

# Temporal variability in sea lice population connectivity and implications for regional management protocol

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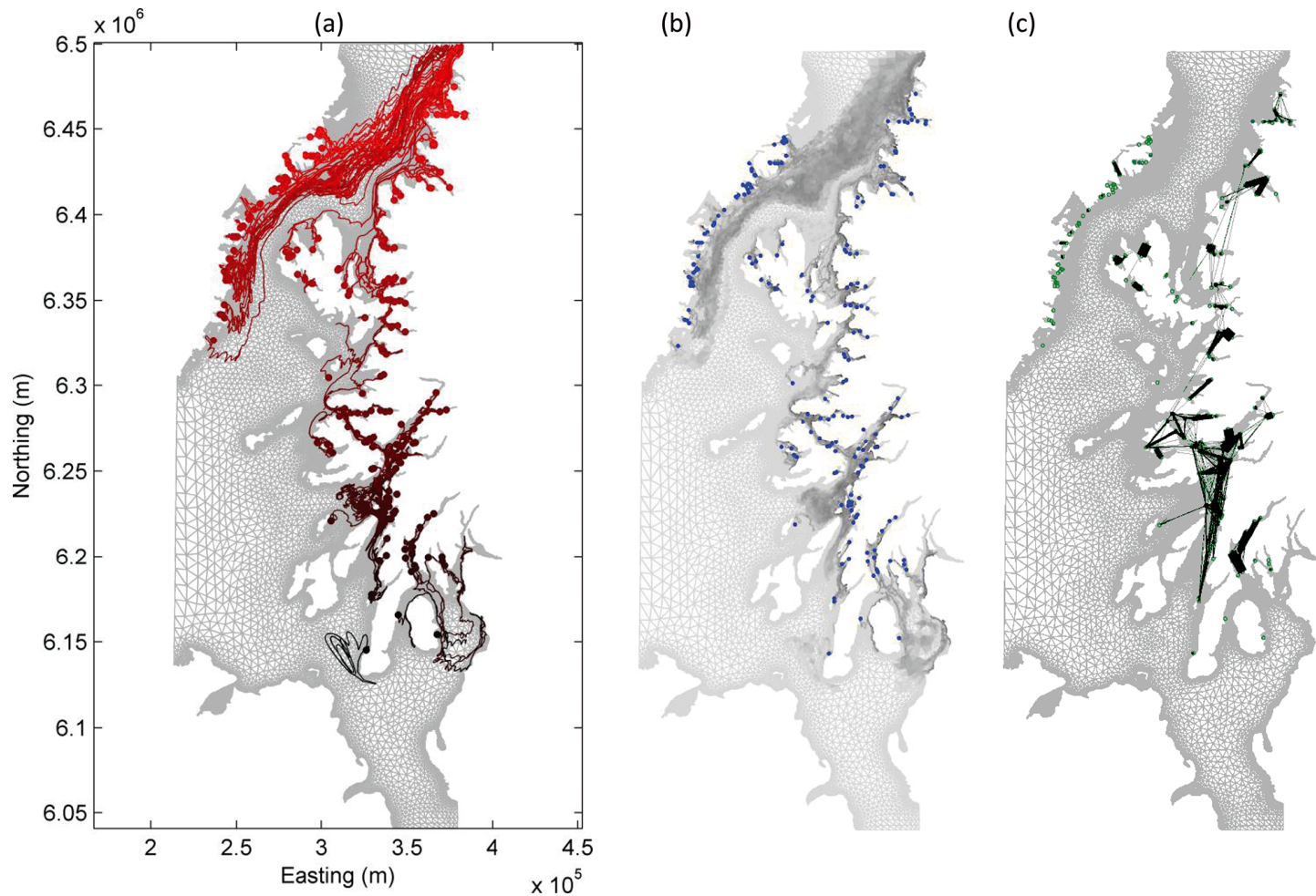


Fig. S1: Example output from particle tracking model. (a) Single tracks from each salmon aquaculture site within the model domain. Sites and respective tracks are coloured based upon their northing coordinate. (b) Relative proportion of time spent by particles in each model element, per unit area. (c) Visual representation of site connectivity matrix for a single simulation, showing connections above a threshold of 0.001.

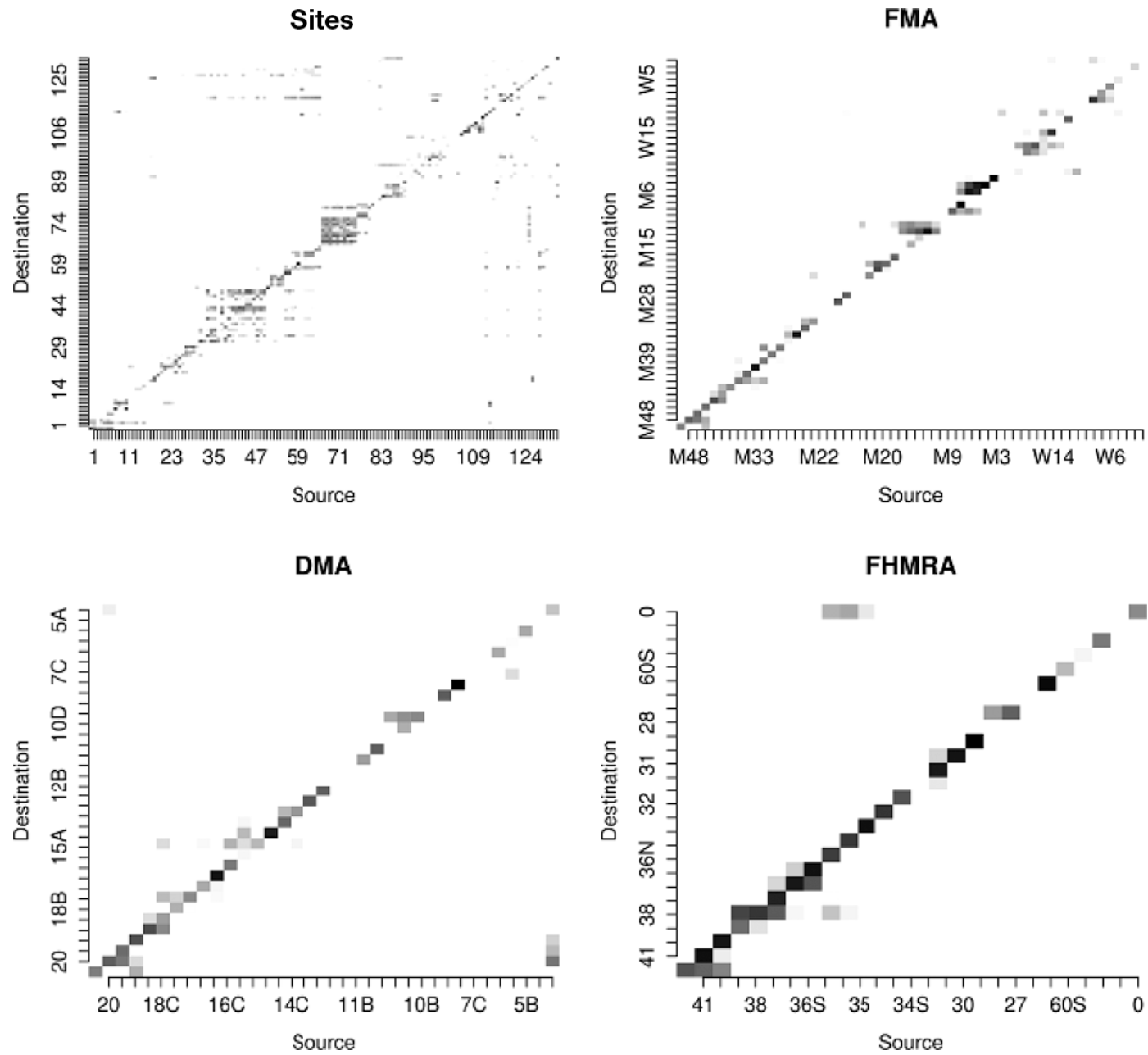


Fig. S2: Mean logarithm of connectivity between active sites, FMAs, DMAs and FHMRA on the west coast of Scotland (sites/management units arranged south to north), omitting connections below a threshold probability of 0.001. Connectivity is relative to maximum for each particular configuration.

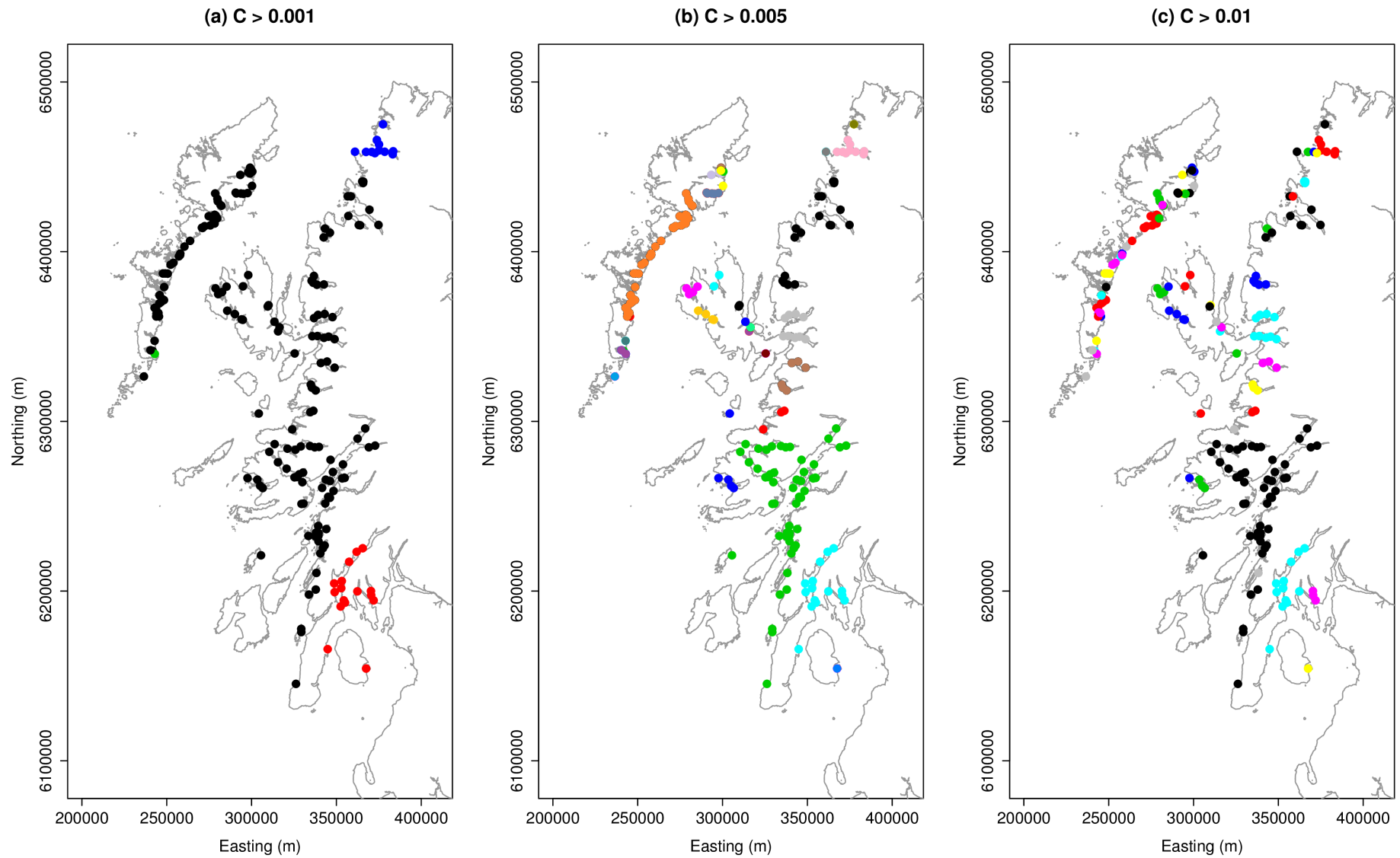


Fig. S3: “Weak” clusters of all (active and inactive) sites (linked by connections either to or from one another) created by including only mean connections greater than a range of thresholds. (a)  $C_{ij} > 0.001$ . (b)  $C_{ij} > 0.005$ . (b)  $C_{ij} > 0.01$ . Sites are coloured by cluster (in (c), several geographically separated clusters share the same colour).

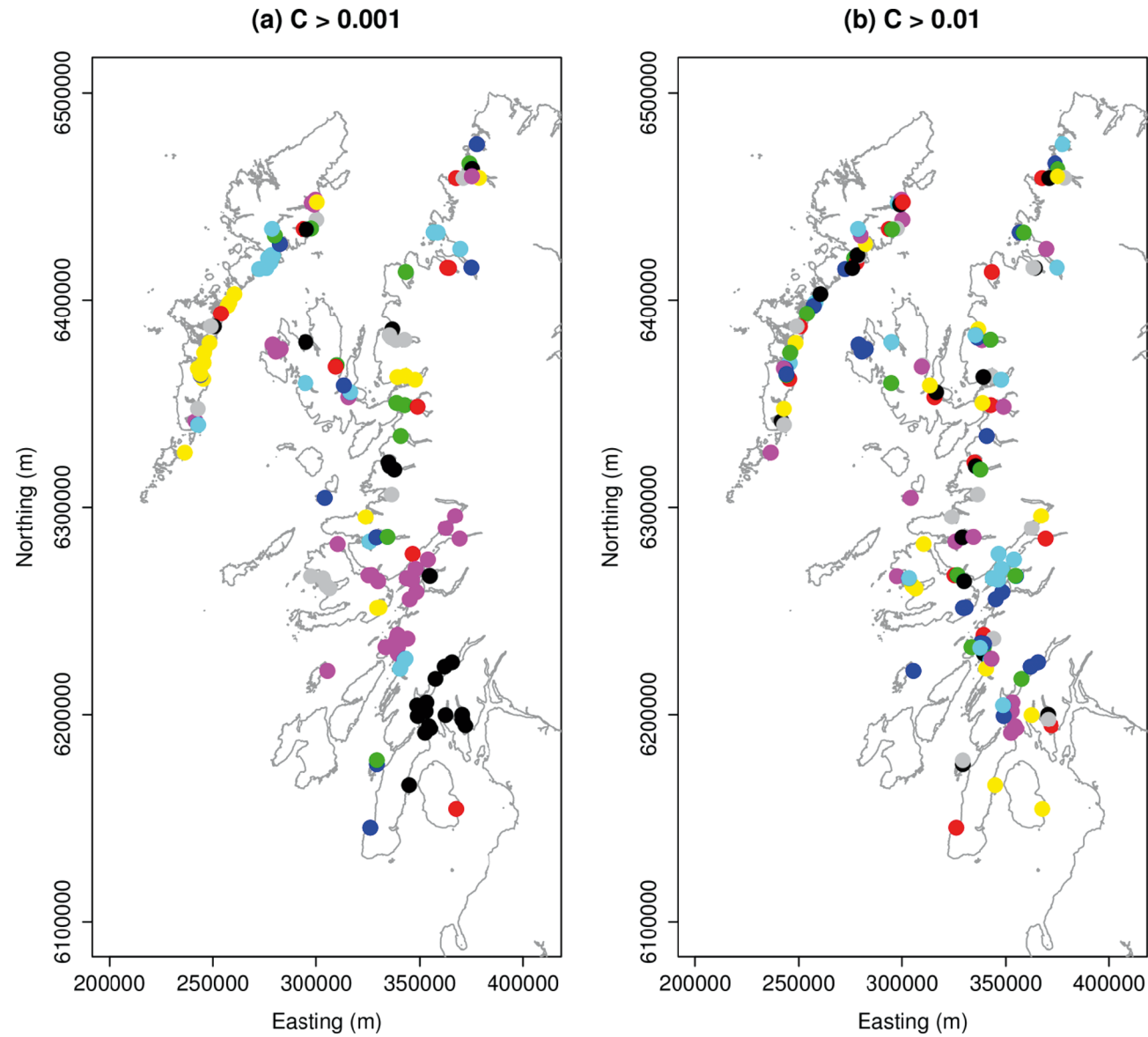


Fig. S4: “Strong” active site clusters (sites linked by connections to AND from one another) created by including only mean connections greater than a range of thresholds. (a)  $C_{ij} > 0.001$ . (b)  $C_{ij} > 0.01$ . Sites are coloured by cluster; sites in the same cluster and located together are coloured similarly (different clusters share colours, as clusters are physically small in this scenario).

## Management units in Scottish Salmon aquaculture

Table S1: List of industry Farm Management Areas with locality description, coordinates of polygon centroid calculated in ArcGIS (UTM Zone 30N), and whether they fall within the hydrodynamic model domain.

Code	Locality	x (m)	y (m)	Included
S1	Haroldswick, Shetland	620557.2	6737190	N
S2	Bluemull sound, Shetland	612854.6	6728915	N
S3	Hascosay Sound, Shetland	609064	6722974	N
S4	Yell Sound, Shetland	601302.5	6701830	N
S5	Dury Voe, Whalsay, Shetland	608877.3	6693972	N
S6	Out Skerries, Shetland	622928.6	6700737	N
S7	Ronas Voe, Shetland	584443.7	6710716	N
S8a	St Magnus Bay north, Shetland	583729.7	6702052	N
S8b	St Magnus Bay south, Shetland	586369.6	6688095	N
S9	West Mainland	600186.2	6677747	N
S10	Gruting Voe, Shetland	581363.2	6676653	N
S11	The Deeps, Shetland	591743.8	6668932	N
O1	Westray, Orkney	505340.7	6575916	N
O4	Holm Sound, Orkney mainland	506266.4	6526340	N
O2	Stronsay Firsth, Westray Firth, Orkney	506457	6549126	N
M1	Loch Eriboll	401899.9	6486913	N
M2	Loch Inchard	381561.3	6480786	Y
M3	Loch Laxford	378448.5	6474521	Y
M5	Bagh Chalbha, Eddrachillis Bay	375140.8	6462747	Y
M6	Loch a'Chairn Bhain, Eddrachillis Bay	383416.1	6457546	Y
M4	Badcall Bay	374068.8	6466188	Y
M7	Eddrachillis Bay	372536.4	6458352	Y
M8	Clashnessie Bay, Oldany	364520.8	6458351	Y
M9	Enard Bay	362900.8	6446153	Y
M10	Summer Isles	358622	6433520	Y
M11	Loch Kanaird, Isle Martin, Ardmair	370472.6	6424967	Y
M12	Loch Broom	375536.3	6414220	Y
M13	Annat Bay	363281.3	6421960	Y
M14	Gruinard Bay, Little Loch Broom	357673.5	6417391	Y
M15	Loch Ewe	343746.7	6411198	Y
M16	Loch Gairloch	337786.7	6400592	Y
M17	Loch Torridon, Loch Shieldaig	340602.9	6382773	Y
M18	Loch Arnish, Raasay	318943.6	6374869	Y
M26	Loch Portree	308696.8	6367125	Y
M19	Loch Kishorn	341410.5	6363972	Y
M20	Loch Carron	348033.5	6361636	Y
M21	Loch Alsh, Loch Duich	348020.6	6349848	Y
M28	Loch Ainort	315777.9	6354201	Y
M24	Loch Snizort	296615.2	6381693	Y
M25	Loch Dunvegan	280492	6378113	Y
M27	Loch Bracadale	292618.7	6361394	Y
M29	Loch Slapin, Loch Eishort	320397.6	6339705	Y
M22	Loch Hourn	346068	6333071	Y
M23	Loch Nevis	338776.3	6321209	Y
M30	Arisaig, Morar	325853.3	6314309	Y
M31	Loch Ailort	332609	6305849	Y
M32	Loch Moidart	325634.6	6296378	Y
M34	Loch Sunart, Kilchoan	323460	6284965	Y
M35	Sound of Mull	324318.6	6269883	Y
M36	Loch Linnhe south, Kerrera, Loch Etive, Creran	354603.4	6265445	Y
M33	Loch Linnhe north, Loch Leven, Loch Eil	368111	6292358	Y
M37	Loch Tuath, Loch na Keal	306424	6263415	Y
M38	Loch Scridain	309774.3	6250832	Y
M39	Loch Spelve	330189.6	6252506	Y
M40	Seil Sound, Loch Melfort, Loch Craignish	340522.7	6231674	Y

Code	Locality	x (m)	y (m)	Included
M41	Loch Sween	336308.3	6208003	Y
M44	Loch Caolisport	336031.7	6197518	Y
M42	Loch Fyne	360658.4	6216126	Y
M45	Kyle of Bute	366253	6197834	Y
M43	Loch Striven	368414.3	6207520	Y
M46	Gigha	328097.9	6173215	Y
M49	Machrihanish Bay, Kintyre	323596	6144504	Y
M47	Kilbrannan Sound, Arran	347977.8	6163536	Y
M48	Lamlash Bay	368462.8	6155432	Y
W2	West Loch Roag, Lewis	271081.9	6456034	N
W1	East Loch Roag, Lewis	277598.4	6462413	N
W3	Loch Erisort, Lewis	293923.5	6445800	Y
W4	Loch Ouirm, Lewis	299117.3	6438783	Y
W5	Loch Shell, Lewis	293014.6	6434628	Y
W6	Loch Seaforth, Lewis	282043.8	6432574	Y
W8	East Loch Tarbert	277436.5	6420843	Y
W9	Loch Stocanaish, Loch Ghreosabhaigh, Harris	273527	6414844	Y
W10	Loch Fhionnsabhaigh, Harris	266435.5	6408641	Y
W7	West Loch Tarbert	266297.8	6426228	N
W12	Lochmaddy	251473.3	6393418	Y
W11	Sound of Harris south	253520.3	6399031	Y
W13	Loch Euphoirt, North Uist	246934.8	6387062	Y
W14	Ronay, North Uist	247431	6381453	Y
W15	Loch Uiskevagh, Benbecula	245214.1	6375663	Y
W16	Benbecula south	244799.2	6370249	Y
W17	Loch Carnan, South Uist	242804.9	6366407	Y
W18	Loch Skipport, South Uist	244447	6361348	Y
W19	Loch Eyenort, South Uist	239429.2	6351119	Y
W20	Loch Boisdale, South Uist	240098	6341612	Y
W21	Barra north	233483.2	6328646	Y
W22	Castle Bay, Barra	228227.8	6320119	Y

Table S2: List of Marine Scotland Disease Management Areas with coordinates of polygon centroid calculated in ArcGIS (UTM Zone 30N) and whether they fall within the hydrodynamic model domain.

Code	x (m)	y (m)	Included
7C	237939.8	6324589	Y
7B	243172.8	6344969	Y
7A	246353.7	6368628	Y
5C	255391.7	6395903	Y
6B	266070	6427579	N
5B	279495.2	6423360	Y
6A	273427.9	6459416	N
5A	297115.4	6440899	Y
9A	402249	6487076	N
9B	378244.9	6477508	Y
9C	375199.6	6460420	Y
10A	364458.2	6442718	Y
10B	366938.4	6424522	Y
10D	363535.5	6416541	Y
10C	343264.3	6411451	Y
11A	341062.3	6382894	Y
11B	313875.6	6361036	Y
12A	296745.6	6378832	Y
12B	280054.9	6377785	Y
12C	294568.1	6359138	Y
14A	345939.2	6355555	Y
14B	345893.5	6333150	Y
14C	337968.6	6321563	Y

Code	x (m)	y (m)	Included
15C	333396.3	6306219	Y
15A	325309.7	6296568	Y
15E	302333.2	6305731	Y
15B	346251.1	6276798	Y
16A	303131.5	6263629	Y
16E	306913.3	6222131	Y
16C	331223	6251480	Y
16D	339615.2	6233300	Y
19A	360249.1	6215635	Y
18A	335182.7	6197422	Y
18B	327691.9	6173980	Y
19B	370778	6199928	Y
19C	347203	6164313	Y
20	368699.2	6155253	Y
18C	324141.8	6144822	Y
8C	489761.5	6527373	N
8A	504986	6577266	N
8B	505684.4	6550542	N
3A	592119.2	6669479	N
3B	580310.7	6676184	N
4A	586686.9	6688445	N
2A	605979.5	6691829	N
2C	602324.3	6702278	N
1D	623017	6701004	N
4B	584444.3	6711041	N
1B	610899.2	6724570	N
1A	620044.6	6737255	N
4C	584822.3	6701803	N
2B	601139.3	6677795	N

Table S3: List of Scottish Salmon Producers' Organisation Fish Health Management Reporting Areas with name, coordinates of polygon centroid calculated in ArcGIS (UTM Zone 30N), and whether they fall within the hydrodynamic model domain.

Code	Name	x (m)	y (m)	Included
42	Fyne	359573.5	6211839	Y
43	Ruel and Drummachloy	369396.4	6193184	Y
41	Carradale and Iorsa	354096.3	6153047	Y
38	Add and Ormsary	331818.3	6175190	Y
40	Islay and Jura	304165.4	6197632	Y
37	Awe and Nell	361230.1	6248948	Y
36S	Sanda to Creran South	348355.5	6270656	Y
36N	Sanda to Creran North	369384	6296214	Y
39	Island of Mull	305154.1	6256141	Y
33	Morar to Shiel	325369.9	6302405	Y
35	Sunart and Aline	327187.7	6280298	Y
32	Glenelg to Kilchoan	342882.7	6331308	Y
31	Loch Long and Croe	352507.7	6351259	Y
30	Kishorn and Carron	342392.7	6363218	Y
29	Badachro to Applecross	339618.3	6384422	Y
34N	Skye and Small Isles North	317252.7	6366728	Y
34S	Skye and Small Isles South	294567.8	6365196	Y
27	Kennart to Gruinard	365393.8	6418132	Y
28	Ewe	340095.6	6411278	Y
26S	Inchard to Kirkaig South	360781.7	6444498	Y
26N	Inchard to Kirkaig North	377328.4	6472116	Y
25	Hope and Grudie	398329.9	6491527	Y
58E	Isle of Lewis East	302802.6	6453340	Y
59	Harris	262741.8	6426439	Y
58W	Isle of Lewis West	283199.3	6468107	N
60N	The Uists North	242499.7	6397201	Y
60S	The Uists South	238197.1	6344851	Y
61	Orkney	507793.5	6555319	N
62W	Shetland West	581468.1	6683944	N
62E	Shetland East	611258.6	6698721	N