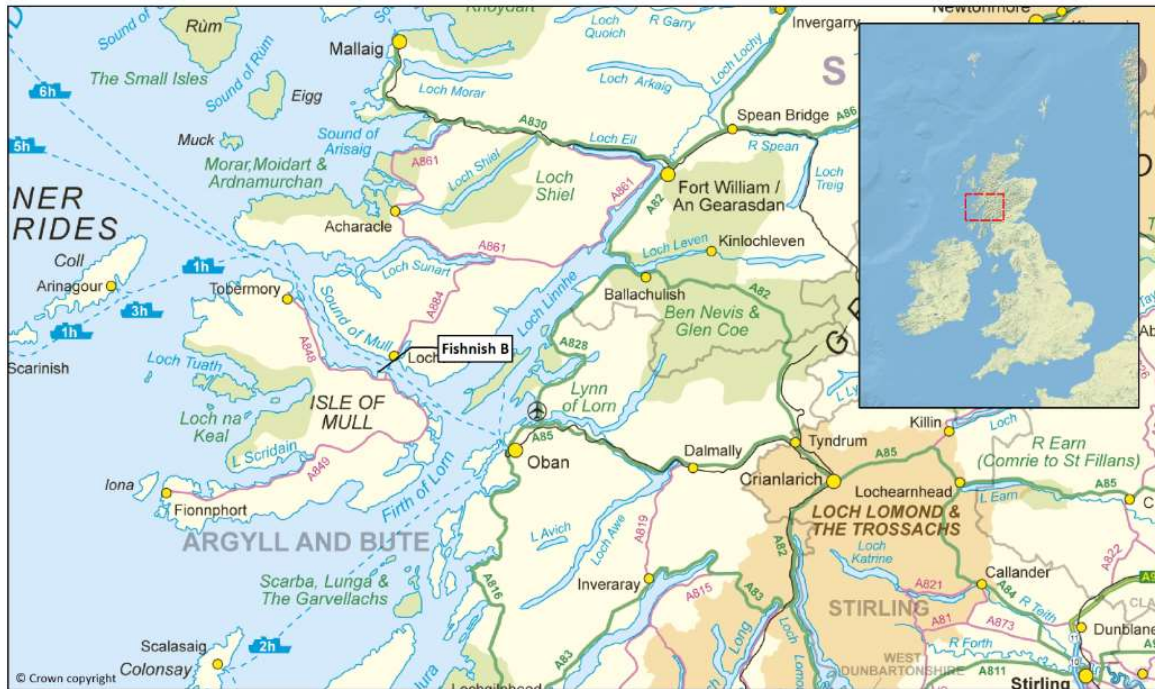


Figure 1: Location of the proposed site relocation for MCFF Fishnish B, Sound of Mull.

2. Model Input Details

2.1 Hydrographic Data

Two separate Acoustic Doppler Current Profiler (ADCP) surveys were carried out at this location in order to collect the 90 days of current speed and direction data required for this site. The details of these surveys are reported in *Fishnish B 2023 Modelling Data Collection Report* (Report No. H0223-1). Data was collected in 2018 and 2022, appropriate subsets were selected from each of these periods and matched for tidal level and phase where possible and connected into one 90-day period (Report No, H0223-1) the data has been corrected to grid north ($^{\circ}$ G). The summary statistics for this 90-day period is shown in table 2 below.

Table 2: Statistics for the 90-day composite current meter dataset at Fishnish B

	Near-bed	Pen-bottom	Sub-surface
Mean velocity (m s⁻¹)	0.198	0.260	0.253
Min velocity (m s⁻¹)	0.004	0.001	0.001
Max velocity (m s⁻¹)	0.634	0.698	0.73
Ranked percentage 0.095 m s⁻¹	22 %	14 %	16 %
Major axis (°G)	105	280	280
Amplitude anisotropy	3.98	5.88	4.97
Residual velocity (m s⁻¹)	0.04	0.01	0.04
Residual direction (°G)	089	257	276
Parallel Residual (m s⁻¹)	0.038	0.008	0.044
Normal Residual (m s⁻¹)	-0.010	-0.004	-0.003
Parallel tidal amplitude (m s⁻¹)	0.308	0.413	0.400
Normal tidal amplitude (m s⁻¹)	0.077	0.070	0.081

2.2 NewDepomod Modelling

SSF have used the precautionary Standard Default Approach as outlined in *Regulatory Modelling Guidance for the Aquaculture Sector* (July 2019 – Version 1.1) (SEPA 2019). Model parameters were set as defined in Appendix A of the same document.

A single point 90-day current meter dataset located at (165294.3, 742856.0) was used in combination with a uniform bathymetry at a depth of (29.79 m). The model domain is a 2 km x 2 km regular grid made up of 25 m grid cells with bounding coordinates

Domain.spatial.minX=164180
 Domain.spatial.maxX=166180
 Domain.spatial.minY=742130
 Domain.spatial.maxY=744130

2.3 Run Details

The model was configured to 7 x 100 m circumference cage with a 13 m sidewall and a SD of 17.952 kg m⁻³ (equivalent to 1300 tonnes) details in table 3 below:

Table 3: Cage setup for model run 1 FB2023.

	CageGroup1
Origin X (m)	165349.0
Origin Y (m)	742754.0
X spacing (m)	50.00
Y spacing (m)	50.00
Bearing	288.00
Cages X	1
Cages Y	7
Type	Circles
Diameter (m)	31.83
Net Depth (m)	13.00
Circumference (m)	100.00

The vertical dispersion coefficient for the resuspension phase ($\sigma_{z,r}$) is set using:

$$\sigma_{z,r} = 0.0003 u^{-0.762}$$

where u is mean flow speed at the bed (m s⁻¹).

The 90 day mean flow speed at this site (u) is 0.198 ms⁻¹ which gives an $\sigma_{z,r}$ of 0.00103053413 m² s⁻¹.

Single runs were carried out with 10 particles for 365 days. The model was set to produce output every 3 hours for the last 90 days of the model run. These surfaces were then used to create an aggregated footprint averaged over the last 90 days of the model run.

3. Modelling Results

3.1 Biomass Results

3.1.1 Full Modelled Flow

A passing run was achieved for a consent biomass of 1300 tonnes and a stocking density of 17.952 kg m⁻³.

Available mixing zone area (cage composite area) – 111217 m²

Predicted mixing zone - 0 m²

Average intensity within predicted mixing zone - 0 g m⁻² yr⁻¹

The predicted mixing zone for this configuration is 0 % of the available mixing zone area.

Residual currents at this site are less than 35% of the mean therefore only the full flow model is presented in this report.

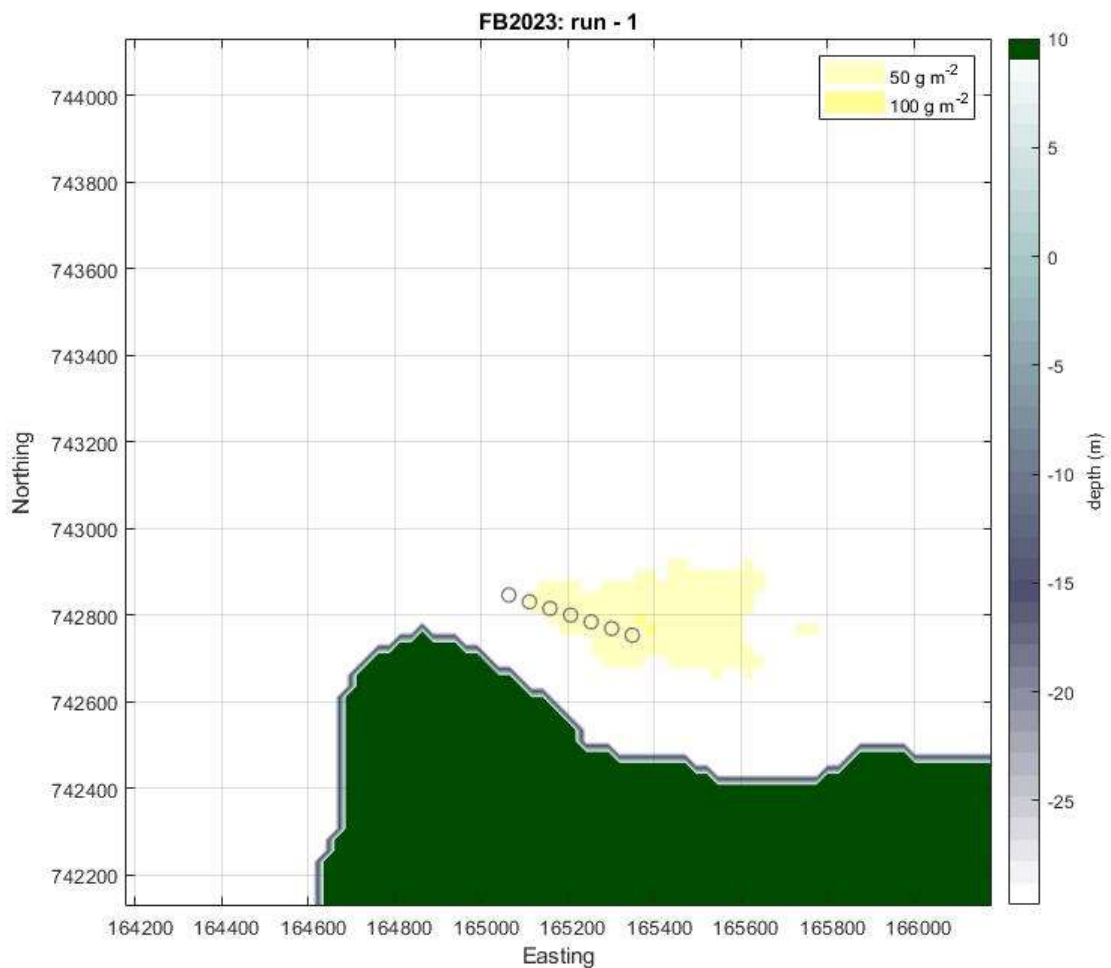


Figure 2: Averaged output from the last 90 days of model run FB2023-1

In line with the new Environmental Monitoring Protocol four sampling transects have been positioned at orthogonal angles (Fig. 4). Seven sampling stations have been placed along each transect at regular intervals. Stations are detailed in table 4 below.

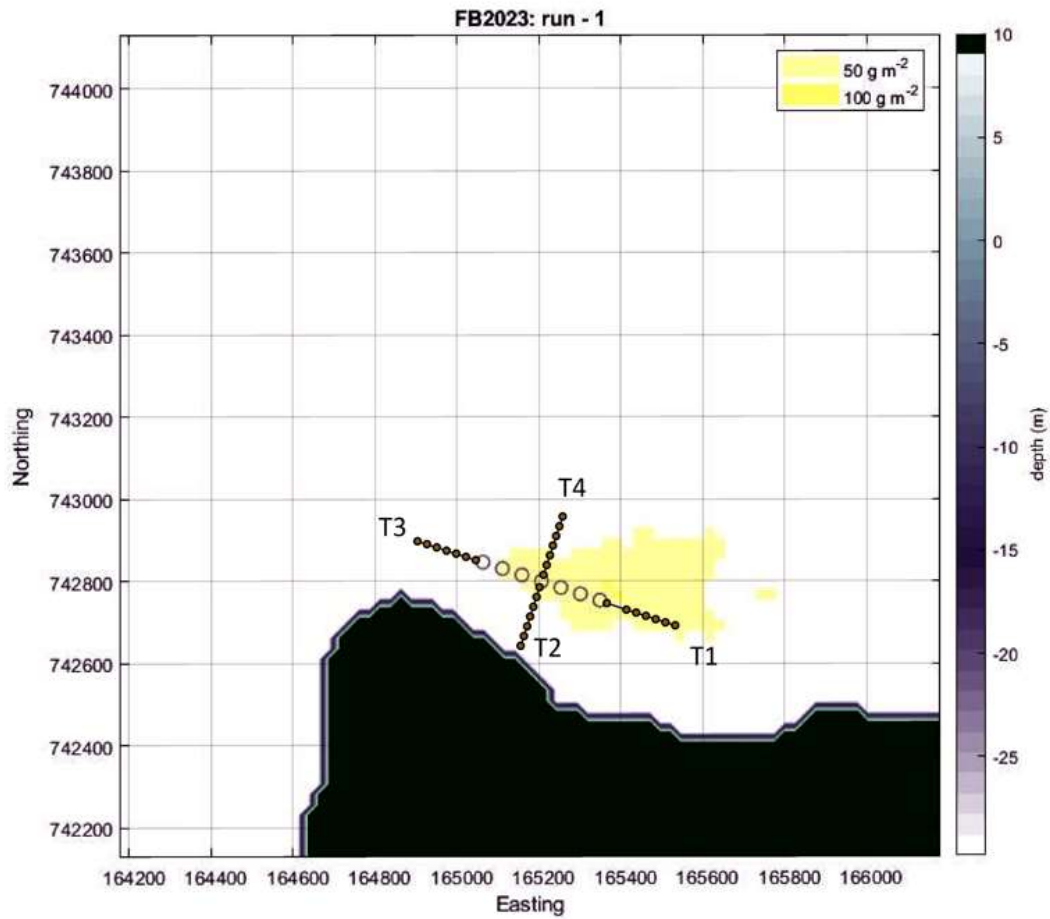


Figure 3: Suggested transects and stations for Fishnish B

Table 4: Transect and station details.

Transect	Bearing	Distance (m)	Latitude	Longitude	Easting	Northing
T1	105	0	56° 31.081'	-05° 48.951'	165365.51	742745.68
T1	105	50	56° 31.074'	-05° 48.903'	165413.08	742730.23
T1	105	75	56° 31.071'	-05° 48.880'	165436.86	742722.51
T1	105	100	56° 31.067'	-05° 48.856'	165460.65	742714.79
T1	105	125	56° 31.064'	-05° 48.833'	165484.43	742707.06
T1	105	150	56° 31.061'	-05° 48.809'	165508.22	742699.34
T1	105	175	56° 31.057'	-05° 48.786'	165532	742691.61
T2	195	0	56° 31.019'	-05° 49.149'	165155.34	742642.26
T2	195	25	56° 31.032'	-05° 49.143'	165163.06	742666.05
T2	195	50	56° 31.045'	-05° 49.137'	165170.78	742689.83
T2	195	75	56° 31.058'	-05° 49.131'	165178.51	742713.62
T2	195	100	56° 31.071'	-05° 49.124'	165186.23	742737.4
T2	195	125	56° 31.084'	-05° 49.118'	165193.96	742761.19
T2	195	150	56° 31.097'	-05° 49.112'	165201.68	742784.97
T3	285	0	56° 31.149'	-05° 49.408'	164903.23	742897.07
T3	285	25	56° 31.145'	-05° 49.385'	164927.02	742889.35
T3	285	50	56° 31.142'	-05° 49.361'	164950.8	742881.63
T3	285	75	56° 31.138'	-05° 49.338'	164974.59	742873.9
T3	285	100	56° 31.135'	-05° 49.314'	164998.37	742866.18
T3	285	125	56° 31.132'	-05° 49.291'	165022.16	742858.46
T3	285	150	56° 31.128'	-05° 49.267'	165045.94	742850.73
T4	15	0	56° 31.114'	-05° 49.105'	165211.02	742814.63
T4	15	25	56° 31.127'	-05° 49.098'	165218.74	742838.42
T4	15	50	56° 31.140'	-05° 49.092'	165226.46	742862.2
T4	15	75	56° 31.153'	-05° 49.086'	165234.19	742885.99
T4	15	100	56° 31.166'	-05° 49.080'	165241.91	742909.77
T4	15	125	56° 31.179'	-05° 49.073'	165249.64	742933.56
T4	15	150	56° 31.192'	-05° 49.067'	165257.36	742957.34

4. Results and Conclusions

NewDEPOMOD simulations using SEPA's standard default approach demonstrate that the proposed increase to the site's historical biomass of 1300 tonnes would meet the relevant EQS criteria. At the proposed biomass the model demonstrates that 0 % of the available mixing zone area would be utilised indicating that 1300 tonnes is a conservative biomass for this location.

The near bed residual current (0.04 ms^{-1} at 089°) at the current meter location flows east along the Sound of Mull. The modelled output shows no build-up of material at this location. Any material exported from the model grid is likely to be dispersed over the wider Sound of Mull area.

REFERENCES

Scottish Environment Protection Agency (SEPA) (2022) "NewDepomod Draft Guidance – 27/04/2022"

Scottish Environment Protection Agency (SEPA) (2019) "Regulatory Modelling Guidance for the Aquaculture Sector" Version 1.1. Available at <https://www.sepa.org.uk/media/450279/regulatory-modelling-guidance-for-the-aquaculture-sector.pdf> (Accessed on 01/12/20)