

Introduction

To give perspective to operations of this relatively new industry to decision makers, we will set out some of the potential impacts and proposed mitigation.

Designated sites (SSSI, SAC and MPA)

Loch Sunart SAC for Rocky Reefs

The Oronsay East development site lies within Loch Sunart SAC for Rocky Reefs, however GreenSea Solutions consider that the proposed site location is not likely to have any significant effect on protected reef features.

Furthermore, any potential risk to seabed habitat disruption will be mitigated by the selection of environmentally sensitive, low impact mooring equipment to be designed and installed by AquaMoor.

Inner Hebrides and the Minches cSAC for harbour porpoise

The Inner Hebrides and the Minches cSAC for harbour porpoise only extends as far as the Western shore of Oronsay so the proposed farm site is outwith this designated area and an appropriate assessment is therefore not required for this site.

GreenSea Solutions has reviewed the literature and can find no evidence of cetaceans being caught up in finfish, mussel or seaweed farms. Consideration has also been given to the work done by the Scottish Entanglement Alliance (www.scottishentanglement.org) in raising awareness of risks to marine mammals from fishing gear. As the seaweed farm will be deployed using mooring lines that are under tension there is considered to be no risk of entanglement posed by the farm.

GreenSea Solutions will of course remain vigilant to the welfare of these and other sea mammals that are in the area. It should be noted that the operation of a seaweed farm does not utilise any ultrasonic or sound devices, any feed or fertilizer, or any chemical or pesticide inputs.

AquaMoor's assessment for GreenSea Solutions of potential impacts and proposed mitigations is presented below.

Benthic Shading

Benthic shading is not well documented or understood in European waters. It is a significant issue in tropical latitudes where red seaweeds are grown in very shallow water <2.0m. The intensity of this type of seaweed cultivation can cause significant benthic shading but this is not a concern for cultivation of brown kelps in Scotland.

The Seaweed farm will be sited off from the coast to ensure they do not interact with the Rocky Reefs in the area, both in the SAC for their protection and at the other proposed sites outwith the SAC. This will prevent any shading damage to the wild seaweed forests and the communities they support in these habitats.

We have used simple arithmetic to show an indicative calculation of the worst possible amount of shading under the Seaweed farm that the plants could create as they grow.

With the assumptions

- Water clarity is 100% clear and there is no turbidity
- The lines and floats provide a negligible level of shading

- The sun's azimuth (midday) at this latitude moves from Sep 40°, Dec 15°, Mar 40°, Jun 60°. But we will assume overhead sun (which it never is) and that the plants will stand out at 90° from the lines (which they never will).
- Even at maximum density, brown kelp plants do not create blanket coverage of the water (coverage est 50% max), nor do they block all available light (shading est 50% max).
- Assuming seeded lines will be 50m long and 2m apart = 100m² of area either side of a line, thus coverage % = plant growth x 50m x 100 x 0.5, shading% = coverage x 0.5
- Seeded lines are placed in the water in Nov, plant length 0cm = 0% coverage = 0% shading
- Growth by end Dec <10cm = 2.5% coverage = 1.25% shading.
- Growth by end Jan <25cm = 6.25% coverage = 3.13% shading.
- Growth by end Feb <50cm = 12.5% coverage = 6.25% shading.
- Growth by end Mar <75cm = 18.8% coverage = 9.4% shading.
- Growth by end Apr <100cm = 25% coverage = 12.5% shading.
- Growth by end May <125cm = 31.25% coverage = 15.63% shading.
- Growth by end Jun <10cm (harvested) = 2.5% coverage = 1.25% shading.
- Growth by end Jul <50cm (regrowth) = 12.5% coverage = 6.25% shading.
- Growth by end Aug <10cm (coppiced) = 2.5% coverage = 1.25% shading.
- Plants naturally stop growing and produce sporophylls (fruiting bodies).

With these assumptions we estimate the maximum shading around the end of May, after which harvesting will reduce the plant lengths. The conservatively high figure of ~15% shading at this point should pose no lasting detrimental effect to the benthic communities of the seafloor, 20m to 30m below the seaweed cultivation lines.

The vast volume of water that moves through any given spot in Loch Sunart will make any effects from shading on the water column negligible.

Deposition of Accumulations of Seaweed Fragments

Brown kelp plants are robust and at point of harvest almost all plants still have their narrow pointed tips. We thus conclude that there is a negligible loss of plant material over the growing season. Photographic evidence of intact plants at harvest has been gathered and reviewed by AquaMoor over the last 2 years of seaweed farming operations.

During recent 2020 harvesting operations by AquaMoor, where 600 kg (wet weight) of *Alaria* was cut on a regular basis, the offcuts and discards from the operation were swept up and estimated to be less than 3kg (wet weight) of plant material. This equates to ~0.5% of waste of harvest weight. We offer that this is a negligible amount of plant material to drift into the wider system and rot away as vast amounts of other wild seaweeds do.

A process for the disposal of fouled, harvested material will be developed for the disposal of seaweeds that fail our strict quality control procedure during our factory processing. If necessary a suitable license will be sought to give consent for the seaweed to be disposed on land as agricultural composting.

Any Risk of Enhanced Sedimentation due to Alterations in Water Flow and the Potential for Physical Impacts to Arise as a Result of the Placement of Moorings

As with the issue of benthic shading, this topic has received an undue amount of attention. The sites for these seaweed reefs are deliberately chosen for their active nature, both in current and wave

exposure. Given the relative mass of the lines and supports of the seaweed reefs and the natural hydrodynamic nature of the brown kelps we intend to grow, we are confident that there will be no alteration to the water flow at our sites. It should be noted that the scale of cultivation that would be necessary to have any meaningful impact on sediment carrying capacity are of an order of magnitude not seen outside of Asia.

As the seaweed cultivation process does not require any inputs of feed or chemical to sustain or nurture the plants, we do not foresee our activities to add to the sedimentation of the area.

Any Operations Required for the Establishment and Subsequent Maintenance of the Development Site

This is an area for speculation, but we will consider worst case scenarios;

- The establishment of the seaweed farm is estimated to be no more than 1 (working) week of boat time on station.
- Deploying of seaweed lines is estimated to be no more than 2 (working) weeks of boat time on station.
- Harvesting of seaweed lines is estimated to be no more than 4 (working) weeks of boat time on station.
- Plant husbandry, monitoring and sampling will be done regularly by rib or small craft, estimated at fortnightly.
- Maintenance of the seaweed farm infrastructure will be contracted to a specialist company, will not require divers and support vessel and will likely be bi-annual, a day each time for each farm.
- The level at which more mature plants will require husbandry over time is unknown but will depend upon the farming practices employed such as coppicing or partial cutting.

The Seaweed farm will be sited away from the shoreline and the Rocky Reefs along it and as such the vessel movements during the phases above should pose no greater disturbance during construction of operational phases than any other vessel movement along this coast.

Marine Protected Area (MPA)

The development site lies within the Loch Sunart to the Sound of Jura MPA. However, due to its scale, it is not considered that this development will have any significant impact on the site.

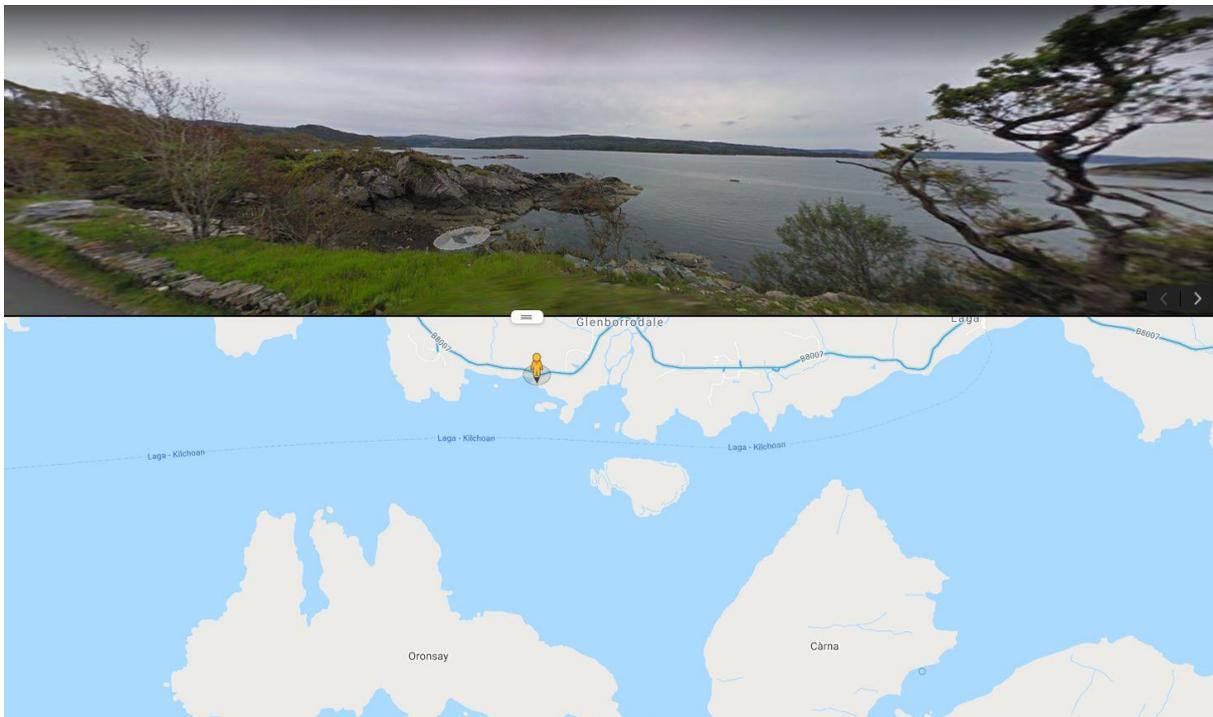
Seascape Impact

The proposed AquaMoor cultivation system has been successfully operated since 2018 with no adverse landscape or seascape impacts being reported from these developments.

GreenSea Solutions respects the duty of SNH (and other competent authorities eg SEPA) to be satisfied that a project will not have a 'likely significant effect' on a Natura Site (in this case an MPA). The site chosen for a seaweed farm is not visible from roads or core paths. It is very remote and away from normal public view. This was a consideration when choosing them so to prevent public distress.



This is a hiker's view of the proposed East of Oronsay site from the neighbouring island of Carna, at a distance of 1.5km and at an altitude of over 140m. If you look carefully you can discern two yellow dots that have been added to the image to represent the Navigation marks required for the site. Due to the limitations of software editing these dots are approximately 3 times the actual size.



This is the only view of the proposed East of Oronsay site from the closest location of the B8007 which at this point is 1.5km to the north. The vast majority of this road runs through woodland and no seascape is visible from it.

The proposed AquaMoor cultivation system works on a far smaller anchor footprint than a conventional drag anchor and chain mooring, lessening the effects of anchor lines on the seabed. The structure of the Seaweed Farm itself is subsurface. This means that all that will be seen on the surface is the grey floats on each corner of each square, shared as the corner of the adjacent square, to form a grid. In the case here 3 floats 50m each apart (100m across). As seaweed is neutrally buoyant the farm structure will utilise 200-300L volume floats.



As an example, this is a view of a seaweed farm in Kerrera Sound that was designed and installed by AquaMoor in 2018 and is currently operated by AquaMoor. The farm is to the left of the navigation mark ahead of the vessel. The image is taken from approximately 0.6km away, which is 33% of the distance from the B807 to the proposed East of Oronsay site.

As can be seen, not to be flippant, much of the west coast looks very similar. This image could be of the site at Oronsay East and it is unlikely anyone would be able to tell, which site was which.

We have demonstrated that the floats will be very hard to see from any distance beyond 1km without binoculars or zoom cameras. The background shoreline and land is similar at both Gallanach (above) and Oronsay with rough grass/heath with rocky outcrops and are used for grazing of sheep. There are no paths along the coastline at any of the sites.

The most obvious visible thing about the sites will be the special marks for the safety of marine navigation, which will be insisted upon by Northern Lighthouse Board as they are at every aquaculture site in Scotland.

EPS and Breeding Birds

GreenSea Solutions have considered that disturbance to otters (EPS) and breeding birds may be an issue during the construction and operation of the site. This Method Statement submitted with the application takes into account these concerns.

Otters (EPS)

Otters are regularly seen on in most parts of the Lochaber and Argyll coast, including in busy towns such as Oban (see photo below). They can be remarkably tolerant of people, vehicle and vessel movements.



Otter eating fish from fishing boat net in Oban Harbour, watched by dozens of tourists.

Otters are European Protected Species (EPS) and as such have legal protection from harm, disturbance and habitat interference. Nothing in the development or operational phases of the Seaweed Farms will constitute a threat to the life of an otter. Nor will any part of our operation touch land to damage or destroy their holts or holes. What we must look at is whether our activities would constitute a disturbance to otter in their hunting or breeding patterns.

The discussion on potential sources of disturbance can be split into 3 parts;

1/ development phase disturbance

Our development phase at each site will last only (est) a week. It will require a 10m to 20m vessel to lay the advanced anchors into the seabed 100m plus from the shoreline. Cables will then be strung between the anchor lines and floats attached.

SNH guidance suggests that “if otters are known or suspected to be breeding, the exclusion zone should normally be at least 200m radius. However, it could be reduced to 100m depending on the nature of the works, topography and natural screening. For shelters, or holts where otters are not breeding, the boundary of the exclusion zone should be a minimum of 30m.”

These exclusions zones are nominally looking at physical changes to the land near otters. As the Seaweed farm will be sited off from the coastline and will not physically touch or alter the holt or hole of any otter, we would hope that the 100m rule would apply as a maximum. It could be argued that the most direct disturbance to the otters could be the presence of any surveyor conducting an survey on the shoreline.

A male otter's territory can be huge, using 20 km of rivers and coastline to hunt and defend up to 3 females against intrusion by other males. The female otters form sub-territories within, in which they produce up to 3 cubs, usually in early summer. The mother will rarely leave them for the first 10 weeks from birth at which point the cubs will begin to become mobile. They will then follow their mother as she hunts and suckles the young. She will use multiple holts and holes to dry off (otters don't like being wet!) and to sleep (which they do for more than half the day). They will nurture the cubs for a year up to 18 months to teach them to fish by catching and releasing live fish for the cubs to re-catch.

It is very difficult (without the aid of photo traps) to assess whether otter shelters or holts are being used by a breeding otter or not as females with cubs reduce sprinting to avoid detection. Indeed, it is a crime to do so, without appropriate licenses.

No works that are proposed will fall within the minimum 30m exclusion zone. Indeed the minimum distance from the high water mark at all the sites appears to be around (est) 100m to avoid encroaching into Rocky Reefs.

The predicted timing of the installation of the Seaweed Farm later in the year will coincide with any otter cubs becoming fully mobile.

2/ operational phase disturbance

All operations will take place in daylight. Deployment periods will be October to November. Harvesting periods will be in April through into May. The mainly nocturnal nature of otters will hopefully allow us to present no disturbance to feeding patterns.

3/ ongoing presence and its effects

For the greater part, the Seaweed farm will be left unattended by vessels. Outwith the operational phases (including all evenings, nights and weekends during the operational phases) little or no activity will take place over the months of June, July, August or September (aka the summer fallow period) and after the October/November deployment, the Seaweed farm will be left unattended in December, January, February and March (aka the winter slow growing period).

A brief diurnal phase of otter feeding during the shortest days of the year will coincide with the winter slow growing period, where the Seaweed farm left mostly unattended save for occasional visits by rib to check condition of the Seaweed farm structure (a condition of consent) and to take samples of the seaweed for quality and growth monitoring. We will ensure we do not visit the sites near to dawn or dusk to prevent disturbance to otter feeding times during the hard winter months. Similarly, the summer fallow period will see the Seaweed farm left mostly unattended save for occasional visits by rib to check condition of the Seaweed farm structure (a condition of consent).

Shorelines of proposed Seaweed Reefs

Some of the coastline rises sheer from the water and as such would be too dangerous to land. These sections of coast, would by their nature not be suitable for otters either.

The land directly behind the shore on this coast rise sharply as "raised beach" formations due to isostatic uplift. This creates a secondary sea cliff visual barrier between the shoreline and inland sites. This may present additional danger to anyone trying to cross the site. These areas, with their rock strewn scree surfaces may, along with the rocky coastline, provide suitable holes and caves that otter could use as holts and shelters.

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Breeding Birds

GreenSea Solutions have considered that the development and operation of the proposed Seaweed farm may cause disturbance to priority bird species (Wildlife & Countryside Act 1981 (as amended in Scotland) Schedule 1, <https://www.nature.scot/sites/default/files/B469673%20-%20Protected%20species%20list%20-%20WCA%20schedules%201A%2C%20A1%20%26%201-4.pdf>).

It is unlikely that any priority bird species which breed in Scotland will nest in the areas where the Seaweed farm is being sited. There are some cliffs and rocky ledges nearby the proposed site that will be used as nesting sites for seabirds.

Wildlife & Countryside Act 1981 makes it illegal to intentionally or, in Scotland and Northern Ireland, recklessly injure or kill any wild bird or damage or destroy an active nest or its contents. This is fairly clear and we can assure that none of our operations will interfere with the nest sites and our Seaweed farms will be a minimum of 100m away from the coastline nest sites.

The law on disturbance of non-schedule 1 birds is not so clear.

The “Scottish Marine Wildlife Watching Code” and the more detailed “Guide to Best Practice for Watching Marine Wildlife”, produced by SNH and are described by them as “a concise code of conduct... of broad Principles.. On the coast, On the sea, and In the sea... this guidance applies equally to everyone”. These state that no legislation provides an actual safe distance from breeding birds but rough advice suggests from 50-150 metres and up to 300 metres for very sensitive species (such as terns, which do not nest near the proposed site).

The waters around Lochaber and Argyll are regularly crossed by commercial and pleasure vessels of all sizes and power methods. With the ever increasing number of vessels and people who venture out on the water it is difficult to say where near Tobermory or in Loch Sunart any site can be considered isolated. Many seabirds are accustomed to the presence of humans and live in harmony with us. Inaccessible cliffs of seabird colonies give added security to nesting seabirds with the closest of these to the proposed farm site being in the nearby Sound of Mull.

There is anecdotal evidence that suggests even the most sensitive species of bird and other animal, can become very tolerant, even cohabiting with humans eg common terns mating in the rigging of fishfarm boats, otters feeding on fishing boats in busy harbours and otters sunbathing in waterside gardens, oblivious to human presence.

The proposed Seaweed farm will be sited away from the shoreline (est 100m) which will place them even further from cliff nest sites of the breeding seabirds of the area.

The Wildlife and Countryside Act 1981 (as amended) also states in Bylaw 37 (3a+b) that there can be no restriction of passage of a vessel through a marine nature reserve (MPA).

Since the marked outer areas of the proposed Seaweed farm will extend an area of exclusion to all shipping (except our vessels) to nearly 1km it could be argued that the Seaweed Reefs existence will enhance the protection of nesting seabird colonies from disturbance from commercial and pleasure vessels for the greater part of the year.