Firth of Clyde Regulating Order Application

Prepared by the Sustainable Inshore Fisheries Trust (SIFT)

This Regulating Order application was submitted to Scottish Government on 15 October 2015

Sustainable Inshore Fisheries Trust

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Sustainable Inshore Fisheries Trust

The Sustainable Inshore Fisheries Trust (SIFT) is a Scottish charity (Registered Scottish Charity Number SC042334, Scottish Charitable Company Limited by Guarantee Number 399582) which promotes the management of Scotland's inshore waters so that they provide the maximum long term social and economic benefits to Scotland's coastal communities. Although SIFT's aims are socio-economic, it places importance on restoring the diversity and health of natural ecosystems: healthier seas support more jobs. For more information go to www.SIFT-uk.org.

The Clyde Regulating Order Application

This document sets out an application to establish a regulated fishery in the Firth of Clyde, an area of inshore waters extending landward to Mean Low Water Springs lying north of a boundary line between The Mull of Kintyre (55°18.626°N and 005° 48.208'W) and Corsewall Point (55° 00.429'N and 005° 09.564'W). Figure 1 indicates the area to which the application refers.

The application is being made for a Regulating Order ('RO'), a legal instrument created under the Sea Fisheries (Shellfish) Act 1967 ('The Act') which confers on a grantee the right to regulate the taking of a prescribed species of shellfish in a defined area of inshore waters for a prescribed time. In this case, an application is being made to regulate *Nephrops* (*Nephrops norvegicus*), king scallop (*Pecten maximus*) and queen scallop (*Aequepecten opercularis*) for an initial period of 10 years. It is anticipated that if the grantee deems it appropriate, a subsequent 10 year period may be applied for at the end of the initial period.

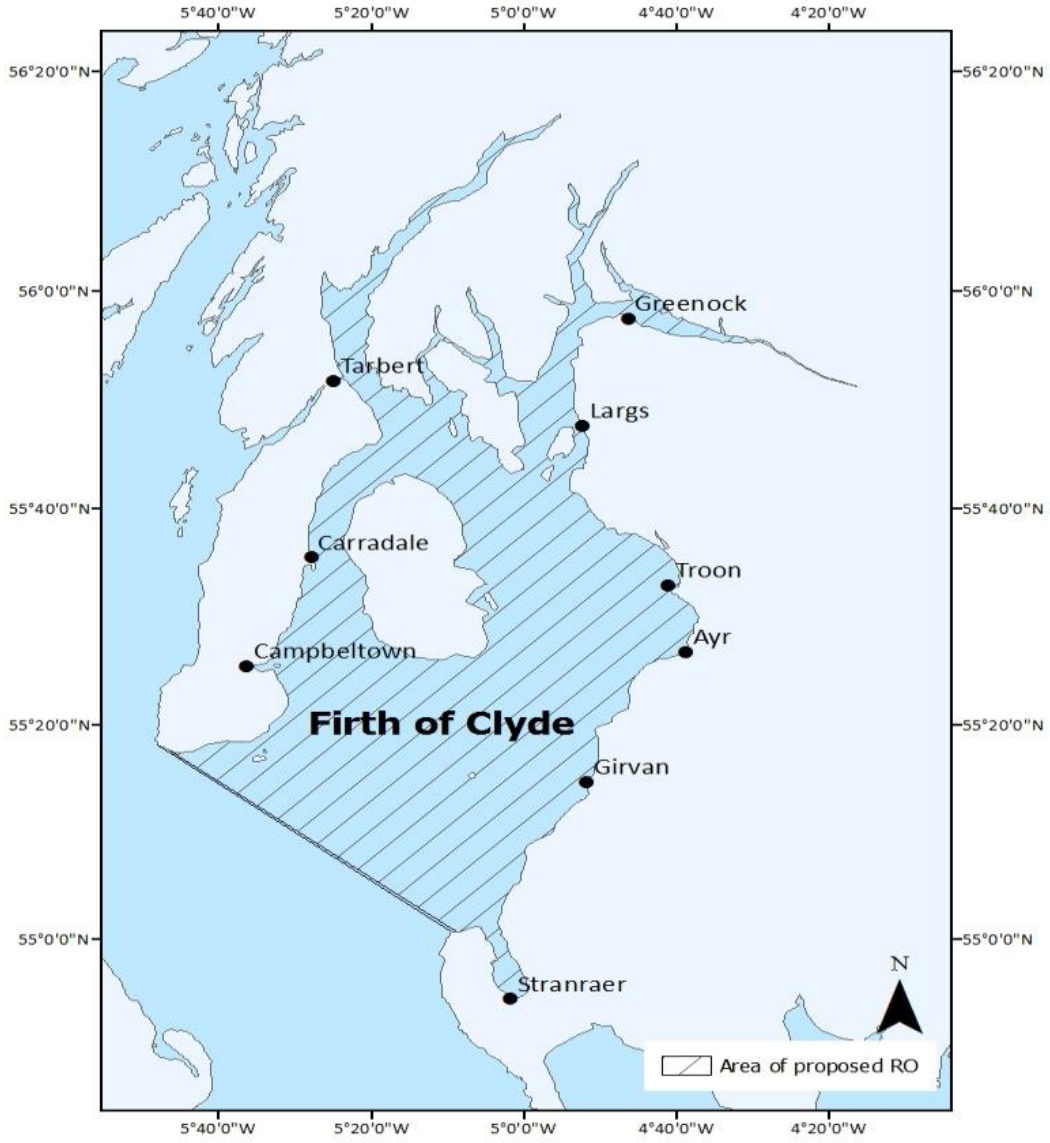


Figure 1|The geographical extent of the proposed Clyde Regulating Order

Executive Summary

Background

This Regulating Order application aims to transform the way that the Firth of Clyde ('the Clyde'), one of the UK's most altered fisheries, can be managed. What was once a diverse fishery is now a shellfish fishery. Overfishing and the widespread use of damaging mobile fishing gears - particularly seabed trawls and dredges - have been widely accepted as the primary causes of the collapse of the Clyde's finfish population. The core element of the proposal is to change the current fishing pattern so that, while mobile fishing continues to be allowed in the great majority of the Clyde, it will be restricted in certain areas, which will either become available for creeling and diving, or would be closed to all fishing. This will protect the seabed, which will provide refuges for shellfish, finfish and other biodiversity, thereby enabling the fishery to become both more productive and diversified.

The Clyde is surrounded by communities which would benefit from a more diversified fishery and a healthier marine ecosystem. SIFT's economic analysis is that the Clyde could then support hundreds more jobs than it currently does. These jobs would also be more secure if the fishery was more diversified.

The proposal also aims to promote equity; it will manage the Clyde in the interests of all stakeholders including recreational sea anglers, wildlife tourism operators, boat charter companies, hotel owners, scientists, divers and environmentalists as well as commercial fishermen. In contrast, current fisheries management policy appears to largely favour the mobile gear fishing fleet as opposed to other sectors.

The proposal will inevitably meet with resistance from this sector. It has a powerful voice, in part because other sectors have declined along with the Clyde's ecosystem. However, the resistance is ill informed: the proposals to restrict the grounds available for shellfish dredging and trawling would actually enhance the shellfish fishery. It would allow breeding and growth which would enrich the surrounding grounds more than any loss arising from the restrictions on grounds. Such spatial measures have been seen to work in other fisheries. Rather than bringing about the demise of the fishery as some opponents have suggested, this proposal presents the only viable option to not only stop the fishery's decline, but enhance it into the future.

The proposal will assist the Scottish Government meet international and national targets regarding good environmental status and sustainable development as outlined below. The Clyde would currently fail to meet the Large Fish Indicator standards. Its scallop fishery is not subject to stock assessments. The proposals would remedy such failures. Furthermore, the proposed measures have been designed so that they can complement existing spatial management measures including Marine Protected Areas.

1. Aim

This document sets out the application by the Sustainable Inshore Fisheries Trust to establish a regulated fishery in the Clyde. The application is made for a Regulating Order, under the Sea Fisheries (Shellfish) Act 1967, which would grant powers to a newly created non-profit organisation, the Clyde

Shellfisheries Management Organisation (CSMO), to regulate the fishing for *Nephrops* and scallops, for an initial ten year period. The proposed RO has an overarching aim:

- To increase the productivity and resilience of the commercial shellfish fisheries;

In addition, a vitally important benefit of the proposal will be to:

- Promote the recovery of the wider ecosystem including finfish stocks to commercially exploitable levels.

2. The Clyde

In this application, the Clyde is deemed to be the area of tidal marine water up to Mean Low Water Springs north of a closing line extending from the Mull of Kintyre to Corsewall Point on the Ayrshire coast: an area of some 3600km^2. The Clyde is fjordic, with long sea-lochs (such as Lochs Fyne and Long) to the north and a wider and in parts deeper basin around the central and southerly waters around the island of Arran. Being largely landlocked and in receipt of large amounts of freshwater from a number of rivers, the Clyde is of lower salinity and experiences weaker tidal currents than neighbouring sea areas. It has a predominantly sedimentary substrate.

3. The Fishery

The Clyde has been a historically important commercial and recreational fishery producing landings of numerous finfish and shellfish species. However, from the 1970s stocks of commercially marketable finfish declined rapidly so that by the early 2000s it had effectively become a shellfish fishery. This situation remains: by 2014, 99% of the landings were shellfish, of which 89% were *Nephrops* and scallops. The fishery now depends upon these species for its survival.

The *Nephrops* stock has generally been classified as 'exploited above Maximum Sustainable Yield' in recent years, and latest International Council for the Exploration of the Sea (ICES) advice for the *Nephrops* fishery is that landings should be reduced in 2015 by 33% on the level in 2014. The scallop stocks have not been formally assessed, so the long-term health of this fishery is unknown - although analysis of the age size structure of scallops from the Clyde indicates that the stock is very heavily exploited.

Basing a fishery on these few species, both of which appear to be unsustainably exploited, is not compatible with good long term management practice. A diversified fishery would be more resilient. Fortunately, the recovery of the Clyde ecosystem, and hence the commercial and recreational fishery is plausible. The Clyde is not so much a desert as a resource needing restoration.

4. Decline of the fishery

Numerous reasons have been given for the decline of the Clyde fishery. Some are unsubstantiated (for example radioactive fallout from the Ukrainian nuclear accident at Chernobyl in 1986). More plausible explanations relate to changes in anthropogenic nutrient levels, seal predation and sea temperature rises. Each of these can have an impact upon marine ecosystem health; however, there is no evidence to demonstrate that they caused the declines seen in commercial finfish stocks across the Clyde from the 1970s.

Instead, the generally accepted explanation for the decline in commercial finfish stocks is the failure of fishery management including the inappropriate use of some commercial fishing gears. In

particular, there were unsustainable levels of harvesting in the 1970s and 1980s compounded by the lifting of the long-standing restriction on the use of towed gears within 3 miles of the coast in 1984. Thereafter, a large proportion of the Clyde, which had previously been protected from the damaging effects of heavy gears on the seabed, was opened up to commercial activity.

5. Future threats

The Clyde fishery now faces new threats from disease, ocean warming, ocean acidification and pollution. More specifically, the *Nephrops* stock is infected with the *Hematodinium* dinoflagellate which can diminish the quality of the meat, rendering it unsellable. The parasite species which precipitated the collapse of the Icelandic scallop fishery has also recently been found in the Scottish scallop stock. Ocean warming and acidification, both of which are occurring in the Clyde, are known to impact fishing by altering fish community structures, enhance sensitivity to stress, and impact adversely on the ability to form shells. Given the fishery's lack of resilience because of its dependence upon *Nephrops* and scallops, these threats reinforce the urgent need for management measures that will promote diversity of target species.

6. Calls for change

Concerns about the decline of the Clyde's fisheries, as well its wider ecosystem health, and the impact these declines have on the socio-economic well-being of its coastal settlements, have been voiced by a wide array of stakeholders.

Calls for change have come from within the fishery – largely from the static gear sector, which despite producing iconic products, has been marginalised by current fishery management measures. Calls have also come from community groups and from special interest groups like Recreational Sea Anglers and environmental NGOs concerned about the damage done to the seabed in their neighbouring waters. Inevitably, these groups call for different solutions; however, there is a broad consensus that:

- In recent decades the Clyde has not been managed for the benefit of all stakeholders;
- The mobile sector has enjoyed relatively unrestricted access to the Clyde;
- There needs to be a return to greater use of spatial management of the fishery.

Importantly there is a widespread but less articulated concern about the state of the Clyde amongst the general public who live around its shores. SIFT conducted a campaign in 2014 which captured this concern. In response, over 7,000 individuals have signed up to a Clyde Charter which called for a revival of the marine environment and a more diverse fishery.

Recognition of the need for change has also come from the scientific community, which has noted, inter alia, that the Clyde would fail to meet EU requirements on biodiversity health and the 'Large Fish Indicator'.

The Scottish Government has also recognised that change is necessary. It has established the 'Clyde 2020' initiative which aims to bring about scientific research and practical measures to improve the Clyde. It also noted in June 2015 in the context of a proposed MPA for South Arran that '*there is not sufficient protection in place to ensure that the marine environment is properly protected and complex ecosystems safeguarded'.*

SIFT believes that this RO application, whilst not endorsed by all stakeholders, proposes the only workable solution to these calls for change. No other solution has been proposed which could balance the interests of all stakeholders.

7. Current fisheries management

Current marine management in the Clyde fisheries includes both spatial and technical measures. A number of these measures are for fisheries management purposes, others are nature conservation or wider marine planning designations.

The current spatial management restrictions on the Clyde have been implemented on a case-by-case basis. Where spatial restrictions have been implemented for fisheries management purposes there is a lack of monitoring and research to determine effectiveness.

For the Clyde *Nephrops* fleet, effort and technical restrictions are in place. These restrictions mainly affect the *Nephrops* trawl fleet. The *Nephrops* creel fleet is less restricted. Some technical measures for the king scallop fleet are extant, although no quota or overall effort restrictions are in place.

Current fisheries management does not adequately meet the needs of the fisheries or the wider Clyde ecosystem.

8. Regulating Orders

SIFT believes that a well-designed RO, incorporating local stakeholders, is the best instrument for managing the Clyde fishery.

Regulating Orders are legal instruments that grant the right to a 'grantee' to manage a shellfish fishery in a given area for a specified duration. The grantee is entitled to issue licences, charge levies and enforce the fishery's rules. The grantee can be a private entity comprised of local stakeholders. Accordingly, it can manage the fishery for the benefit of local communities, and – not having to await central government approval – can make rapid decisions in the interests of good management. The grantee must work to a Management Plan; this ensures that exploitation rates and sustainability are intrinsic.

9. Developing the Management Measures

The management measures proposed under the RO have been developed by SIFT with extensive advice from stakeholders, fishery management experts from UK academic institutions and from the Environmental Defense Fund. Case studies, publications and consultations have also informed the choice of measures. These information sources have focused on both spatial management and technical measures.

10. The Management Plan

The management measures proposed in the application only apply to the *Nephrops* and scallop fisheries - the species that underpin the existing Clyde fishery. No other fisheries would be managed by the RO, however, SIFT believes that by managing these fisheries sustainably, all other fisheries and the wider ecosystem can benefit.

The RO proposes to manage the entire area of the Clyde; this is an ecologically coherent scale to operate on, which lends itself to the ecosystem approach to management and is pragmatic.

The proposed duration of the RO is ten years, with a further ten year application thereafter. This timescale would ensure that there is adequate time to allow ecological recovery arising from the management measures to take effect.

Management measures would be introduced under a Strategic Management Plan (SMP), Annual Management Plans (AMPs), and on an ad hoc basis. The SMP will guide the content of AMPs and ad hoc measures in order to ensure that the RO's overarching aim and benefits are achieved. The measures will be either spatial or technical. The spatial management measures lie at the core of the proposal.

Spatial measures

Spatial measures, developed in collaboration with a wide range of experts and stakeholders, will form the core of the management measures in the SMP. The measures centre on Spatial Management Zones (SMZs) intended to protect the seabed substrates and habitats for the benefit of fish and wider ecosystem recovery. It is proposed that seventeen SMZs are designated covering an area of c.1.016km^2, equating to 28% of the Clyde.

- Six of these areas will be Creel and Dive Only - covering an area of c.439km^2 (12%);
- Ten of these areas will be Restoration Areas (closed to all *Nephrops* and scallop fishing) - covering an area of 297km^2 (8%);
- A South Arran SMZ (in the area of the South Arran MPA) would be comprised of three zones; Creel and Dive Only (165km^2), Trawl, Creel and Dive Only (107km^2) and Restoration Area (8km^2).

The remainder of the Clyde, covering an area of 2,584km^2 (72%) will be a multi-use area open to all commercial fisheries regulated by the RO.

The 17 SMZs aim to meet six core Design Objectives (1. Promoting *Nephrops* fishery sustainability, 2. Promoting scallop fishery sustainability, 3. Promoting finfish recovery, 4. Minimising impacts on the fishing industry, 5. Minimising user conflicts and 6. Conserving biodiversity and promoting ecosystem resilience).

The SMZs must form a coherent network if they are to achieve the RO's aim and intended benefits. In order to ensure this, six network Design Considerations were taken into account in their design. These include: the network of SMZs must be geographically dispersed around the Clyde, the total area protected from mobile fishing gear must be between 20-30% of sea area, and crucially, the boundaries of the SMZs are determined by substrate and habitat types. SIFT believes that without this network coherence the overarching aim and intended benefits of the RO will not be met.

Technical measures

A range of technical measures are also proposed under the SMP. As a consequence of the impending introduction of the Landings Obligation under the Common Fisheries Policy, which is expected to mandate technical changes to the *Nephrops* fishery, the only technical measure to be proposed is a limit on *Nephrops* creel numbers. The bulk of the proposed technical measures relate to the scallop fishery, including reducing the number of dredges used in the Clyde, phased increases in Minimum Landing Sizes for scallops, restrictions on bar lengths and nocturnal curfews.

11. Benefits

The RO has been designed to benefit the fishing industry and the wider community. Key benefits include:

Fishing industry Benefits

The RO proposals provide the following benefits to the fishing industry:

- Expected **increases in *Nephrops*** populations arising from higher recruitment and spillover from certain SMZs;
- Expected **increases in scallop populations** arising from higher recruitment and spillover from certain SMZs. These should **benefit the dredging sector** more than it would lose from the reduction in the size of the dredging grounds. The **scallop diving industry would also benefit** from increased stocks and from being able to operate independent of interaction with the dredging sector;
- Whilst there will be short term costs on the trawling sector, it is expected that these will be less than the natural fluctuations that frequently already occur from one year to the next. This is because most of the proposed SMZs are not intensively trawled. In contrast, the **creeling sector will benefit from having more zones where it could operate without any interaction with the trawl fishery**. SIFT's economic evaluation predicts that **over a 20 year period the gains in the *Nephrops* fishery will exceed losses**. Nevertheless, compensation for some vessels incurring short term losses may be appropriate. SIFT believes this should be assessed on a case-by-case basis in line with previous fisheries compensation payments.
- Evidence from the Lamlash Bay NTZ on Arran indicates that recovery and spillover effects can occur in spatially managed protected zones in the Clyde. Accordingly it is expected that **stock enhancement benefits will occur in the crab and lobster fisheries**;
- The proposed spatial and time restriction measures will keep gear types apart. This will help to **reduce gear conflict**;
- Closed areas of the type proposed under the RO assist the recovery of habitats and substrates that support the spawning and early life history stages, and hence **increase the recruitment of commercial finfish species** such as cod;
- The mandatory nature of the RO proposals is expected to **overcome some of the shortcomings of voluntary agreements and ensure fair access for all fishing sectors.**

Public Policy objectives

The RO is designed to support public policy objectives, accordingly the RO proposals:

- Are **consistent with the Scottish Government's ambition to increase sustainable economic growth**;
- **Are consistent with the Scottish Government's 2015 Inshore Fisheries Strategy.**
- Will **help bring the fisheries into line with the wider objectives of the revised EU Common Fisheries Policy**, particularly regarding the obligation to have "**action plans for the development, competitiveness and sustainability of small scale coastal fishing**";
- Align with the **Marine Strategy Framework Directive's** objective to **promote an ecosystem approach to marine management as a means of achieving Good Environmental Status by 2020;**

- Will assist the Clyde fishery **conform with the objectives of Scotland's National Marine Plan** (which endorses the "ecosystem-based management of inshore fisheries at local level, on the basis of participative management with interested stakeholders") by providing a **sound basis for fisheries management aligned with the Scottish Marine Regions;**
- **Integrate with and complement the Marine Protected Areas conservation objectives;**
- **Complement other existing protected area designations** including the three Marine Conservation Orders to the south of Arran, the Lamlash Bay No-Take Zone, two Special Areas of Conservation and some existing voluntary fishery management measures;
- Could form the basis of a wider fisheries action plan, incorporating sound science, which will **contribute to the delivery of fishery management proposals for the Clyde under the Clyde 2020 initiative**.

Wider socio-economic benefits

The RO proposals will provide wider socio-economic benefits:

- By restoring a mixed fishery, the RO will **enable the Clyde to regain its former status as one of Scotland's most productive recreational sea angling waters,** bringing employment and income as well as health, well-being, personal development and community benefits;
- By reviving the health of the marine ecosystem, the proposals will **enhance the conditions for the expansion of the wildlife tourism industry** within the Clyde;
- By helping to preserve wrecks, reduce disturbance of sea floor sediments and promote biodiversity, all of which **will increase the potential for recreational diving**.

Ecosystem benefits

The RO proposal's anticipated beneficial impact on biodiversity are expected to:

- Have **positive effects on the delivery of ecosystem services**. These services, in addition to the fishery oriented food-web benefits, may range from nutrient cycling to scenery benefits;
- Protect and enhance ecosystem elements and so **improve the overall ecosystem resilience**.

Public interest

The RO is the only proposal that recognises the Clyde fishery as a public resource and the proposal sets out how the public can take more interest in, and benefit from, the management of that resource. **The Clyde fishery is a public resource. It is owned by the people of Scotland, and should be managed for the common good.**

12. Economic Impact Report

An economic assessment of the impacts of the RO proposals ('policy on') over a 20 year period (to reflect the initial ten year application plus a subsequent ten year extension) was undertaken and compared to a projection of the existing fishery management regime in the Clyde ('policy off'[1]). The assessment supports the following conclusions:

[1] The defining aspect of the 'policy off' option is that the current de facto allocation of *Nephrops* between creelers and trawlers would not be changed.

- In quantitative terms, introducing the policy will have a positive overall effect on the commercial fishery of the Clyde Sea. Over the 20 year period of the appraisal, introduction of the RO (compared to 'policy off') is expected to produce:
    - Additional monetised benefits to commercial fishing equivalent to £2.5m NPV;
    - 1,000 fewer tonnes of *Nephrops* landed from trawl;
    - 1,000 more tonnes of *Nephrops* landed from creel;
    - 3,800 additional tonnes of scallops landed;
    - 35,000 additional tonnes of finfish landed;
    - Up to 134 new fishing jobs, if standard industry ratios of turnover/job are applied, and if new workload is converted into new FTE jobs (in addition to the existing approximately 250 supported by the existing fishery).
- A small negative impact on the revenues of the *Nephrops* trawl sector, estimated at around £2m (undiscounted) over the whole 20 year period (i.e. a fall of about 1%), and a larger positive impact on the revenues of the *Nephrops* creel sector, estimated at around £8.5m (undiscounted) over the 20 year period (i.e. a rise of over 25%);
- Spatial management of trawling within the *Nephrops* sector and dredging within the scallop sector is expected to promote a short to medium term recovery in biodiversity, creating additional finfish stocks, which will support new commercial fishing activities. Such activities will result in an estimated £2.7m worth of benefits to the commercial fishing sector in NPV terms.
- *Nephrops* trawlers, if able to adapt to the changing fisheries environment, may therefore be able to mitigate any losses and/or reduce their dependency on a single species by fishing for a wider range of species, including cod, saithe, whiting and haddock;
- The improved biodiversity and environmental prospects for the Clyde (as evidenced by the recovery of some finfish species and the wider ecosystem), will in turn have beneficial economic impacts through tourism, driven by increased recreational sea angling and (to a lesser extent) diving opportunities;
- Additional expenditure from angling visits generated under 'policy on' is expected to begin in year four with some £3.5m of net additional spend per annum being generated, forecast to rise to £7.5m pa in year 13, and remain at that level thereafter. This level of expenditure will support an additional 60 -130 jobs in the region, compared to 'policy off';
- In addition, a one-off Willingness to Pay figure of £11.6m has been estimated in respect of 'policy on', reflecting improvements in environmental habitat and biodiversity.

Current management measures have failed to halt declines of stocks. The proposed solution using specific areas for *Nephrops* trawling and scallop dredging, would better manage these fisheries and provide the catalyst for the return of a commercial viable finfish population; and in doing so, increase employment, create value and build resilience in the local fishing fleet.

13. Governance

It is proposed that the grantee of the RO will be a new non-profit making company called the Clyde Shellfisheries Management Organisation (CSMO). It will be responsible for management of the RO, including the issuing of licences, the setting of measures and monitoring. In order to ensure that it represents all stakeholders in the fishery and to reflect the fact that the fishery is a public asset the

CSMO Board will be composed of representatives from a range of sectors. Half will be fishermen (split between mobile gear and static gear sectors to reflect their equal right to operate) and the remainder will be from community groups, NGOs and government bodies. The CSMO will have a small executive team to deliver the board's strategy.

The CSMO will be advised on scientific matters by a newly established Clyde Scientific Trust (CST) that will commission, undertake and publish scientific study that supports the management of the Clyde. The CST, which will apply to be a Scottish Charitable Incorporated Organisation, aims to draw on the expertise of the marine science community to provide this advice. In so doing it will ensure that fishery management decisions are based upon the best science available and will also foster improved collaboration between the fishing industry and fisheries scientists. It is intended that, although initially focused on the fishery, the CST would be constituted to have a wider remit than fisheries, so that in due course it could provide advice on a range of scientific issues associated with the management of the Clyde.

Draft business plans for the CSMO and the CST have been developed. These will be finalised following the formal consultation process. Funding applications will subsequently be made to EU and private sources, with whom preliminary discussions have already been held.

14. Monitoring

Enhancing the monitoring of the fisheries and wider ecosystem of the Clyde is a key objective of this proposal. Monitoring of the Clyde fisheries takes place primarily through catch sampling and stock assessment for the key commercial species. This monitoring is not comprehensive; for example, the Clyde's king scallop fishery, the second largest fishery by value, is not surveyed or assessed.

It is proposed that a bespoke monitoring programme be instigated from the outset of the RO, which will deliver comprehensive stock assessments for the key commercial species, help better identify Clyde ecosystem baselines, and crucially, monitor the impact of the spatial management proposed under the RO. Where possible this monitoring programme will use or build on current monitoring activity. In other instances, it will be necessary to instigate novel monitoring strategies. Overall, the proposed monitoring programme has been designed to provide the CSMO with the necessary data to take informed fisheries management decisions for the both the shorter and longer-term management of the Clyde.

The CST will be responsible for overseeing the delivery of the proposed RO monitoring programme.

15. SIFT stakeholder engagement

Local stakeholders must play a large part in the design of a fishery if they are to ensure its subsequent stewardship. Any group or individual whose livelihood or amenity is impacted by the proposed RO is a stakeholder. Accordingly, SIFT sought to provide information to, and consult with, all stakeholders in order to identify their issues of concern and to integrate their representations into the proposals.

SIFT sought the advice of Marine Scotland and other bodies to identify stakeholders. It then engaged with these stakeholders through bilateral and multilateral meetings, public meetings, presentations, through social media and publications. In excess of 200 meetings were held. In addition to this dialogue, the views of stakeholders were further solicited through SIFT's website.

The engagement process was made complicated by the often mutually exclusive nature of the representations made by different stakeholders. As a consequence, not all representations have been fully accommodated. Nevertheless, numerous representations were received and these have informed the design of the proposals. Furthermore, the difficulties of obtaining of engaging with some stakeholders, means that not all viewpoints have been entirely captured.

Whilst these engagements with stakeholders had a significant impact upon the design of the proposal, it should be noted that they formed only the first, informal, pre-application stage of the consultation process. SIFT looks forward to the opportunity for further engagement during the formal consultation stage of the RO process.

1. Aim of the Clyde Regulating Order

The Regulating Order (RO) has the overarching aim to:

- **Increase the productivity and resilience of the commercial shellfish fisheries.**

In addition, a vitally important benefit of the proposal will be to:

- Promote the recovery of finfish stocks to commercially exploitable levels.

In so doing, the RO intends to achieve the following outcomes over a 20 year period:

- Achieve a positive Net Present Value for the existing commercial shellfish fishery;
- Reduce shellfish dependency and boost resilience in the commercial fishery;
- Provide wider economic benefits such as reviving the recreational sea angling sector.

Important subsidiary benefits include:

- **Greater local control of the fishery**
  The establishment of the RO will enable management powers to rest with local stakeholders. This will encourage stewardship of the fishery and ensure that management decisions are made in the interests of local communities.

- **Greater flexibility for fishery managers**
  The RO will enable rapid decision-making of fishery management issues providing greater flexibility than if management decisions are made by Scottish Government.

- **Enhanced sustainability**
  The RO will ensure that all fishing for the specified shellfish is carried out under a management plan intended to minimise the impact of the fishery on other parts of the ecosystem. This will increase the Clyde's capacity to provide ecosystem services to local communities.

- **Better use of science**
  The proposal will foster better scientific understanding about the Clyde which will enable more informed management.

- **Complement other marine management measures**
  The RO will be designed so that it complements other progressive management measures including Marine Protected Areas and those measures promoted by the Clyde 2020 initiative.

2. The Clyde and its physical characteristics

For the purposes of the proposed Regulating Order, the 'Clyde' describes the area of marine tidal waters up to Mean Low Water Springs north of a closing line extending from the southern tip of the Mull of Kintyre (55°18.626°N and 005° 48.208'W) and Corsewall Point (55° 00.429'N and 005° 09.564'W). In total the Clyde encompasses an area of some 3600km^2 and has a volume of approximately 180km^3 (Scottish Government, 2012).

The Clyde's physical characteristics are summarised below. Please refer to Appendix A for associated charts.

Bathymetry

The Clyde is a large fjordic system separated from the Irish Sea and the North Channel by a broad underwater sill and from the Atlantic by the Mull of Kintyre. The sill (sometimes termed the 'Great Plateau') has an average depth of some 45m, which divides the waters of the North Channel from the Clyde's' 'Arran Basin' where water depths can reach 150m. The Arran Basin exhibits complex bathymetry with both deep channels to the north and relatively shallow shelving areas to the east (Figure A1, Appendix A).

Substrate

The sub-tidal environment of the Clyde is predominantly sedimentary in nature consisting of predominantly fine grained layered muds (Moore, 1931). The large expanses of muds in the deeper water around Arran extend to the deep basins of the upper sea-lochs. Although the substrate is muddy throughout much of the area, there are a wide range of habitats; including sands along the Ayrshire coast and hard ground along the edge of the deep channel in Loch Fyne (Figure A2, Appendix A).

Hydrography

The hydrography of the Clyde is complex and is largely driven by bathymetry. Salinity and temperature distributions described by Craig (1959) and Dooley (1979) point to a front on the Great Plateau which separates the tidally mixed waters of the North Channel from the stratified waters and weak tidal currents of the Clyde.

The maximum velocity of the tidal currents in the Clyde is generally less than 0.5 ms^{-1}. Within the sea lochs, tides are even weaker, attaining about 0.2 ms^{-1}. Water movement is dominated by pressure gradients set up by tide, wind and freshwater outflows. In deeper waters below the sill, dense water settles, flows are blocked, and are dominated by oscillatory internal movements. Bottom water stagnation, some oxygen depletion and nutrient build-up occurs within the lower levels of the sea lochs.

Salinity

The Clyde receives large inputs (up to 700 m^{3}s^{-1}) of freshwater from the River Clyde and other rivers mainly in the north (Poodle, 1986). These freshwater inflows produce a typical fjordic regime with the salinity of the outflow surface water reduced relative to the inflowing waters entering the Clyde over the sill to the south. This surface water tends to maintain a stable stratification which is not seriously eroded by tidal stirring - on account of the generally weak tidal flows (Simpson and Rippeth, 1993) (Figure A3, Appendix A).

Temperature

The temperature of the Clyde, compared to the North Channel, is warmer in the summer and colder in the winter. The shallow waters of the sea lochs and estuaries experience much greater temperature fluctuations; surface ice forms at the heads of some lochs in the winter and a marked thermocline is established during the summer (Connor, 1991). Mean surface temperature varies quite considerably (depending on the season) from 6-14°C (Figure A4, Appendix A).

3. The Clyde's fishery

The Clyde fishery has been an important contributor to the economy of its local communities for many centuries. At its peak the fishery directly employed 1,023 in 1950 (Marine Scotland dataset, 2015a). Its relative importance has tended to be greater around its western shores in Argyll and Bute than in its more populous eastern shores of Ayrshire and Inverclyde.

However, the fishery has declined significantly since the 1950s; in 2014 employment directly in the fishery numbered around 634 (Marine Scotland dataset, 2015a).

The Clyde's formerly world-renowned herring fishery began to decline after the mid-1960s from a landings peak of almost 16000 tonnes in 1960 to recent landings of between 21 - 226 tonnes in the five years to 2013. Since the mid-1970s the remaining finfish fishery has also become less productive and less broadly-based (McIntyre *et al.*, 2012). In 1973, landings peaked with a diverse commercial catch of more than 11,000 tonnes, of saithe, cod, whiting, haddock, hake and plaice. Since then, catches have fallen to the point that by 2013 recorded landings were in the order of a few hundred tonnes.

Figure 2 below sets out the decline in finfish landings and the rise in shellfish landings.

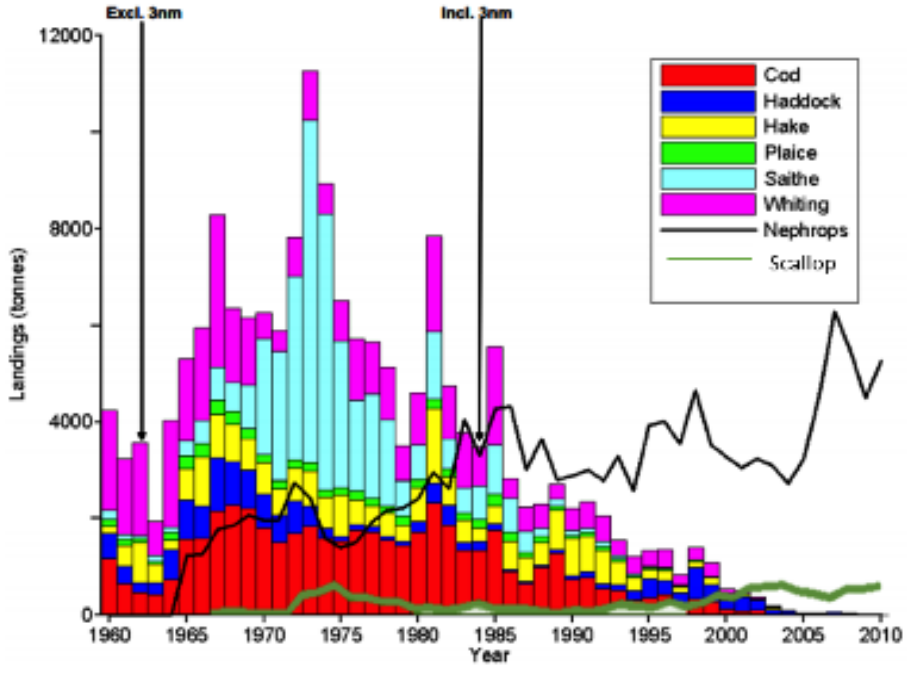


Figure 2 | Clyde landings 1960 - 2010. Adapted from Heath & Spiers (2011).

After the period of peak finfish harvesting in the 1970s and 1980s, some of the commercial finfish species remained. However, there were too few of a commercially marketable size to support a fishery. This situation remains; the Clyde finfish stocks, which are now mainly whiting, are mostly too small to land (McIntyre *et al.*, 2012). In place of finfish, the Clyde fishery now has to rely on shellfish.

In 2014 over 99% of the Clyde's landings were shellfish, 89% of which were scallops and *Nephrops* (Scottish Government dataset, 2015b).

The historic diversity, abundance and quality of near-shore fish species made the Clyde a world-class recreational sea angling (RSA) destination for both shore and boat fishing (Radford *et al*., 2009). Between 1970-1980 the Clyde hosted a variety of local and international RSA competitions including the European Cod Festival, attracting sea anglers from all over the UK. In any weekend, competitions could bring in over £3,000 in1970s money; equivalent to £38,587 in 2015 (Office for National Statistics, 2015), contributing to many aspects of the local economy not directly related to fishing. In the 1970s, 59 charter boats operated in the Upper Clyde alone, and 60 operated in the Lower Clyde (Tony Waas, Pers. Comms, November 2014). Today, with three charter boats remaining the Clyde has suffered a dramatic decline in investment and participation in angling resulting from the poor quality of sea angling available.

The existing fishery

The current stocks

The Clyde's *Nephrops* and scallop stocks form the basis of the remaining fishery. The wellbeing of these critically important shellfish stocks are themselves now subject to question.

The *Nephrops* stock

In recent years ICES has generally classified *Nephrops* stock as 'exploited above Maximum Sustainable Yield' due to fishing mortality and fishing pressure both being above target. The most recent advice from ICES in 2014 states that fishing pressure now meets targets advised by ICES. However, ICES also advises that landings in 2015 should be no more than 3,776 tonnes for the Clyde - which is 33% less than ICES advice for 2014 (ICES Advice, 2014).

The scallop stocks

No formal stock assessments have been made of the Clyde's king or queen scallop stocks (Dobby *et al*., 2012). Instead, these fisheries are monitored by analysis of trends in landings and occasional market-based sampling (Dobby *et al*., 2012). Analysis of the size structure of the king scallop catch indicates it is very heavily exploited: 57% of scallops were under 110mm in 2010/11 (Cappell *et al*., 2013). A study by Howarth *et al*., (2015) found highly significant differences between the size structure of king scallops on Clyde fishing grounds and those in the Lamlash Bay NTZ. There were almost no king scallops larger than 130mm shell length on the fishing grounds compared to a high proportion of that size in the NTZ (Howarth *et al*., 2015). This further illustrates the high exploitation rates.

Potential for Recovery

The Clyde Ecosystem Review (McIntyre *et al.,* 2012), considers the Clyde to be an ecosystem with great potential for future sustainable use. It sees positive trends for the future of the finfish fisheries where the species evenness index is increasing. From 1995 to 2004 just four species made up 95% of the biomass (87% whiting), whereas from 2005 to 2009 this had increased to eight species (72% whiting). Although the biomass of demersal fish species in 2010 has been estimated to be twice that of the

1930s and 40s, 90% of the recently estimated biomass was below the minimum landing size, and the composition of the biomass is still heavily weighted towards small whiting (Heath and Spiers, 2011).

> *If we were to seek a terrestrial analogy it would not be that of a desert. Rather it might be that of used agricultural land in need of restoration.*
>
> Clyde Ecosystem Review, Marine Scotland,

Despite the fundamental changes in the Clyde ecosystem, Ryan and Bailey (2012), consider that the characteristics of the Clyde (populations with limited external exchange, the continued strong presence of juvenile fish, and the presence of suitable juvenile fish habitat), make recovery plausible providing the necessary management action is taken.

Summary

The fishery currently depends upon only two species: scallops which are not subject to stock assessments (but other research indicates are heavily exploited) and *Nephrops* which are assessed but are subject to advice that reflects concerns about the sustainability of the current exploitation. More positively, there is a broad recognition that the Clyde could, with the correct management measures in place, return to the state where it would support a diverse commercial fishery and a revived recreational sea angling sector.

4. The reasons for the decline of the finfish fishery

A range of reasons has been given for the decline of the Clyde's commercial finfish stocks. These include seal predation, pollution and sea temperature rise. These reasons can play a part in the decline of finfish stocks. But there is no convincing evidence that any of these reasons explain either the extent or timing of the decline experienced in the Clyde. There is much stronger evidence that poor fishery management explains the alteration in the mix of species which has led to the decline in finfish landings (McIntyre *et al.,* 2012). This chapter summarises these issues.

Pollution: sewage disposal and agricultural run-off

It has been suggested that changes to sewage disposal practices in the Clyde, and the impact of nutrient and other chemical run-off from agriculture were to blame for the general decline in commercial finfish stocks. There is also a popular misunderstanding that because the Clyde was affected by pollution this must be the reason for the decline in its commercial finfish stocks. With the exception of a few localised impacts, these assertions do not stand up to scrutiny. Indeed, it should be noted that, not only do concentrations of nutrients in the Clyde fail to differ materially from concentrations recorded elsewhere on Scotland's west coast inshore waters, but they are well within the threshold levels (OSPAR, 2009) (Figure 3).

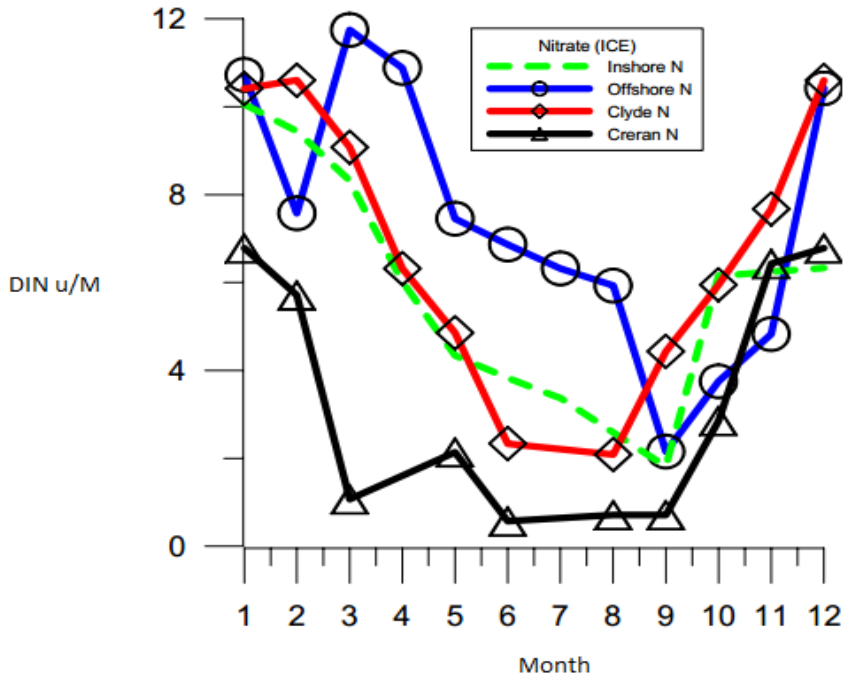


Figure 3| Average seasonality of Dissolved Inorganic Nitrogen (Nitrate, Nitrite and Ammonium) within the Clyde compared to regions of the west coast of Scotland. (Kennington and Johns, 2007).

There is no adequate case for disputing the conclusion of The Clyde Ecosystem Review that concentrations of pollutants in the Clyde are at low levels and that in comparison with the environmental status of some UK waters, the Clyde has few problems. Furthermore, the Clyde Ecosystem Review states: *'…there are no obvious signs of negative effects on the food web of pollution, nutrient enrichment of any other man-made source of contamination'* (McIntyre *et al*., 2012).

Seal Predation

Studies of the impact of fish-consumption by seals in the Clyde have shown that sand-eels, gadoids, flatfish and herring make up a significant proportion of the diet of both species of native seal (SCOS Main Advice, 2011). However, seals are also known to be opportunistic feeders and so may feed upon other abundant food sources - which can include shellfish.

Even if seals were to consume no shellfish, the estimated population of seals in the Clyde would consume between 1,200 to 2,100 tonnes per year of finfish. On average, grey seals eat 4 to 7 kg of finfish per day and harbour seals eat 3-5kg per day (SCOS Main Advice, 2014). This level of predation is insufficient to explain the decline in the commercial-sized finfish stocks in the Clyde.

Accordingly, it has been concluded that whilst seal predation inevitably impacts finfish numbers, and potentially lengthens the recovery of diminished stocks, it is insufficient to be the cause of the decline in the Clyde's commercially sized fish.

Climate Change

There is no evidence that the warming the Clyde has experienced to date has reduced its potential productivity (McIntyre *et al*., 2012). However there is a higher likelihood it may do so in the future (Martinez *et al.,* 2009).

Failure of fishery management

It is generally accepted that the most likely explanation for the decline in commercial finfish stocks in the Clyde has been the historic and inappropriate use of commercial fishing gears.

Unsustainable levels of harvesting occurred in the 1970s and 1980s (Thurstan and Roberts, 2010; Heath and Speirs, 2011). Furthermore, the protection afforded to Scotland's close- inshore areas which acted as nurseries and refuges for the fish population under the former '3 mile limit', was removed in 1984. It is widely held that the combination of this loss of spatial protection and excessive harvesting represented the significant failures of management that resulted in the loss of the commercial finfish stocks.

In subsequent decades fish stocks were almost certainly further reduced because of finfish by-catch in *Nephrops* trawling gear (Bergmann *et al.,* 2002). Furthermore the use of heavy gears in the shellfish fishery (particularly dredges and trawls) in areas which have historically acted as nursery grounds for finfish, appears to continue to underlie the failure of finfish stocks to recover (Kamenos *et al.,* 2004; Thurstan and Roberts 2010; McIntyre *et al.,* 2012; Lilley *et al.,* 2014).

There is also extensive international and national evidence to support this explanation. It is acknowledged that the excessive use of heavy fishing gear, particularly on complex areas of the seabed has exacerbated this decline (Bergmann *et al.,* 2002).

Scallop dredging has been identified as one of the most damaging fishing activities in relation to benthic habitats and species (Hall-Spencer and Moore, 2000; Kaiser *et al.,* 2000 and Blyth *et al.,* 2004).

Bottom trawling can crush, bury and expose marine animals and structures, sharply reducing structural diversity. The impacts are exacerbated when the time-interval between trawls is less than the time the ecosystem needs to recover. Furthermore, the advent of rock-hopping gear has meant former fish refuges have been lost (Wattling & Norse, 1998).

Studies have suggested that trawling has reduced habitat complexity in the Clyde (Coggan *et al*., 2001). Reduction in complex habitats and their associated species may reduce food availability for commercially important fish species (Collie *et al*., 1997). It is unknown if such shifts in community structure are temporary, but these shifts may represent an alternate stable state for highly disturbed benthic communities (Kaiser *et al.,* 2000a).

It should be acknowledged that the Clyde's shellfish mobile-gear fleet has introduced some measures in an effort to reduce its general impact on fish stocks (McIntyre *et al*., 2012). These included increases in minimum landing size of *Nephrops* and weekend bans on mobile gear use (McIntyre *et al*., 2012). Measures have also been introduced to modify the finfish fisheries - for example by establishing a 'Cod Box' to provide seasonal protection to the cod population. A summary of effort restrictions and technical measures currently applicable to the Clyde fisheries is at Chapter 7.

Whilst these measures, introduced in the last century, were important steps towards developing more sustainable fisheries, they do not go far enough. These measures alone have not led to a recovery in commercial finfish stocks.

More substantial measures are clearly needed to bring about a recovery in commercial finfish stocks. It is intended that this Regulating Order proposal, whilst having the aim of increasing the productivity and resilience of the commercial shellfish fisheries, will provide the fishery management changes that are needed to bring about that recovery.

5. Future threats to the fishery

There are threats to the viability of the remaining shellfish fishery. These threats, including from disease, climate change and pollution, reinforce the need to implement management measures that will promote diversity and hence increase the resilience of the industry. SIFT believes that without such diversification any one of the problems listed below could put the Clyde fishery, with its current shellfish monoculture, at risk.

An overview of the primary threats is set out below.

Stress and productivity

Finfish and shellfish stocks that are stressed by non-fishing impacts such as disease, pollution and climate change are less productive and less able to withstand harvest levels than they might otherwise tolerate (Howarth *et al.,* 2014). Fishery managers must take these issues into account when considering the long term viability of the fishery. Conversely, management that aims to preserve more natural age/size structures, spatial distribution of species, and ecological architecture such as complex habitats will make the stocks better able to withstand those impacts (Pikitch *et al.,* 2004; Hixon *et al.,* 2014).

Disease

Some of the Clyde *Nephrops* stock is infected by the microscopic dinoflagellate *Hematodinium* (Field *et al.,* 1998). In general, *Nephrops* with advanced stages of this parasitic infection have poor quality meat in terms of taste, texture and appearance. As a result, many infected *Nephrops* have to be discarded prior to sale.

Studies have shown that the infection peaks in spring with a background prevalence of 20 - 25% in trawl caught Clyde *Nephrops* and with incidences of up to 70% infection in some years (Beevers *et al.,* 2012; Bell *et al.,* 2013).

A disease caused by an apicomplexan parasite which was implicated in the collapse of the Icelandic scallop fishery (Jonasson *et al.,* 2007), has also recently been detected in Scottish scallop stocks (Kristmundsson, *et al.,* 2011).

Although currently at low levels, sudden outbreaks can and do occur – with dramatic consequences (Eiriksson *et al*, 2010).

There is a significant chance that both of these diseases (and others) may become more widespread in the future due to anthropogenic climate change and warming oceans (Howarth *et al.,* 2014; Rowley *et al.,* 2014; see below).

Disease therefore poses a threat to the existing Clyde fishery.

Ocean Warming

Ocean warming is caused by the greenhouse effect and the warming of the atmosphere (Pachauri *et al.,* 2014). Some 80-90% of that heat is absorbed by the ocean, hence the recent rises in both sea surface and deep water temperatures (Pachauri *et al.,* 2014). A recent analysis of temperature data shows that the Clyde may be warming faster than other UK coastal waters (such as the North Sea) (McIntyre *et al.,* 2012). The Clyde has experienced a rise of some 1.3°C since the 1960s (Figure 4).

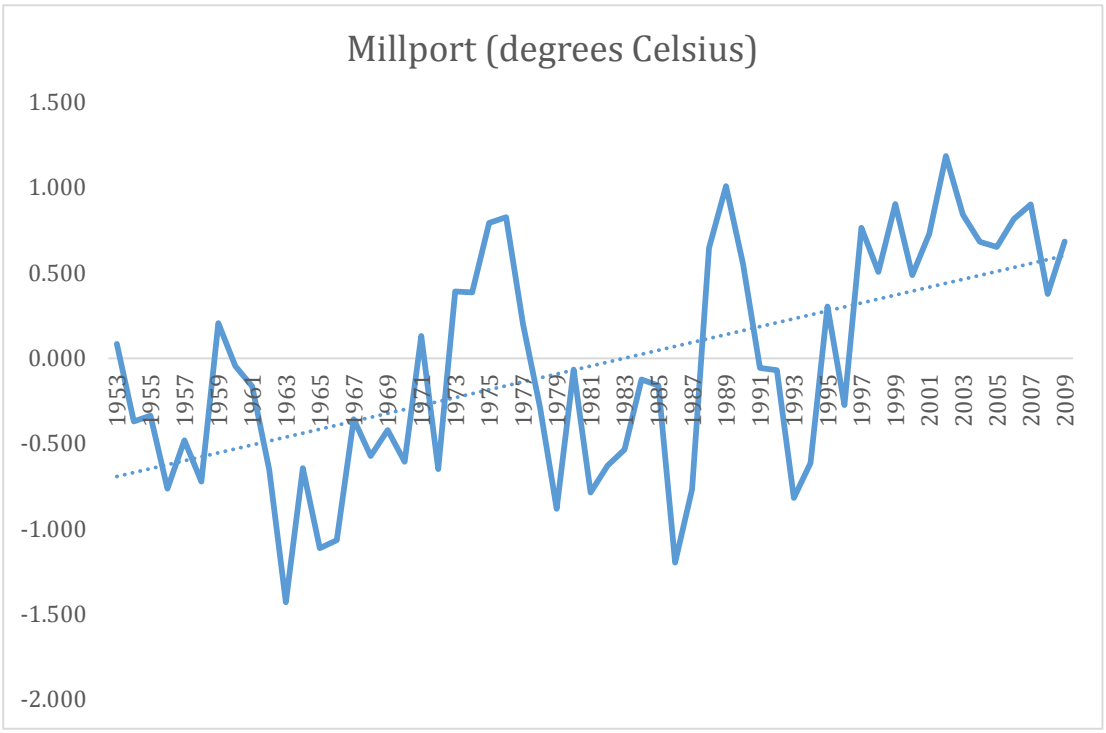


Figure 4| Changes in coastal sea temperature recorded at Millport, 1953- 2009. (Marine Scotland dataset, 2010).

Ocean warming is likely to cause changes in the distribution of many marine species, with the Clyde expected to see the appearance of species with a southern affinity while those already at the southern edge of their range contract north (Perry *et al.,* 2005; Simpson *et al.,* 2011).

Rising average water temperatures will result in faster growth rates for some marine species but prolonged periods of warmer summer temperatures may cause thermal stress (Gubbins, 2007). Sea surface temperatures in the Clyde are steadily rising meaning *Nephrops* may become increasingly stressed and more vulnerable to disease, as was the case with the Long Island Sound lobster fishery (Balcom & Howell, 2006).

'Climate change has the potential to have significant impacts on fish stocks and fishing activities. Changes in sea temperature and other climate induced environmental factors have been shown to alter fish community structure through changes in distribution, migration, recruitment and growth.'

Levels of ocean warming to date appear to have benefited scallop stocks around the UK by enhancing reproductive output and the survival of early life history stages (Shephard *et al.,* 2010). However, warming oceans are likely to facilitate the

establishment and spread of invasive species in the Clyde e.g. the slipper limpet (*Crepidula fornicata*), which could have detrimental effects on scallop fisheries and the marine ecosystem in general (Occhipinti-Ambrogi 2007; Stiger-Pouvreau & Thouzeau 2015). Furthermore, future exposure to temperatures at the limit of thermal tolerance of scallops will enhance their sensitivity to other stresses, including ocean acidification (Shephard *et al.,* 2010; Dupont and Portner, 2013).

Ocean Acidification

Ocean acidification is also caused by anthropogenic carbon dioxide, but in this case through the CO^2 being directly absorbed by the ocean (Pachauri *et al.,* 2014). Approximately one third of all anthropogenic CO^2 emissions have been taken up by the ocean (Pachauri *et al.,* 2014). This has caused the pH of the global ocean to already drop from 8.25 in the pre-industrial period to 8.14 in the present day; which represents a 30 % increase in H+ ions (Pachauri *et al.,* 2014). This increase in H+ ions makes it more difficult for shellfish to obtain the calcium they need to form hard parts (i.e. shells) (Aze *et al.,* 2014; Mackenzie *et al.,* 2014). The decrease in pH also starts to dissolve existing calcium based structures.

Increases in acidity could therefore affect the Clyde shellfish fisheries in a number of ways:

- Shellfish, particularly scallops, become less able to access the calcium needed to build their shells and consequently form less robust shells (Gazeau *et al.,* 2013). This will make them more vulnerable to predation and damage from fishing gear (Aze *et al.,* 2014; Gazeau *et al.,* 2013; Stewart *et al.,* 2015).

- Increased acidity is also likely to reduce survival and growth during the early life history stages, thereby reducing overall stock sizes and productivity (Andersen *et al.,* 2013; Gazeau *et al.,* 2013).

- Recently published research has shown that more acidic water adversely affects the taste of shellfish meat, making it considerably less marketable (Dunpot *et al.,* 2014).

Micro-plastic pollution

Recent studies reveal that plastics have the potential to accumulate within *Nephrops* (Martinez *et al*. 2014). In 2011, researchers from Aberdeen University and the Marine Research Station on Cumbrae showed that 83% of Clyde *Nephrops* had plastics in their stomachs (Murray & Cowie, 2011). A similar study carried out by Glasgow University found 84.1% of Clyde *Nephrops* contained traces of micro-plastics in their stomachs (Welden, 2015). Traces of plastics in other *Nephrops* stocks have been found around Scotland. An estimated 30% of *Nephrops* in the North Sea and 28.7% in the North Minch hold traces of plastics - a significant reduction on Clyde concentrations (Welden, 2015).

Prolonged retention rates of these plastics in Clyde *Nephrops* could potentially impact upon *Nephrops* growth and reproduction if leached in high enough levels. This would put further pressure on the already highly exploited stock (Welden, 2015).

Market risks

Any fishery is vulnerable to fluctuations in demand. Such fluctuations may result from changes in consumer taste or competition. Other factors may also influence demand – such as political decisions of the type that caused the collapse in demand from Russia for Scottish mackerel in 2014 (Munro,

2014). Self-evidently, fisheries like the existing Clyde fishery, which rely on only two products are more vulnerable to changes in demand than fisheries that have a diverse range of products.

6. Calls for Change

Concerns about the decline of the Clyde's fisheries, its ecosystem health and the impact this has on socio-economic well-being have been voiced by a wide variety of stakeholders. This has led to calls for changes to the way that the Clyde's fishery is managed from community groups, scientists and from within the fishing industry. These stakeholders rarely call for a single solution, but there is broad consensus that:

- In recent decades the Clyde has experienced 'regulatory capture' (wherein regulation created in the public interest becomes dominated by the special interests of one stakeholder group).
- As a result, the mobile sector, whilst subject to various technical measures, has enjoyed relatively unrestricted access to the Clyde's waters.
- There needs to be a return to greater use of spatial management of the fishery.

The fishing industry

Individual fishermen and industry spokesmen from the static gear sector have called for the reintroduction of spatial management measures in the Clyde in order to promote a more equitable and sustainable fishery. Such measures would also address the costly issue of gear conflict.

Similar calls for spatial management have been made by former members of the Clyde's mobile gear fishery, although active members and their representatives are generally content with the status quo.

However, it should be noted that the mobile fishery has called for new non-spatial management measures.

Community groups

Community groups, most notably the Community of Arran Seabed Trust (COAST), have also called for greater use of spatial management measures in the Clyde.

Special interest groups

There have been well publicised calls from the Clyde's recreational sea-angling community and the environmental protection sector for more effective management of the inshore waters. The RSA community has called for a 'golden mile' to be introduced around the coastline, and environmental NGOs have called for a variety of spatial management measures to be developed and enforcement to be improved.

The public

The well documented demands for change from the fishing industry and community groups and have been joined by widespread, but less obvious, calls for change from the public around the Clyde. To this end SIFT initiated a campaign in 2014, named Revive the Clyde (RTC) to establish the extent of, and then capture, public support for changes to the way that the Clyde is managed.

The campaign focussed on being forward looking, and aimed to attract the public to sign up to a 'Clyde Charter', which called for three key principles to be adopted in the Clyde:

1. Revive the marine environment;
2. Support a diverse fishery;
3. Promote management based on sound science.

By October 2015, 7,920 signatures had been gathered in support of the Clyde Charter. SIFT's experience is that the number of signatures it gathered for the Charter is directly related to the time it devoted to gathering them. Given the limited resources of a charity of SIFT's size it is expected that a substantially higher number than 7,920 of the Clyde's regional population would support significant changes to the management of the Clyde fishery if further campaigning resources were to be deployed.

SIFT believes that the level of public support for the Charter justifies the proposal for a Regulating Order which ensures the continuation of the existing shellfish fishery but also promotes the more effective use of science, revives the marine environment and diversifies the fishery.

Fishery science community

Members of the scientific community have been calling for changes to the Clyde's management for many years. The publication of the Clyde Ecosystem Review, by McIntyre *et al.* in 2012, which reviewed previously published information and knowledge concerning the Clyde ecosystem, provided a focus for such calls. Significantly, it aimed to provide a starting point for government and stakeholders concerned with the future of the Clyde, and stated:

"It could be argued that the Clyde *gives Scotland an opportunity to demonstrate leadership in terms of ecosystem restoration. It is our own inland sea over which we have significant management control. We will be required to bring the* Clyde *to Good Environmental Status by 2020 by the Marine Strategy Framework Directive. Currently the* Clyde *would certainly fail tests such as the Large Fish Indicator, and measures of biodiversity health. A restored* Clyde *ecosystem could bring market advantages to the fishing industry, through ecolabelling and headline conservation achievements."*

Government

There is recognition within the Scottish Government that the management of the Clyde requires to be modified. To that end, in 2013 The Cabinet Secretary for the Environment and Rural Affairs announced the Clyde 2020 initiative to bring together existing activity and new action - both scientific research and practical measures - to improve the marine ecosystem of the Clyde.

And as recently as June 2015 the 'Partial Business and Regulatory Impact Assessment' in relation to the South Arran Marine Protected Area published by The Cabinet Secretary Richard Lochhead, noted that:

'Currently there is not sufficient protection in place to ensure that the marine environment is properly protected and complex ecosystems safeguarded.' and that *'beyond a certain point of degradation, changes to ecosystems may be large and irreversible, resulting in a significant societal cost. Avoiding such a reduction in ecosystem services is thus a key benefit of introducing fisheries management measures.'*

"Conservationists must also accept that the Clyde is not a pristine ecosystem and never will be. It is heavily used by society for many legitimate purposes, of which food extraction is one. Focus must always be on the best way forward for all. Compromises will be possible if all stakeholders approach the challenges in a constructive way."

Clyde Ecosystem Review, 2012.

Summary

Calls for change have come from all stakeholder groups. A variety of solutions have been proposed, but they

frequently conflict. The proposed Clyde RO provides the only reasonable solution. It balances the interests of different stakeholders. Whilst no single party will be satisfied, it provides the best hope for the recovery of the fishery and the ecosystem.

7. Current Fisheries Management

Introduction

Current management in the Clyde fisheries includes both spatial and technical measures. SIFT has reviewed these measures to inform the management planning process of this RO proposal.

This Chapter summarises the spatial and technical measures currently in place in the Clyde.

Spatial Measures

The Clyde fisheries are subject to various spatial restrictions. A number of these restrictions are explicitly for fisheries management purposes. Others are primarily for nature conservation purposes. A third category is as a consequence of private fishery rights or Ministry of Defence restrictions. A summary of the spatial restrictions applicable to the Clyde fisheries is shown in Table 1 and Figure 5 below.

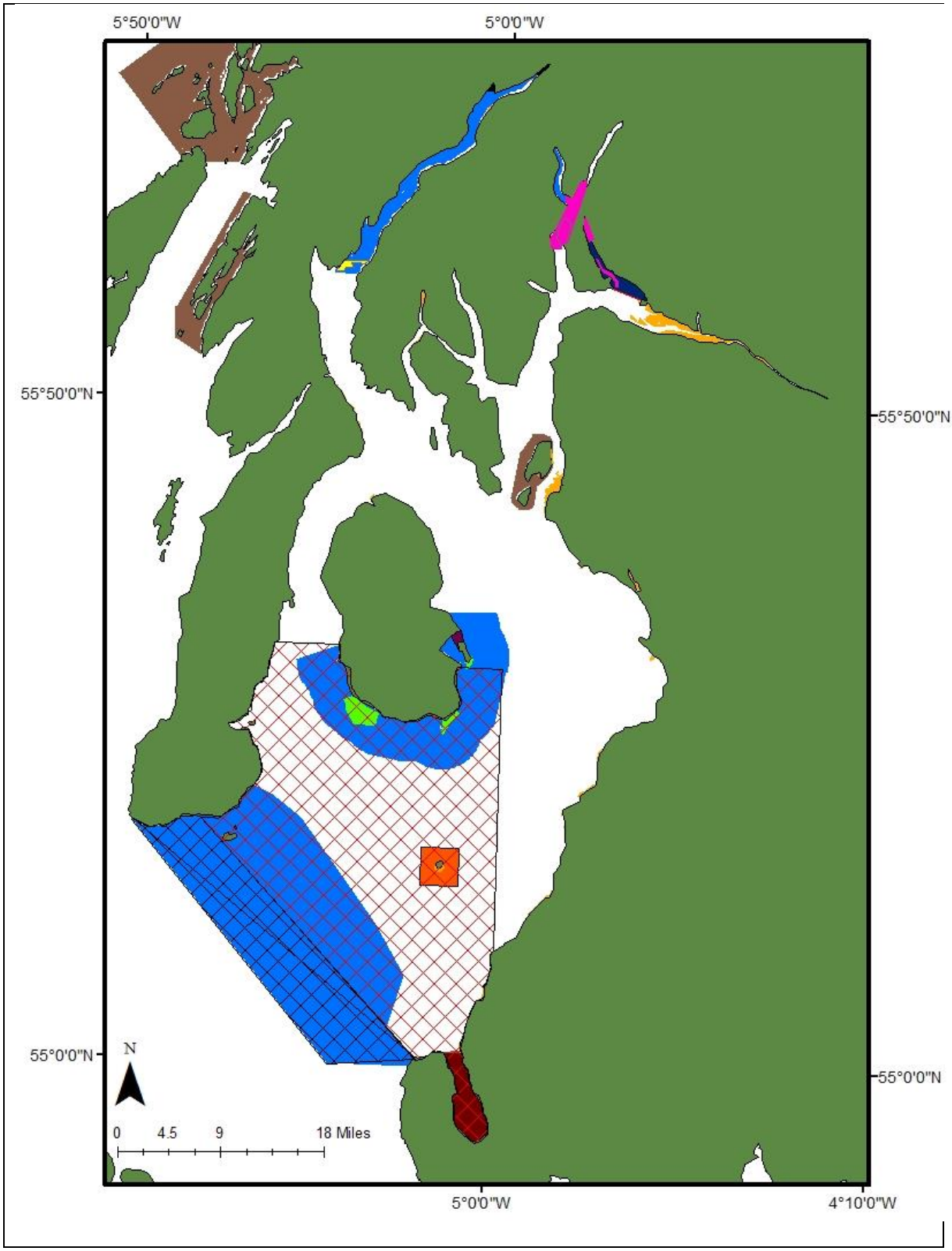
Table 1 | Summary of current spatial management measures on the Clyde

Spatial management measure	Site	Year	Legislation	Management
Marine Protected Area (MPA)	South Arran	2014	South Arran Nature Conservation Marine Protected Area Order 2014	• No suction dredge, mechanical dredge, beam trawl, or demersal trawl (including seine net) is permitted inside the entirety of the South Arran MPA. • Demersal trawl only allowed within an area of 107km^2 by vessels smaller than 120 gross tonnes. • No static gear permitted within an area of 8km^2. • No fishing of any kind in Lamlash Bay No Take Zone (8km^2).
	Upper Loch Fyne and Loch Goil	2014	Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014	• No suction dredge, mechanical dredge, beam trawl, or demersal trawl (including seine net) is permitted inside the management area. • Demersal trawl only allowed within the derogated areas by vessels smaller than 120 gross tonnes. • No static gear permitted in the static gear area.
	Clyde Sea Sill	2014	Clyde Sea Sill Nature Conservation Marine Protected Area Order 2014	• Currently no management measures in place but the following measures have been suggested; - Prohibition on the use of any type of set nets within 2km of Sanda

Spatial management measure	Site	Year	Legislation	Management
				to mitigate the risk of black guillemot being entangled whilst foraging. - Prohibit the use of demersal mobile gear on some of the circalittoral sand and coarse sediment communities. This is the proportion of the habitat with little or no mobile demersal fishing activity and is not driven by a target proportion of habitat. The area to be managed would represent all the component biotopes. - This prohibition would also apply to suction and hydraulic dredging, both boat and diver operated.
No Take Zone (NTZ)	Lamlash Bay	2008	The Inshore Fishing (Prohibition on fishing) (Lamlash Bay) (Scotland) Order 2008 (SSI 2008/317)	• Prohibition of all fishing for sea fish in the 2.6km^2 area of Lamlash Bay, Arran.
Marine Conservation Order	South Arran	2014	The South Arran Marine Conservation Order 2014	• Three sites within the South Arran MPA prohibiting commercial mobile fish gear
Special Protected Area (SPA)	Inner Clyde Estuary	2000	EC Directive (79/409/EEC)	• A 1826.02 ha area designated for redshank. • Currently no marine management measures in place.
	Ailsa Craig	1990	EC Directive (79/409/EEC)	• A 99.94 ha area designated for seabird species. • Currently no marine management in place for marine area.
Site of Special Scientific Interest (SSSI)	Ballochmartin Bay	1985	EC Directive (92/43/EEC)	• Protected for littoral sediment (Marine) Sandflats
	Kames Bay	1985		• Littoral sediment (Marine) Sandflats
	Ruel Estuary	1986		• Littoral sediment (Coast) Saltmarsh
	Inner Clyde	1999		• Littoral sediment (Coast) Saltmarsh
Marine Consultation Area	The Cumbraes	1980	N/A	• Intertidal zone
	Loch Ryan	1980s	N/A	• Native Oyster beds

Spatial management measure	Site	Year	Legislation	Management
Cod Box	Area 1	2007	2007 (63) The Sea Fish (Prohibited Methods of Fishing) (Firth of Clyde) Order	• From 1st of March to 30th of April all trawling except trawling for *Nephrops* is prohibited inside box 1. • *Nephrops* must comprise 35% of catch.
	Area 2			• From 1st of March to 30th of April all trawling except trawling for *Nephrops* is prohibited inside box 2. • *Nephrops* must comprise 35% of catch.
Gareloch			Clyde Dockyard Ports of Gareloch and Loch Long Act 2011	• Annual prohibition of mobile or active gear from 1st January to 31st December within Loch Long, Loch Long and Gareloch.
Loch Ryan		2004	2004 (276) SSI Schedule 1 of prohibition of fishing	• Annual prohibition of mobile or active gear from 1st January to 31st December except dredging for mussels and oysters within Loch Ryan.
Ballantrae Banks		2004	2004 (276) The Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Order	• Mobile or active gears is prohibited from the 1st of February to the 30th of April each year in the designated area.
Clyde		1984	Inshore Fishing (Scotland) Act 1984	• 1 Jan to 30 April all Clyde closed to herring fishing north of a line from Mull of Kintyre to Corsewall Point. The target species needs to represent at least 50% of the catch. Herring by-catch, maximum 50 kg per boat.

Spatial management measure	Site	Year	Legislation	Management
Upper Loch Fyne Voluntary Closures	Loch Shira		N/A	• Members of the Clyde Fishermen's Association have implemented a voluntary agreement which prohibits the use of mobile gear in waters less than 15m depth within Loch Shira
	Upper Loch Fyne		N/A	• Members of the CFA and the Argyll Fisheries Trust have implemented a voluntary agreement not to trawl in waters shallower than 50m at the head of the loch, north of Dunderave Point
	Otter Narrows	2014	N/A	• Members of the SFF have implemented a voluntary agreement that prohibits the use of all commercial gear within the area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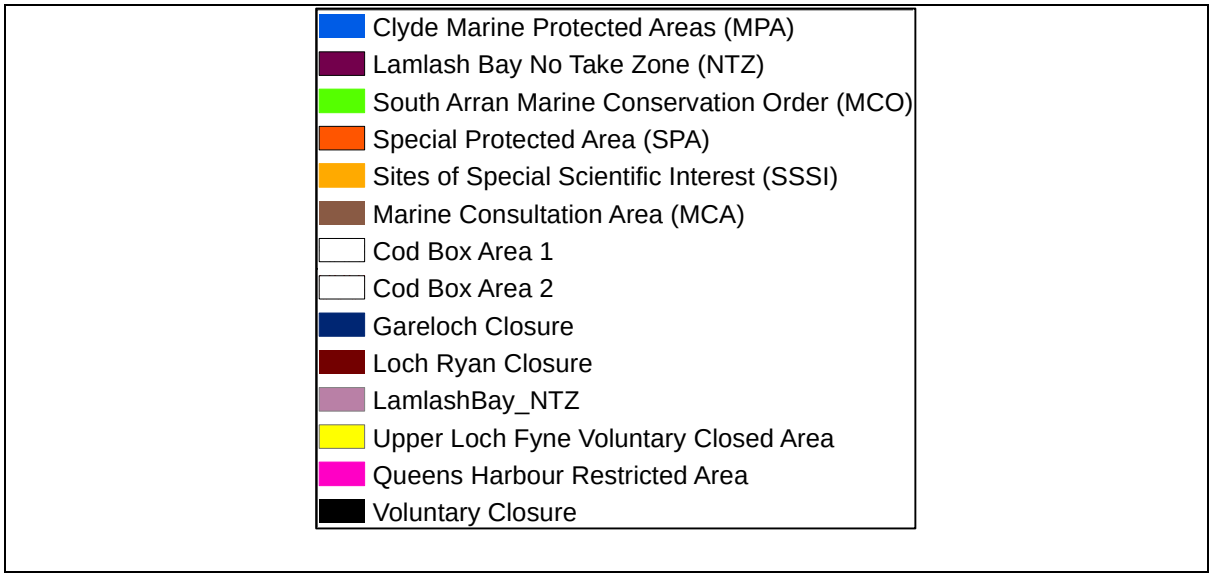


Figure 5 | Current spatial management in the Clyde

Effort Restrictions & Technical Management

A range of effort restrictions and technical measures are applied to manage the Clyde shellfish fisheries. Some restrictions apply to all vessels fishing in the area, regardless of the target species. Other restrictions and measures apply specifically to the *Nephrops* or scallop fisheries. A summary of these restrictions and measures are provided below.

General Restrictions

The following restrictions apply:

- fishing for sea fish (except herring, mackerel and sprats) from a fishing boat with an overall length no greater than 21.34 metres is prohibited[2]; throughout the year;
- All mobile gear is prohibited at weekends (midnight Friday until midnight Sunday) throughout the year.

Nephrops Trawl Fishery Restrictions

The Clyde *Nephrops* trawl fishery is subject to Total Allowable Catch (TAC) quota restrictions, which are set annually on the advice of ICES, under the terms of the EU Common Fisheries Policy. The Clyde *Nephrops* fishery is also subject to fishing effort restrictions ('days at sea') under the EU Cod Recovery Plan (CRP) (EU Annex 1342/2008). The CRP provides exemptions from days at sea restrictions where *Nephrops* vessels can show cod catches of less than 1.5%.[3] A number of Clyde *Nephrops* vessels have achieved exemption, allowing them to fish without being subject to 'days at sea' effort restrictions.

Other *Nephrops* trawl fishery restrictions in the Clyde include:

- Whole *Nephrops* must have a Minimum Landing Size (MLS) of at least 20mm carapace length;
- *Nephrops* 'tails'[4] where landed, must be landed in quantities equal to or less than 290 tails per kilo;

[2] SSI 276/2004, Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Order 2004, Schedule 3.
[3] Article 11 of Council Regulation (EC) No 1342/2008
[4] 'Tailed' *Nephrops* are those with their head and thorax removed at sea.

- At least 30% of the retained catch must be *Nephrops;*
- Trawl nets must have a minimum mesh size of 80mm (single twine);
- In line with 'days at sea' restrictions, square mesh panels must be used in *Nephrops* trawl nets as follows[5];
    - Vessels over 15 metres and more than 112kw must have a square mesh panel of 120mm minimum and 3 metres in length;
    - Vessels over 15 metres and less than 112kw must have a square mesh panel of 120mm minimum;
    - Vessels under 15 metres and over 112kw must have a square mesh panel of 110mm minimum and 3 metres in length;
    - Vessels under 15 metres and less than 112kw must have a square mesh panel of minimum 110mm and 2 metres in length;
    - Vessels exempted from 'days at sea' have different restrictions.

Nephrops Creel Fishery Restrictions

The Clyde *Nephrops* creel fishery is subject to the same Total Allowable Catch (TAC) quota restrictions as the trawl fishery. The creel fishery is also subject to same MLS restrictions as the trawl fishery. However, given the creel fishery only prosecutes whole and large *Nephrops,* these restrictions tend not to be onerous.

King Scallop Dredge Fishery Restrictions

The Clyde king scallop fishery is not subject to any EU TAC or quota restrictions. It is also not subject to 'days at sea' effort controls.

Other king scallop dredge fishery restrictions in the Clyde include:

- A MLS of 100mm;
- Maximum of 8 dredges per side[6]

Following Marine Scotland's 'Consultation on New Controls in the Scottish King Scallop Fishery 2014' (Marine Scotland, 2014a), Marine Scotland has recently announced additional restrictions on the king scallop fishery which will be introduced in spring 2016. Consequently, the Clyde king scallop fishery will be subject to:

- A MLS of 105mm[7].

King Scallop Dive Fishery Restrictions

The Clyde king scallop dive fishery is not subject to any EU TAC or quota restrictions. The fishery is subject to the same MLS restrictions as the scallop dredge fishery, i.e.:

- A MLS of 100mm currently; and

[5] EU 850/98 Annex XIVc and XIVd.

[6] SSI 2003 no 371.

[7] Assuming similar exploitation patterns to 2012-14, an increase this increase corresponds to an initial decrease in yield of between 6 and 10% in the short term assuming meat and gonad weights are similar to those in the West of Kintyre (comparable weights for the Clyde are unavailable).

- A MLS of 105mm from spring 2016.

Summary

The current spatial management restrictions on the Clyde have been implemented on a case-by-case basis. Consequently, they do not form a coherent fisheries-management network. Where spatial restrictions have been implemented for fisheries management purposes there is a lack of monitoring and research to determine effectiveness.

For the Clyde *Nephrops* fleet, effort and technical restrictions are in place. These mainly impact on the *Nephrops* trawl fleet. The *Nephrops* creel fleet is less restricted. A range of technical measures for the king scallop fleet are extant, although no quota restrictions are in place.

8. Regulating Orders

What is a Regulating Order?

A Regulating Order is a Statutory Instrument which may be applied for under the powers of the Sea Fisheries (Shellfish) Act 1967. Under a RO, a named person or body ("the grantee") has the right to manage a fishery and to regulate fishing therein for named shellfish species in a defined area of inshore or tidal waters, for a specified period of time.

Species covered

A RO may be granted for the following species; oysters, mussels, cockles, clams, lobsters, scallops and queens or any other molluscs or crustaceans cited under the 1967 Act. Following amendments to the Act, *Nephrops norvegicus* may be managed under an RO.

Area

A RO must be within six nautical miles of baselines, and may cover any portion of the shore or seabed, or estuary or tidal water, partly above or below the low water mark. Whilst there is no restriction on the size of a RO, the area must be shown to be necessary for the purposes of the application and is required to take full account of the interests of other users of the area including inshore fishermen.

Duration

The 1967 Shellfish Act allows ROs to be granted for a period of time of up to 60 years. The duration of a RO is dependent on the specific details of an application.

The Grantee

The grantee can issue licences, charge fees or royalties and enforce the observation of the terms of a RO and its associated Management Plan. Only those licensed to fish the specified species in a regulated area may do so.

Merits

ROs have the following merits:

- **Local control**

A grantee can be a non-profit company made up of local stakeholders. So it can put local interests at the heart of its decisions. This should encourage stewardship of the fishery and, with a wide representation of local stakeholders on the board, should ensure that management decisions are made in the interests of local communities.

- **Flexibility**

A RO allows the Grantee to open and close parts of the fishery and to set how much stock may be removed. It can act quickly when needed; for example when a storm impacts on shellfish stocks or when mild spring weather causes species to spat earlier than anticipated. This gives greater flexibility than if management decisions are made by central government.

- **Sustainability**

A RO ensures all fishing for the specified shellfish is carried out under a Management Plan. This can reduce the impact of the fishery on other parts of the ecosystem - whilst keeping the management of the designated shellfish species the priority.

Regulating Order Precedents

Scotland

In Scotland ROs have been granted to two bodies:

- Shetland Shellfish Management Organisation (SSMO)

The only current Scottish Regulating Order covers the waters around Shetland and was originally granted in 1990 (Box 1). SSMO's website www.ssmo.co.uk for a period of 10 years. It has been extended twice since 2000 with the current extension having been granted until 2028.

Box 1| Scallop Management under the Shetland Regulating Order

The SSMO has, through a Regulating Order, put in place management measures for the scallop fishery within the six nautical mile zone around Shetland. These include:

- *A limited entry fishery (vessels must have a licence issued by the SSMO);*
- *A curfew on scallop fishing before 0600 hours or after 2100 hours;*
- *A minimum landing size of 110 mm (queen scallop 40mm);*
- *A limit of two tow-bars with a combined maximum overall length, or a single tow bar with a maximum overall length of 8.80m;*
- *A maximum limit of 10 scallop dredges;*
- *Areas closed to scallop dredging;*
- *Ban on use of French dredges.*

These and other management arrangements under the RO, including a log book scheme, have contributed to the SSMO gaining Marine Stewardship Council (MSC) certification for the fishery.

- Solway Shellfish Management Association (SSMA)

The only other Scottish Regulating Order to be granted, the Solway Regulated Fishery (Scotland) Order 2006, was established to manage the cockle fishery in the Solway. Following a decision by the board of the SSMA not to pursue a new RO the 2006 RO fell in September 2011 at the end of its five-year life span.

England & Wales

Numerous Regulating Orders are extant in England and Wales. These have historically been granted to public bodies such as Local Authorities, and Inshore Fisheries and Conservation Authorities, which has contributed to their financial stability and success.

Why a Regulating Order is the best legislative instrument for the Clyde

SIFT believes that a Regulating Order is the best legislative instrument for bringing about the necessary management changes to the Clyde fishery. There is no other available instrument which can foster the flexibility and stewardship needed for the fishery. Furthermore as the fishery has become, in effect, exclusively a shellfish fishery, it is fitting that the management changes needed to bring about change should fall under shellfish fishery legislation. However it is accepted that ROs have shortcomings, which need to be taken into account. These are:

Species covered

ROs lack the powers to manage the finfish fishery. Accordingly, they do not facilitate a holistic ecosystem based approach to fishery management.

Duration

The Scottish Government's current policy of granting ROs for a period of up to 10 years may result in an RO which is of insufficient duration to ensure recovery of the fishery. ROs in England and Wales tend to be granted on a longer term basis.

Funding

The stability of funding is of crucial importance.

This is particularly the case when a RO is for a small number of species - as the natural cycle of stock levels may preclude the opening of the fishery in certain seasons. In such an event, the grantee will need sufficient reserves to continue until the next seasonal opening.

Governance

The governance arrangements of a grantee must ensure that the RO does not simply 'privatise' the fishery. To that end it is vital that there is wide stakeholder representation on the board of the grantee. The grantee must also recognise that it must be prepared to review the Management Plan in the event of changes within the fishery.

9. Developing the Management Measures

Introduction

The management measures proposed under the RO have been developed with the assistance of fisheries management experts. The measures have also been informed by the development of the Scottish Marine Protected Area network, relevant case studies, published scientific research and consultations. These are summarised below.

SIFT has benefitted from advice from fishery management experts at a range of UK academic institutions. SIFT has also been advised by the Oceans team at the U.S.-based Environmental Defense Fund (EDF), one of the world's largest non-profit environmental organizations (with a staff of 500 scientists, economists, policy experts, and other professionals). EDF has an extensive history of designing sustainable fisheries policies which combine the private sector and sound science to empower communities and meet the needs of fishermen and other stakeholders.

The Scottish Marine Protected Area Network

The purpose of the MPA management measures is to meet the conservation objectives for the protected features they contain. They are not fisheries management measures. To achieve a sustainable fishery in line with the National Marine Plan or EU objectives additional spatial measures are needed.

The RO proposals have therefore taken account of the proposed MPA management measures where they are sufficient for fishery management purposes. Where insufficient, additional management measures have been proposed. More specifically:

- The proposed MPA management measures for the South Arran MPA are consistent with the RO objectives for promoting fishery recovery and thus no further RO measures are proposed;
- The proposed MPA management measures for Loch Fyne and Loch Goil MPA would not, on their own, meet the RO aim and further management measures are proposed;
- The Clyde Sill MPA management measures have yet to be announced.

Case Studies

The management measures have also been informed by examples of successful fisheries management in temperate waters. A small selection of these are set out below.

1. **The Isle of Man scallop fishery: illustrating the benefits of spatial management for shellfish productivity.**
   In the UK, a small closure for scallops on the Isle of Man has illustrated how an enhancement in commercial shellfish stocks can be achieved through spatial management measures. In the 1990s the fishery suffered from overcapacity and declining catches. **After 17 years of spatial management measures, scallop densities rose thirty fold within closed areas, and scallop catch rates reached a 20 year high on many grounds** (Beukers-Stewart et al, 2002).

2. **The New England Sea scallop fishery: demonstrating how spatial management measures can benefit non-target species.**
   The New England Sea scallop fishery has benefitted from the implementation of spatial management measures. Although the measures were implemented to bring about ground-

fish recovery, wider benefits were accrued particularly to the scallop fishery and it is now one of the most valuable in the USA. **Biomass of scallops in the protected areas increased more than 10 fold within 6 years and has remained above that level since** (Hart *et al.*, 2013).

In addition, the rotational reopening of portions of the protected areas has contributed to the high scallop landings over the past decade (Hart *et al.*, 2013). Although other management changes (limits on access and effort and changes to gear specifications) were implemented at the same time and afterwards, the designation of large-scale closed (and subsequently rotationally opened) areas is widely credited with being central to the turn-around.

3. **The New England groundfish fishery: illustrating the benefits of spatial management for fish nursery and refuge areas.**
   The fishery (composed of 13 species including cod and haddock) is the oldest commercial fishery in the USA. Overfishing and poor management led to declines in many groundfish species, notably cod. To address this a network of spatial closures were designed to aid recovery, notably for the haddock and cod populations. Progress has been made with several stocks over the period 2010-2013. On Georges Bank, the most important effect has been the recovery of the haddock stock, which is currently estimated to be well in excess of its biomass target (Smith *et al.*, 2013).

4. **Lamlash Bay, Arran, No Take Zone is illustrative of the benefits of spatial management for the protection of vulnerable seabed habitats.**
   Underwater surveys have shown that since the Lamlash NTZ was established in 2008 it has experienced increasing abundance of a range of seabed habitats. In 2013 the animals and plants that attach to the seabed such as maerl, seaweed, hydroids, bryozoans and sponges were found to be approximately two times more abundant within the NTZ than outside it. (Howarth et al, 2013).

   This exemplar of spatial management is particularly instructive for the RO proposals, given that it is located in the Firth of Clyde, and therefore illustrates that the Clyde ecosystem is capable of recovery as has been experienced in other locations.

5. **Devon, UK: illustrating the the use of spatial management to separate gears and minimize gear conflict.**
   The inshore area off the coast of Devon is targeted by several sectors of the fishing industry; static pots target crab and lobster, dredgers target king scallops, and beam and otter trawlers target plaice. Consequently there was a problem with static gear interacting with towed gear, causing loss of gear and earnings. A series of voluntary restrictions - essentially spatial and temporal separation - was introduced in 1978. This became statutory in 2002.

   The restrictions, known as the South Devon Inshore Potting Agreement, covering an area totaling 478km^2, are widely regarded as a success by both fishermen and managers as they have effectively allowed fishers from different sectors to operate profitably on traditional fishing grounds. Unintentionally, in the areas where mobile gear was excluded, wider benefits to marine biodiversity and increased scallop densities have been reported **(Blyth *et al.,* 2002).**

Publications and consultations

The management measures have also been informed by the conclusions of peer-reviewed publications and relevant Scottish consultations. A small selection of these are set out below.

1. **A Review of the Scottish Scallop Fishery (Cappell *et al.,* 2013)**

   In 2013 a comprehensive review of the Scottish Scallop Fishery was carried out by Poseidon Consultants on behalf of Scottish Government (Cappell *et al*., 2013). This review considered the structure and performance of the fleet; the health of the stocks; the current management and regulation; and any environmental impacts of the fishery and culminated in a range of informed options aimed at achieving a more productive, efficient and sustainable Scottish scallop sector. A summary of the recommendations of this review, is provided below.

   i. **Joined up management:** The dredge fishery and the dive fishery target the same resource so should be under an overall management plan of the Scottish scallop fishery that supports local IFG planning.
   ii. **Cap effort and remove latent capacity:** The total number of scallop entitlements within the fishery should be reduced to include only active scallop vessels with an important additional restriction to prevent upsizing of existing vessels. Further management of effort is required and should be applied when there is a better understanding of relationship between nominal effort and F.
   iii. **Increase in Minimum Landing Size MLS:** An initial increase from 100mm to 105mm is proposed as some stock conservation and market benefits are expected. Compared to an immediate move to 110mm, this will reduce, but not remove the short term economic impact. The costs and benefits of any further MLS increase should be explored.
   iv. **Spatial reserves:** To protect locally important scallop beds from over exploitation and support recruitment into the fishery, Marine Scotland should work with IFGs to identify fishery reserves within the 6 N mile zone. These could be permanently closed to all forms of fishing or opened and closed on a rotational basis.
   v. **Bar length:** Bar length restrictions should be implemented within specific zones to replace the current dredge restrictions. A reduction in permitted bar length for inshore zones should be considered when the impact of such measures is better understood
   vi. **Inshore Curfew:** A curfew should be introduced prohibiting scallop fishing within 6 N miles of shore between agreed hours of the night. The details may vary seasonally and some flexibility could be agreed in the case of tide limited harbours.
   vii. **Dive fishery:** The dive caught scallop sector should be considered a full partner in the future management of the Scottish scallop fishery.
   viii. **VMS and higher resolution data collection:** A VMS system should be mandatory for all vessels engaged in commercial scallop fishing to demonstrate compliance with spatial management and provide data to inform science.
   ix. **Quality and marketing initiatives** will be required as management improvements are implemented in order to capitalise on improved governance and industry standards.

2. **The Dredge Fishery for Scallop in the United Kingdom: Effects on Marine Ecosystems and Proposals for Future Management (Howarth and Stewart, 2014)**

   This report, commissioned by SIFT, made specific recommendations for spatial management of scallop fisheries. A summary of these recommendations is set out below.

i. Protected areas should be strategically located and designed to offer multiple benefits wherever possible. This includes maximising the potential for larval export / spillover of scallops and other commercial species, offering protection to biodiverse and vulnerable areas and reducing conflict between static and mobile fisheries.

ii. Scallop dredging should be excluded from vulnerable habitats within existing and future protected areas at the site level, rather than just specifically where vulnerable features currently exist. Experience from case studies demonstrates both the need for buffer zones around vulnerable features, and that recovery of such habitats can extend beyond what was originally perceived to be likely.

iii. Protected areas should not just cover the most vulnerable habitat types, but ensure representation of the full of range of substrates and biodiversity. All habitat types contribute to biodiversity and fisheries in different ways and therefore should be afforded some element of protection.

iv. Protected areas should ideally be permanent to maximise benefits to fisheries and conservation. Case studies of protected areas indicate that recovery of both scallops and other benthic species has been less rapid in the UK than in some other areas in the world. The use of a second tranche of rotationally open/ closed areas could also be considered.

v. Protected areas should be well monitored in order to assess performance. This will inform management strategies and be crucial for communication with stakeholders. Given the uncertain, but likely substantial effects of ocean warming and acidification in the future, some adjustments to the protected areas are likely to be necessary over time.

3. Recommendations for Management of Clyde *Nephrops,* Heumacher *et al*., (2013)

This paper, commissioned by EDF for SIFT, made specific recommendations for managing the Clyde *Nephrops* fishery. Using both ICES advice and a further stock assessment commissioned by EDF (Edwards, 2013) Heumacher *et al.,* (2013) concluded that *Nephrops* harvest in the range of 4,700 to 5,000 tonnes range for the Clyde is likely to be a reasonable bound for near-term productivity. Heumacher *et al.,* (2013) recognised that the highest overall *Nephrops* productivity is tightly correlated with muddy substrates and suggested selecting an allowable trawl zone of muddy substrates that could produce the recommended *Nephrops* harvest range.

4. **Designing marine reserve networks for both conservation and fisheries management (Gaines *et al.,* 2010)**

A number of studies have developed spatial management network design guidelines, in an attempt to balance the inherent trade off that exists between conservation and fisheries goals. In developing the spatial management plans in this proposal, SIFT has been guided by the network design guidelines developed by Gaines *et al.,* (2010). EDF reviewed the Gaines *et al* spatial management guidelines with specific regard to the Clyde and identified six bespoke Network Design Considerations (Chapter 10).

Gaines *et al* (2010) also undertook an analysis of 57 case studies from around the world, concluding that optimal fishery productivity benefits are achieved when the total protected sea area is circa 30% of the overall network. EDF considered this target in relation to the Clyde

fisheries and recommended achieving a total protected sea area from the overall network of between 20% -30%.

5. **Scottish Government Consultation on 'New Controls in the Scottish King Scallop Fishery' (Cappell *et al*, 2013)**

   In October 2014 the Scottish Government issued a consultation paper seeking views on new management measures in the Scottish scallop fishery. In particular it sought views on.

   i. Increasing the Minimum Landing Size of scallops

   ii. Introducing new restrictions associated with the use of dredges

   iii. Changes to licensing arrangements to restrict the upsizing of replacement vessels

   iv. Placing restrictions on the time that vessels can spend at sea

   Although recommended by Cappell *et al.* the consultation did not seek views on spatial reserves.

6. **The Clyde IFG Management Plan (Clyde IFG, 2011)**

   The Clyde IFG made one specific recommendation with regard to the king scallop fishery.

   i. MLS in the Clyde to be increased over a two-year period, with an initial increase to 105mm and a subsequent rise to 110mm.

10. Fisheries Management Plan

Introduction

This Chapter sets out the detailed management measure proposals for the Clyde RO. The chapter is divided into four sections.

Section 1 sets out the scope of the proposed RO and associated justifications together with the recommended management planning arrangements under the CSMO.

Section 2 sets out details of the proposed spatial management measures.

Section 3 sets out the proposed technical management measures and licencing arrangements.

Section 4 sets out the proposed enforcement strategy.

Section 1: The Scope of the Regulating Order

The Scope of the proposed RO includes three wide parameters: geographical extent, duration and species covered. These parameters and associated justifications are as follows.

Geographical extent of the RO

The geographical extent of the proposal is shown at Figure 1, page 4. This area of inshore waters extends landward to Mean Low Water Springs lying north of a boundary line between The Mull of Kintyre (55°18.626°N and 005° 48.208'W) and Corsewall Point (55° 00.429'N and 005° 09.564'W).

SIFT believes the RO and the measures it proposes must cover the entire Clyde. This area, defined by the Scottish Government as the Clyde Sea Area, is consistent with the area covered by the former Clyde IFG. This geographical extent of the RO is justified as follows:

- It is a pragmatic scale for management;
- Scientific advice is that the Clyde can be managed separately from the Scottish west coast and has a good chance of recovery using local restoration measures (McIntyre *et al.*, 2012);
- Managing the Clyde at this proposed scale provides opportunities to work at an 'ecosystem level' which conforms with the ecosystem approach adopted by the RO. This ensures that the deeper waters in the centre of the Clyde as well as the sea-lochs in the north and the open waters over the Great Plateau are managed holistically;
- Management of smaller areas of the Clyde would lack ecological coherence;
- The local fleet operates throughout the Clyde. If the RO were to be granted for any significantly smaller area than that proposed, fishermen would fish within and outwith the RO area. This would make the enforcement and administration of the RO more complex.

Duration of the RO

SIFT believes the duration of the Clyde RO should be 10 years in the first instance, with an expectation that the CSMO will seek a new RO to be granted for a further 10 years thereafter. This aligns with the Clyde Ecosystem Review, which states that restoration measures cannot be expected to have immediate effects, particularly if the ecosystem has moved from one stable state to another.

A minimum 10-year duration is justified as follows:

- The Clyde's king scallops' capacity to recover in protected areas has recently been assessed in the Lamlash Bay NTZ. Initial signs of increased productivity were measurable after only four years of protection. However, SIFT believes this would be insufficient to maximise commercial benefits. Indeed, latest research suggests that in order to achieve results like those observed in the Isle of Man, Lamlash Bay marine reserve would have to be established for at least 10–15 years (Howarth et al, 2015);
- A meta-analysis of marine reserves carried out by Molloy *et al* (2006) demonstrated that, globally, old reserves are more effective than young reserves at increasing fish densities. Their results imply that reserves should be maintained for at least 15 years following establishment, even if they initially appear ineffective. If protection is maintained for long enough, fish densities within the reserve will recover and such benefits will be particularly pronounced for large, locally fished species.
- To promote the recovery of finfish stocks to commercially exploitable levels SIFT believes that a minimum 10-year duration will be necessary. Whilst it is difficult to predict the timescale of finfish recovery, evidence from studies of marine protected areas indicates that a duration of ten years or more is a key feature of success. (Edgar, 2014; Gell and Roberts, 2003). Other studies argue that the effectiveness of marine spatial management has been shown to increase with age;

A 10-year duration will also facilitate business planning for the fishing industry and other stakeholders affected by the proposals.

Species covered by the RO

A RO is sought for *Nephrops* (*Nephrops norvegicus*) and king scallop (*Pectin maximus*) because they are the most economically important species in the Clyde. Queen scallop (*Aequapecten opercularis*) is also included because it often shares ground, is frequently fished alongside and is impacted by similar management measures as king scallop. Selecting these species for the RO should therefore provide direct economic benefits to the current commercial fleet. In addition, the methods employed by these fisheries impacts upon the livelihoods and amenities of other stakeholders.

Other shellfish species could also benefit from being managed under a Clyde RO. It is recommended that the CSMO consider submitting an application for additional species during the lifetime of the RO.

Management of Quota Species

Nephrops is a quota species and the Clyde covers one part of a Functional Unit, which is one of several that constitute west of Scotland *Nephrops* quota, a quota that is ultimately decided at EU level. Negotiations over the share of quota which might be allocate to the Clyde would need to be conducted annually. This would be unduly burdensome on the CSMO and would be unnecessary, given that the fishery can be adequately managed through spatial and technical controls.

Accordingly, the RO Application seeks to manage *Nephrops* through spatial and technical controls only.

Management Plans

Introduction

Under the RO, the CSMO will have the power to introduce management measures in a Strategic Management Plan (SMP), Annual Management Plans (AMPs) or on an ad hoc basis as the need arises.

Strategic Management Plan

The SMP is the core document for the RO. It defines what measures can be introduced so that the RO remains focussed on its main aim (increasing the productivity and resilience of the commercial shellfish fisheries). As well as ensuring that the RO's long-term aim is retained, the SMP will help provide the certainty which is required to facilitate business planning.

The SMP is intended to cover the first 5 years' of the RO's operation. The CSMO will be expected to review the SMP in time to agree a second SMP, covering the subsequent 5 years. This second SMP would need to be approved by Scottish Government.

The key management measures of the first SMP are provided below. They include spatial and non-spatial management measures and the conditions attached to the RO licences.

Annual Management Plans

An AMP will be produced by the CSMO each year. This will enable adjustments to be made to management that are based on the most recent scientific advice. These will conform to the strategic measures in the SMP.

In order to allow the CSMO an adequate opportunity to develop its protocols and operational structures, it is expected that the first AMP will adopt the management measures set out in the SMP.

This is deemed necessary as the CSMO is unlikely to be fully operational at that point in time, yet it will be vital to avoid a period of hiatus whereby any of the following scenarios might occur:

1) '**Business as Usual**': Current management measures remain in force until the CSMO is fully functional. Effectively this is likely to increase effort on the ground as fishers rush to maximise landings before the imposition of further restrictions. An associated increase in gear-conflict inter and intra gear-types would also seem likely under this scenario.

2) **Fishery Closure**: Scottish Government could close the fishery for an agreed period of time to prevent scenarios such as described at 1) above taking place. This measure would of course have grave short-term economic impacts on all sectors of the commercial fishing community.

Neither scenario 1) or 2) would seem desirable. In order to allow the CSMO an adequate opportunity to develop its protocols and operational structures, it is expected that the first AMP will adopt the management measures set out in the SMP.

Ad hoc measures

The CSMO will have the powers to introduce management measures in response to changes in circumstances. These measures may be in response to new scientific advice or to other events and are expected to conform to the strategic measures in the SMP.

Section 2: Spatial Management Measures

Introduction

Spatial management measures form the core of the RO's proposed management measures. They were developed using the best available data covering a wide range of parameters including seabed substrates, habitat type and recent fishing patterns.

Spatial Management: Aims

Spatial management measures proposed for the ***Nephrops* fishery** are for two purposes:

1. To enable a shift in effort from mobile gear to static gear, and
2. To provide breeding refuges for *Nephrops*

Spatial management measures proposed for the **scallop fishery** are for three purposes:

1. To enable a shift in effort from mobile gear to hand dive fishing;
2. Providing breeding refuges where scallop populations can obtain higher densities and more natural age and size structures. These aim to enhance larval export to surrounding areas through increased reproductive output and increased fertilisation;
3. Protecting areas of seabed which should enhance scallop spat settlement.

Many of the spatial management measures will also promote ancillary benefits such as finfish recovery.

Spatial Management Zones (SMZs)

Four types of SMZ were developed with the purpose of segregating different users of the Clyde so that the RO's overarching aim and intended benefits could be realised. The SMZ types are set out below (Table 2).

T**able 2|** Spatial Management Zones (SMZs) and proposed management

Spatial Management Zone	*Nephrops* and scallop fishing methods		Rationale
	Allowed	**Prohibited**	
Creel and Dive Only (CDO)	• Creeling for *Nephrops* • Hand diving for scallops • Other low impacts fishing practices	• Scallop dredging • Trawling for *Nephrops*	Reduce gear conflict and promote lower impact fishing over complex habitats
Trawl, Creel and Dive Only (TCDO)	• Trawling for *Nephrops* • Creeling for *Nephrops* • Hand diving for scallops	• Scallop dredging	Reduce gear conflict and promote lower impact fishing over complex habitats
Restoration Area (RA)	Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallops throughout the area.		Enable revival of complex habitats to restore fish stocks
Multi-Use	Open to all mobile and static licence holders		Continuation of existing fisheries

Spatial Management Zones: Design Objectives

Each SMZ has been designed to meet one or more of six specific Design Objectives which would contribute to the overarching aim of the RO. These Design Objectives are set out below (Table 3). They were developed in collaboration with fishery spatial management specialists from a range of leading international organisations and institutions and through engagement with stakeholders.

Table 3 |Spatial Management Zone (SMZ) Design Objectives

	Design Objectives		Detail
1	**Promoting *Nephrops* fishery sustainability**	1.1	Providing breeding refuges for *Nephrops*
2	**Promoting scallop fishery sustainability**	2.1	Providing breeding refuges for scallops
		2.2	Protecting areas of seabed which should enhance scallop spat settlement
3	**Promoting finfish recovery**	3.1	Protecting nursery habitats
		3.2	Protecting juvenile finfish from fishing disturbance during the early life history phase.
4	**Minimising impacts on the fishing industry**	4.1	Restoration Areas situated away from main ports
		4.2	Minimise potential impacts of displacement of existing *Nephrops* and scallop fishing activity
		4.3	Aid navigation and compliance
5	**Minimising user conflicts**	5.1	Minimising conflict between mobile and static gear fishing sectors within the Clyde
6	**Conserving biodiversity and promoting ecosystem resilience**	6.1	Aligning with existing spatial management measures
		6.2	Contributing to promotion of ecosystem resilience

Design Objectives- Justifications

The six Design Objectives and associated justifications are set out below. Together they aim to achieve the RO's overarching aim and intended benefits;

1. Promoting *Nephrops* fishery sustainability

1.1 Providing breeding refuges for *Nephrops:*

- Nephrops breeding refuges aim to protect important habitats associated with Nephrops reproduction;
- *Nephrops* breeding refuges are important for *Nephrops* to attain a more natural age and size structure;
- Prohibiting mobile gear from certain zones can encourage less destructive fishing methods which in turn can reduce by-catch of smaller *Nephrops* and encourage landings of larger individuals;
- *Nephrops* breeding refuges in zones with no mobile fishing can lead to higher survival rates of juveniles which in turn, increases the size structure of the stock;
- Encouraging *Nephrops* to grow to a larger size can economically benefit the fishing industry;
- Provides scientific reference sites.

2. Promoting scallop fishery sustainability

2.1 Providing breeding refuges for scallops:

- Scallop breeding refuges aim to protect important habitats associated with scallop reproduction;
- Scallop breeding refuges can enable scallop populations to attain higher densities and more natural age and size structures;
- Scallop breeding refuges will give a higher level of protection than neighbouring, unprotected fishing grounds to these relatively sedentary animals that are nonetheless capable of moving small distances;
- Scallop breeding refuges aim to improve yield per recruit and reproductive output which will in turn enhance larval export to surrounding areas (spill-over effect), benefitting the fishing industry;
- Provides scientific reference sites.

2.2 Protecting areas of seabed which should enhance scallop spat settlement:

- Protecting areas from fishing can allow suitable juvenile scallop habitats (such as seaweeds, hydroids and other organisms) on the seafloor to recover, which in turn provides further protection and shelter for spat and juvenile scallops;
- Protecting areas from fishing will allow a higher survival rate of juvenile scallops leading to an increase in the size of commercial scallop stock.

3. Promoting finfish recovery

3.1 Protecting nursery habitats:

- Protecting nursery habitats, areas of marine or coastal habitat where the density of juvenile organisms is greater than in other habitats (Beck *et al*., 2001), will increase the survival rate of fish attaining a larger size class;
- Protecting nursery habitats will increase and rebuild the structural complexity of the seafloor which provides shelter and feeding for fish during younger, more vulnerable life stages;
- Protecting nursery habitats for finfish will also create refuge areas and shelter for other animals.

3.2 Protecting juvenile finfish from fishing disturbance during the early life history phase:

- Protecting juvenile finfish from fishing disturbance increases the survival rate of year classes helping to increase recruitment to adult stock;
- Protecting juvenile finfish from fishing disturbance during early life stages will decrease mortality rates during the juvenile life stage increasing commercial fisheries;
- Protecting juvenile finfish from fishing disturbance during early life stages will increase reproductive sizes of fish leading to an increase in the size of commercial finfish stocks.

4. Minimising impacts on the fishing industry

4.1 Restoration Areas situated away from main ports:

- Placing restoration areas away from main ports will ensure that fuel costs and time associated with traveling to fishing grounds from port are not increased for commercial *Nephrops* and scallop vessels.

4.2 Minimise potential impacts of displacement of existing *Nephrops* and scallop fishing activity:

- Where possible, SMZs have been strategically placed in an attempt to minimise potential displacement effects on the commercial fishing industry to prevent disruption;
- Notwithstanding efforts to minimise impacts on fishing activities within SMZs, there will, at times, be unavoidable impacts.

4.3 Aid navigation and compliance:

- To ease navigation and compliance, the boundaries of SMZs have been designed to incorporate simple shapes. Convoluted shapes have been avoided where possible.

5. Minimising user conflicts

5.1 Minimising conflict between mobile and static gear fishing sectors within the Clyde:

- Creating separate fishing zones for different gears will help to alleviate conflict between fishermen and as a result will help to reduce the amount of gear loss and associated economic losses.

6. Conserving biodiversity and promoting ecosystem resilience

6.1 Aligning with existing spatial management measures:

- The network of SMZs will sit within a wider framework of existing spatial management measures aimed at protecting and sustainably managing the marine ecosystem;

- The wider framework includes existing spatial measures such as Marine Protected Areas (MPAs), Special Protection Areas (SPAs), No Take Zones (NTZs) and voluntary closures.

6.2 Contributing to promotion of ecosystem resilience:

- The network of SMZs is likely to increase resilience (the ability of an ecosystem to maintain key functions and processes in the face of stresses or pressures by either resisting or adapting to change (IUCN-WCPA, 2008)) of ecosystems by covering a wide range of ecosystem processes, biodiversity, substrate and broad-scale habitats therefore spreading the risk of disturbance (particularly in the face of large-scale and long-term changes) and facilitating recovery through replication and connectivity;
- This is particularly relevant in view of increasing adverse impacts, such as disease, climate change and pollution within the Clyde and the west coast of Scotland.

Network Design Considerations

In addition to the objectives for each SMZ, the SMZs were designed to form a coherent network. A network is "a collection of individual spatially managed sites or reserves operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels that are designed to meet objectives that a single reserve cannot achieve" (IUCN-WCPA, 2008).

To ensure a network is coherent, OSPAR recommends that it has the following features (OSPAR, 2006):

i. A network's individual sites should firstly be identified on the basis of criteria which aim to support the purpose of the network;
ii. The development of an ecologically coherent network of protected sites should take account of the relationships and interactions between marine species and their associated habitats;
iii. A functioning ecologically coherent network of protected sites should interact with, and support, the wider environment as well as other MPAs although this is dependent on appropriate management to support good ecosystem health and function within and outside the protected sites.

Without a coherent network the RO is unlikely to meet its overarching aim and intended benefits. Given the high level of functional and spatial connectivity within marine ecosystems, individual SMZs may be not be adequate to safeguard important ecosystem processes, the services they underpin, and their associated habitats (Defra, 2007).

Accordingly, six network Design Considerations were developed to inform the development of the spatial plan, with input from fishery spatial management specialists and relevant literature. Inevitably, some considerations conflict. Where this occurs, priority was given to achieving a total area protected from mobile fishing gear between 20-30% of sea area in order to sufficiently represent complex substrates and habitats. The considerations are listed in Table 4.

Table 4 |The six network Design Considerations that were adhered to when designing the spatial network

Network Design Considerations	
I.	The network of the SMZs must be geographically dispersed around the Clyde in order to promote connectivity
II.	Total area protected from mobile fishing gear must be between 20-30% of sea area in order to sufficiently represent complex substrates and habitats
III.	Complex and important substrates must be most protected
IV.	Habitat types must be represented across the network in order to support the sustainable use and protection of marine biological diversity and ecosystems
V.	Length of perimeter of SMZs must be high in relation to sea area protected to increase the potential for spill-over effects, to aid the fishing industry
VI.	Individual SMZ shapes must be simplified where possible to ease compliance and enforcement

The considerations and associated justifications are set out below. Together these six Design Considerations aim to achieve a spatial network capable of delivering the projects overarching aim and intended benefits.

i. The network of the SMZs must be geographically dispersed around the Clyde in order to promote connectivity

- Connectivity is the extent to which populations in different geographical areas of a species range are linked by the movement of eggs, larvae or other propagules, juvenile or adults (Palumbi, 2003);
- Maximising connectivity between SMZs will improve the ecological coherence of the network and will afford greater ecosystem resilience;
- Connectivity between zones will promote:
    - Connections through larvae dispersing between SMZs;
    - Regular settlement of larvae from one SMZ to another;
    - Movements of adults and juveniles from one SMZ to another;
    - Additional ecosystem benefits such as the transfer of nutrients and energy from one SMZ to another which will further encourage biodiversity and productivity.

ii. Total area protected from mobile fishing gear must be between 20-30% of sea area in order to sufficiently represent complex substrates and habitats

- Optimal fishery productivity benefits are achieved when the total protected sea area is circa 30% of the overall network (Gaines *et al*., 2010);
- Evidence suggested that goals of maximising fisheries catches and sustainability could best be achieved with spatial networks that cover 20-40% of the sea area (Gell & Roberts, 2003)

iii. Complex and important substrates must be most protected

- A well-connected network will facilitate species distribution by providing suitable 'stepping stone' substrates which will increased dispersal potential within the network;
- Ensuring that the network protects complex and important habitats for finfish and shellfish will ensure the protection of nursery habitats which will assist in promoting their sustainability and long-term viability as well as contributing to the recovery of finfish fisheries;
- Replication of complex substrate protected within SMZs across the network can further boost the resilience of the marine ecosystem, helping to maintain the structure and functioning of the ecosystem (Natural England Commissioned Report NECR037).

iv. Habitat types must be represented across the network in order to support the sustainable use and protection of marine biological diversity and ecosystems

- To be representative of habitat types, the network should protect the whole range of Clyde marine biodiversity and ecosystems. This can be achieved by ensuring that examples of each of the 10 broad-scale habitats located within the Clyde are protected by the spatial network;
- Representation and replication of sufficiently sized broad-scale habitats across the network has major implications for the ecological connectivity of populations and the resulting effectiveness of the network (Grorud-Colvert *et al*., 2014);
- In addition, representing habitat types across the network will further boost the resilience of the Clyde's marine ecosystem which will help maintain the structure and functioning of the ecosystem (OSPAR, 2006).

v. Length of perimeter of SMZs must be high in relation to sea protected to increase the potential for spill-over effects, to aid the fishing industry

- Zones with high perimeter length the area ratio will increase spill-over across the borders (Buechner 1987; Kritzer, 2004) which will benefit both the fishing industry and promote ecosystem resilience;
- By optimising the size of the area based on the perimeter length the area ratio, SMZs in the network should allow for movement of larvae and spill-over whilst at the same time reducing enforcement and management costs.

vi. Individual SMZ shapes must be simplified where possible to ease compliance and enforcement

- SMZs with simple shapes helps to aid compliance from the fishing industry.

The Spatial Management Zone network

It is proposed that the Spatial Management Zone network will be as follows:

- **Seventeen SMZs, covering an area of c.1,016km^2, equating to 28% of the Clyde;**
- **Six SMZs will be 'Creel and Dive Only' covering an area of c.439km^2;**
- **Ten SMZs will be 'Restoration Areas' covering an area of 297km^2 ;**
- **The South Arran SMZ is comprised of three sub-zones; Creel and Dive Only (165km^2), Trawl, Creel and Dive Only (107km^2) and Restoration Area (8km^2);**
- **The remainder of the Clyde, covering an area of 2,584km^2 will be a Multi-Use area- open to all commercial fisheries regulated by the RO.**

In accordance with the network Design Considerations, the SMZs are geographically dispersed and located over the full range of habitat types and substrates.

Figure 6 shows the proposed Spatial Management Zones indicated by letters A-Q and the identity of the 17 SMZs and their sizes and designations are set out in Table 5.

It can be seen that although the majority (10/17) of zones are Restoration Areas, which would be closed to *Nephrops* and scallop fisheries, the majority (687/1,016km^2) of the area that the SMZ network covers remains open to fishing.

More widely, the network ensures that:

- 75% of the Clyde remains open to *Nephrops* trawling;
- 72% of the Clyde remains open to scallop dredging;
- 92% of the Clyde remains open to static gear.

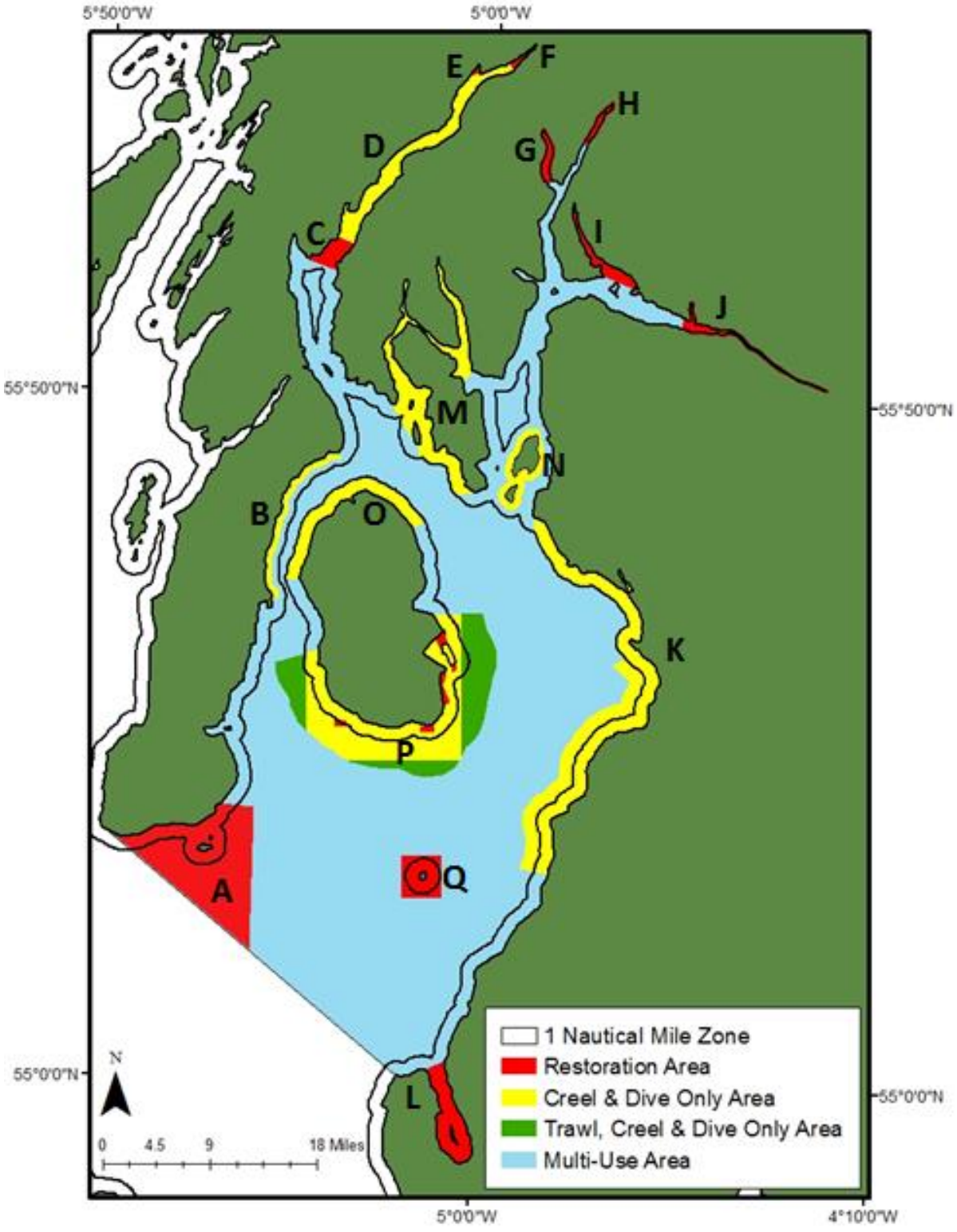


Figure 6|Proposed Spatial Management Measures under the Clyde Regulating Order

Table 5 | Identity of the 17 SMZs and their sizes and designations

Zone Ref.	SMZ	Size (km^2)	Designation
A	Mull of Kintyre	178	Restoration Area
B	Skipness	23	Creel and Dive Only
C	Otter Narrows	12	Restoration Area
D	Upper Loch Fyne	60	Creel and Dive Only
E	Loch Shira	1	Restoration Area
F	Cairndow	2.3	Restoration Area
G	Loch Goil	6	Restoration Area
H	Upper Loch Long	4	Restoration Area
I	Gareloch	15	Restoration Area
J	Upper Clyde Estuary	9.4	Restoration Area
K	Ayrshire Coast	192	Creel and Dive Only
L	Loch Ryan	39	Restoration Area
M	Kyles of Bute	90	Creel and Dive Only
N	The Cumbraes	24	Creel and Dive Only
O	North Arran	50	Creel and Dive Only
P	South Arran	280	Creel and Dive Only, Trawl Creel and Dive Only and Restoration Area
Q	Alisa Craig	30	Restoration Area

SMZ Key
Creel and Dive Only
Trawl, Creel and Dive Only
Restoration Area

How the SMZs meet the Design Objectives

The SMZs have been designed so that they would meet the Design Objectives as follows:

- Seven zones promote *Nephrops* sustainability (Objective 1);
- Eight zones promote scallop sustainability (Objective 2);
- All zones promote finfish recovery (Objective 3);
- Fifteen zones aim to minimise impacts on the fishery (Objective 4);
- Three zones aim to minimise user conflict (Objective 5);
- All zones promote biodiversity conservation and ecosystem resilience (Objective 6).

All SMZs meet at least three of the Design Objectives. The Kyles of Bute CDO and the North Arran CDO meet all six. The specific objectives each SMZ meets are set out in Table 6.

Table 6 | A summary of which SMZs meet six Design Objectives

		Design Objective					
Zone Ref.	**SMZ**	**1. Promoting *Nephrops* sustainability**	**2. Promoting scallop sustainability**	**3. Promoting finfish**	**4. Minimising impacts on fishing industry**	**5. Minimising user conflicts**	**6. Conserving biodiversity and promoting ecosystem resilience**
A	Mull of Kintyre		x	x	x		x
B	Skipness		x	x			x
C	Otter Narrows			x	x		x
D	U Loch Fyne	x	x	x	x	x	x
E	Loch Shira			x	x		x
F	Cairndow			x	x		x
G	Loch Goil			x	x		x
H	U Loch Long			x	x		x
I	Gareloch			x	x		x
J	Inner Clyde Estuary			x	x		x
K	Ayrshire Coast	x	x	x	x		x
L	Loch Ryan			x	x		x
M	Kyles of Bute	x	x	x	x	x	x
N	The Cumbraes	x		x	x		x
O	North Arran	x	x	x	x	x	x
P	South Arran	x	x	x			x
Q	Alisa Craig	x	x	x	x		x
	TOTAL	**7**	**8**	**17**	**15**	**3**	**17**

SMZ Key
Creel and Dive Only
Trawl, Creel and Dive Only
Restoration Area

How the SMZs meet the Network Design Considerations

It is important that the SMZs jointly form a coherent network. Table 7 below sets out how the network considerations have been met.

Table 7| A summary of how the SMZs meet the network Design Considerations

	Network Design Considerations	**How the SMZs meet the consideration**
I.	The network of SMZs must be geographically dispersed around the Clyde	• The SMZs are distributed across all coastlines of the Clyde; from sea-lochs in the north to the Clyde sill in the south; from the Kintyre shore in the west to the Ayrshire coast in the east.
II.	Total area protected from mobile fishing gear is between 20-30% of sea area	• 25% of the Clyde's RO area is protected from mobile gear, of this, 8% is protected from all forms of commercial *Nephrops* and scallop fishing.
III.	Complex and important substrates must be most protected	• 57% of known complex habitats are protected from mobile gear within the 27% of the Clyde covered by SMZs.
IV.	Habitat types are represented across the network	• All of the 10 broad-scale habitats found within the Clyde have been replicated within at least two SMZs
V.	Length of perimeter of SMZs is high in relation to sea protected.	• Effort has been made to maximise the perimeter: area ratio as high as possible for individual sites where there's indication that larvae dispersal is possible and/or desirable. • SMZs on Kintyre, Arran and Ayrshire coast have all been designed to have a high ratio. • NB - where sites are 'landlocked' (i.e. have more than one landward boundary), it has not been possible to obtain high perimeter areas ratios.
VI.	Individual SMZ shapes have been simplified where possible	• Where possible, SMZ perimeter boundary lines follow NM limits or other existing regulatory boundaries. • All closing lines in all loch designations are straight.

Network parameters

In designing the SMZ network, and ensuring that it met its Design Objectives, the following key parameters were taken into account:

- Complex Substrates;
- Habitat Types;
- Fishing Activity;
- Interaction with existing spatial management measures;
- User conflict data.

Further information on how they informed the SMZs are set out below.

Complex Substrates

Complex substrates comprised of coarse and mixed sediments and rocks and reefs are important nursery, breeding and refuge areas for shellfish and finfish. Accordingly, their protection is important to achieving Design Objective 1, 2, 3, and 6.

The SMZ network, although only covering 28% of the Clyde, has been designed to protect the majority of complex substrates from mobile gear. More specifically:

- 62% of the Clyde's known complex substrates are closed to scallop dredgers;
- 61% of the Clyde's known complex substrates are closed to *Nephrops* trawls;
- 33% of known complex substrates are closed to all fisheries regulated by the RO.

The proposals also ensure that the majority of non-complex substrates, particularly the more robust sands and muds in the centre of the Clyde, remain open to all *Nephrops* and scallop fishing gear. The proposed SMZs coverage of complex substrates within the Clyde is shown in Figure 7. The coverage is also set out numerically in Table 8.

Table 8 |Substrate type protected across the network

Substrate Type		**Coverage in Clyde (km^2)**	**Coverage in SMZ (km^2)**	**% closed to scallop dredge (%)**	**% closed to scallop dredge**	**% closed to *Nephrops* Trawl**	**% closed to *Nephrops* trawl (%)**
Complex	Coarse	279	195	70	62	67	61
	Mixed	78	44	56		56	
	Rock or Reef	237	141	60		55	
Muds and sands	Mud and Sand	2185	318	15	23	9	14
	Sand and Muddy Sand	707	215	30		30	
Unknown		114	104	91		91	

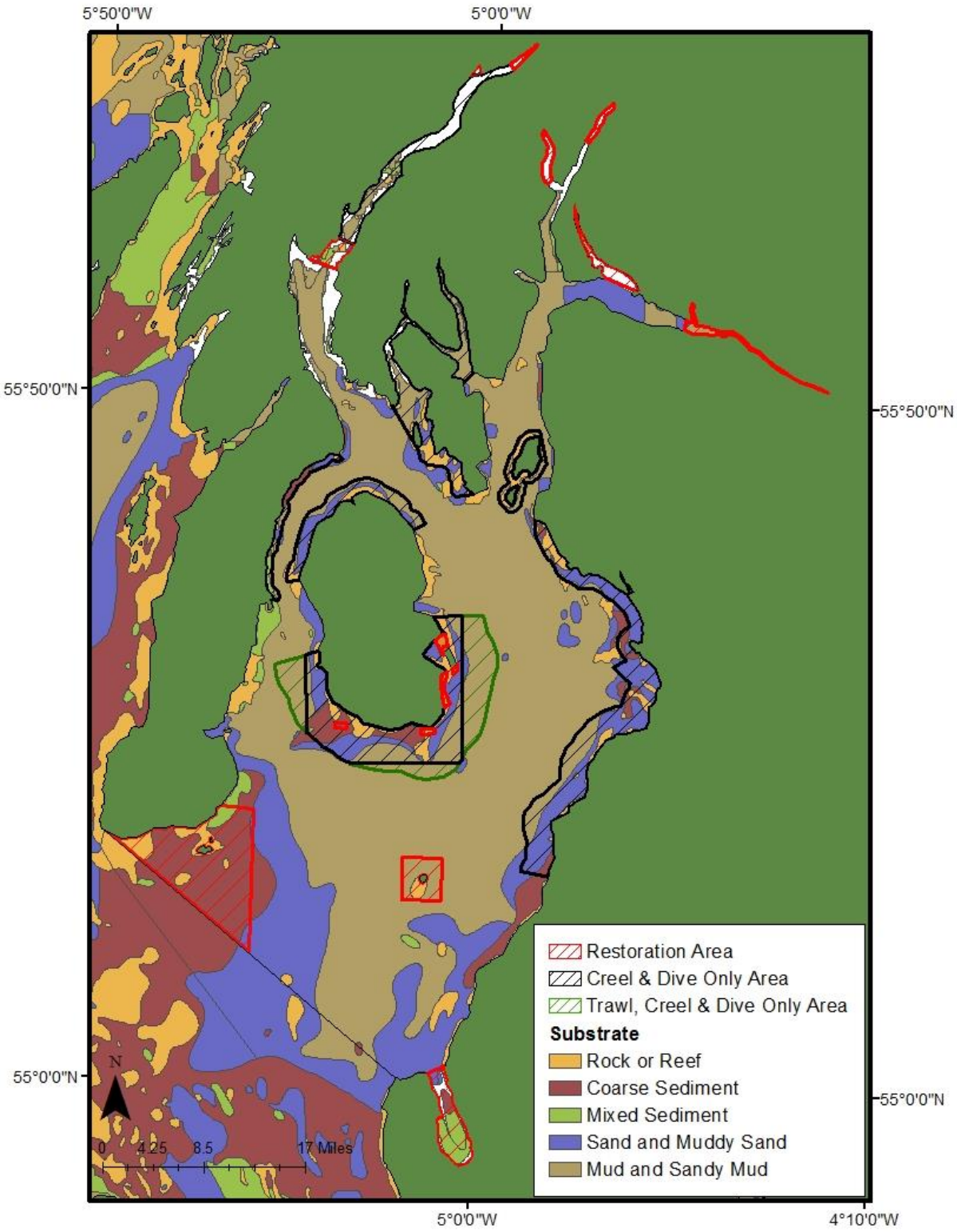


Figure 7 |Complex substrates coverage in the SMZ network

Complex Substrate representation within each SMZ

As well as protecting the majority of complex substrates across the network, the design also protects complex substrate types within individual SMZs. This further assists the SMZ proposals achieve Design Objectives 1, 2, 3 and 6. Where possible, the SMZs have been designed to cover at least two substrate types.

The mix of substrates in each SMZ is detailed in Table 9 below. In some SMZs substrate type has not been noted because adequate high resolution substrate data was unavailable.

Table 9 | Substrate coverage within each SMZ

Zone Ref.	SMZ	Substrate coverage in each site (%)					
		Complex			Muddy		Unknown
		Coarse	Mixed	Rock or Reef	Mud and Sand	Sand and Muddy Sand	
A	Mull of Kintyre	78	4	16		3	
B	Skipness	22	21	11	27	18	
C	Otter Narrows		32	9	2	4	53
D	Upper Loch Fyne		6	2	21	1	70
E	Loch Shira						100
F	Cairndow*						100
G	Loch Goil*						100
H	Upper Loch Long*						100
I	Gareloch		8		41		50
J	Upper Clyde Estuary*						100
K	Ayrshire Coast	8		13	22	58	
L	Loch Ryan	10	53	4		5	26
M	Kyles of Bute		3	22	44	15	17
N	The Cumbraes			46	54		
O	North Arran			21	38	41	
P	South Arran (OVERALL)	12		13	55	20	
P	*South Arran: Creel and Dive Only Areas*	*18*	*	*20*	*30*	*32*	
P	*South Arran: Trawl, Creel and Dive Only Areas*	*		*	*97*	*3*	
P	*South Arran: Restoration Areas*	*29*		*64*		*7*	
Q	Ailsa Craig			15	82		

*No high resolution data

SMZ Key
Creel and Dive Only
Trawl, Creel and Dive Only
Restoration Area

Habitat

Ten broad-scale habitats identified by EUNIS are found in the Clyde– see Table 10. All ten habitats are indicators of fish species presence and are associated with specific marine communities. They form

important nursery, breeding and refuge areas for shellfish and finfish and their protection contributes to the achievement of Design Objectives 1, 2, 3, and 6.

The SMZ network, although only covering 28% of the Clyde, has been designed to maximise protection of all the broad-scale habitat types. Each broad-scale habitat is represented within at least four SMZs. Seven of the broad-scale habitats lie largely within the network. The exceptions are the sublittoral muds and sands largely located in the centre of the Clyde, which remain open to all *Nephrops* and scallop fishing gear. The proposed SMZs coverage of the broad-scale habitat types within the Clyde is shown numerically below and in Table 10.

Table 10 | Area of broad-scale habitats in within the Clyde and within the SMZs

Broad-scale habitats in the Clyde	Extent within the Clyde (km^2)	Extent within the SMZs (km^2)	Total extent with the SMZs (%)	Total zone replicates (number)
Atlantic and Mediterranean high energy infralittoral rock	59.71	40.99	68.66	7
Atlantic and Mediterranean moderate energy infralittoral rock	32	17.96	56.12	8
Atlantic and Mediterranean low energy infralittoral rock	34.99	14.42	41.21	9
Atlantic and Mediterranean high energy circalittoral rock	10.6	6.53	61.6	6
Atlantic and Mediterranean moderate energy circalittoral rock	19.1	12.42	65.03	7
Atlantic and Mediterranean low energy circalittoral rock	54.9	36.48	66.45	8
Sublittoral coarse sediment	275	191.28	69.55	5
Sublittoral sand	694	200.25	28.85	10
Sublittoral mud	2168	310.79	14.34	10
Sublittoral mixed sediments	72.4	37.07	51.2	6

Habitat representation within each SMZ

As well as proposing significant coverage of broad-scale habitat type across the SMZ network, the design also protects habitat types within individual SMZs, as shown in Table 12. Where possible, the SMZs have been designed to cover at least two broad-scale habitats. This additional complexity further assists the SMZ proposals achieve Design Objectives 1, 2, 3 and 6. The mix of broad-scale habitats in each SMZ is detailed in Table 11 and Figure 8 below. In some SMZs broad-scale habitat type has not been noted because adequate high resolution data was unavailable.

Table 11 |Broad-scale habitats present in the Clyde and their associated biological subtypes

	EUNIS Code	EUNIS habitat type Broad-scale habitat	Habitat description*	Associated biological subtypes
Infralittoral rock and other hard substrata	**A3.1**	Atlantic and Mediterranean high energy infralittoral rock	Shallow water rock, below the tides, exposed to very strong waves and currents	- Kelp - Foliose seaweeds and animals, - Dabberlocks (*Alaria esculenta*).
	A3.2	Atlantic and Mediterranean moderate energy infralittoral rock	Shallow water rock, below the tides, with some shelter from waves and currents	- Kelp (*Laminaria digitata*) - Seaweeds: predominantly reds and including a greater variety of more delicate filamentous types than found on more exposed coasts
	A3.3	Atlantic and Mediterranean low energy infralittoral rock	Shallow water rock, below the tides, sheltered from waves and currents	- Kelp - Seaweed - Animal-dominated communities
Circalittoral rock and other hard substrata	A4.1	Atlantic and Mediterranean high energy circalittoral rock	Deeper water rock, exposed to very strong waves and currents	- Sponges such as *Pachymatisma johnstonia*, *Halichondria panicea, Esperiopsis fucorum* and *Myxilla incrustans* - Oaten pipes hydroid (*Tubularia indivisa).* - Barnacle *Balanus crenatus* is recorded in high abundance on the rocky substrata. - *Dead man's fingers (Alcyonium digitatum)* is often present.
	A4.2	Atlantic and Mediterranean moderate energy circalittoral rock	Deeper water rock, with some shelter from waves and currents	- Echinoderms and crustose communities - Sabellaria reefs - Circalittoral mussel beds
	A4.3	Atlantic and Mediterranean low energy circalittoral rock	Deeper water rock, sheltered from waves and currents	- Encrusting red algae, - Brachiopods (*Neocrania anomala*) - Sea squirts- ascidians (*Ciona intestinalis* and *Ascidia mentula*)
Sublittoral sediments	A5.1	Sublittoral coarse sediment	Coarse sediments which are often unstable due to tidal currents and/or wave action	- Robust fauna including venerid bivalves

	EUNIS Code	EUNIS habitat type Broad-scale habitat	Habitat description*	Associated biological subtypes
	A5.2	Sublittoral sand	Such habitats are often subject to a degree of wave action or tidal currents which restrict the silt and clay content to less than 15%.	- Polychaetes, - Bivalve molluscs - Amphipod crustacea.
	A5.3	Sublittoral mud	Predominantly found in sheltered areas where the reduced influence of wave action and/or tidal streams allow fine sediments to settle.	- Polychaetes - Echinoderms, in particular brittlestars such as Amphiura spp. - Seapens such as *Virgularia mirabilis* and - Burrowing megafauna including *Nephrops*
	A5.4	Sublittoral mixed sediments	Predominantly found from the extreme low water mark to deep offshore circalittoral habitats. These habitats incorporate a range of sediments including heterogeneous muddy gravelly sands and also mosaics of cobbles and pebbles embedded in or lying upon sand, gravel or mud.	- Infauna and epibiota including polychaetes, bivalves, echinoderms, anemones, hydroids and Bryozoa.

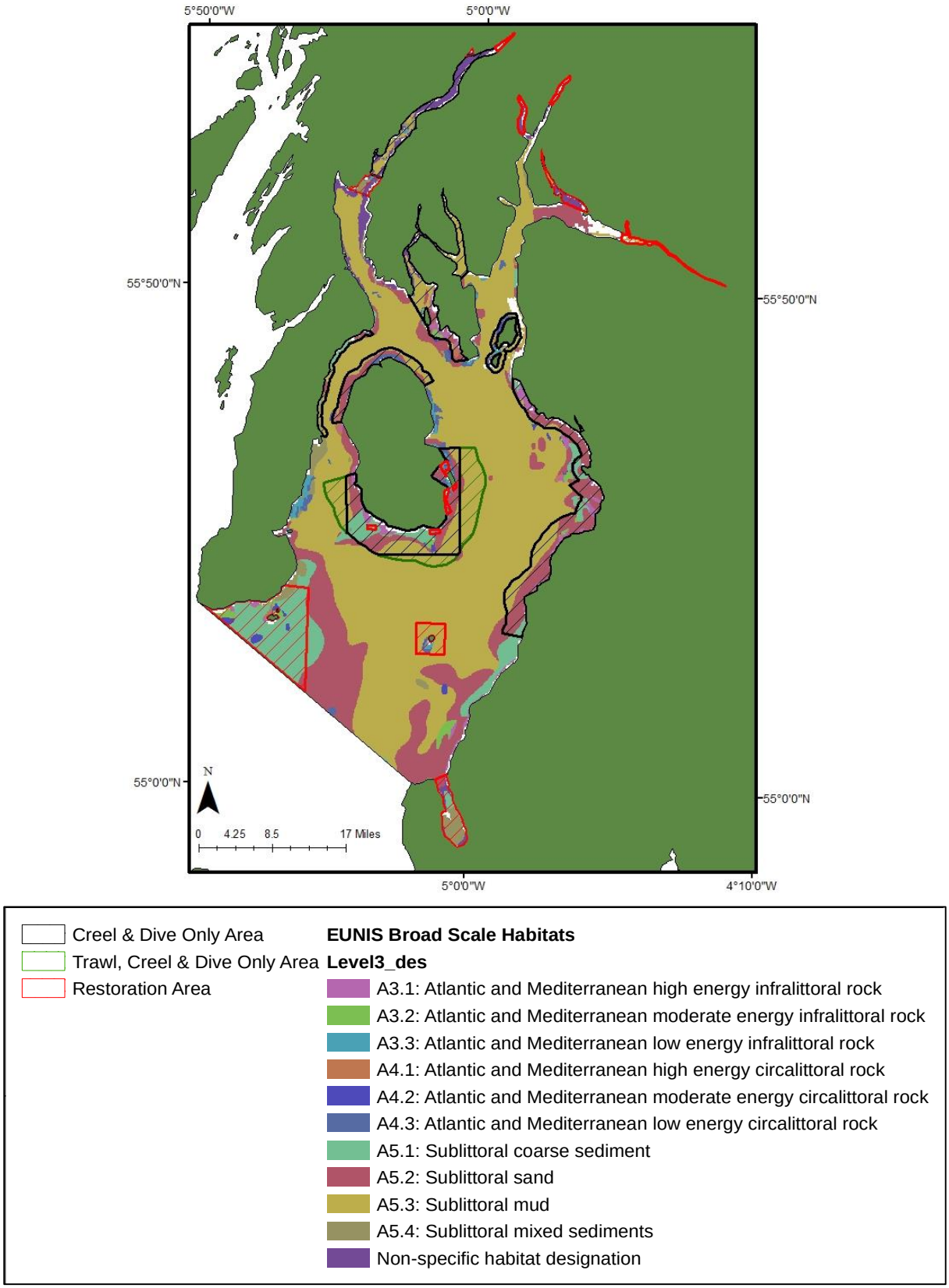


Figure 8 | Broad-scale seabed habitats and the SMZ network

Table 12| EUNIS broad-scale habitats present in the SMZs

Zone Ref.	SMZ	Percentage of habitat within SMZ (%)												
		Infralittoral rock and other hard substrata			Circalittoral rock and other hard substrata			Sublittoral sediment						
		Atlantic and Mediterranean high energy infralittoral rock	Atlantic and Mediterranean moderate energy infralittoral rock	Atlantic and Mediterranean low energy infralittoral rock	Atlantic and Mediterranean high energy circalittoral rock	Atlantic and Mediterranean moderate energy circalittoral rock	Atlantic and Mediterranean low energy circalittoral rock	Sublittoral coarse sediment	Sublittoral sand	Sublittoral mud	Sublittoral mixed sediments	Non-specific habitat designation**	Unknown	Total number broad-scale habitats covered in each SMZ
A	Mull of Kintyre	2	5		1	5		81	3		3			7
B	Skipness			1			3	22	17	33	24			6
C	Otter Narrows			3	*		5		2	1	28	30	25	6
D	Upper Loch Fyne		*	2			*		*	19	4	50	25	6
E	Loch Shira													
F	Cairndow													
G	Loch Goil													
H	Upper Loch Long													
I	Gareloch								*	22		55	23	2
J	Upper Clyde Estuary													
K	Ayrshire Coast	10	1	*	*	*		7	53	21			7	8
L	Loch Ryan	1	2					10	7		48	15		5

Zone Ref.	SMZ	Percentage of habitat within SMZ (%)												
		Infralittoral rock and other hard substrata			Circalittoral rock and other hard substrata			Sublittoral sediment						
		Atlantic and Mediterranean high energy infralittoral rock	Atlantic and Mediterranean moderate energy infralittoral rock	Atlantic and Mediterranean low energy infralittoral rock	Atlantic and Mediterranean high energy circalittoral rock	Atlantic and Mediterranean moderate energy circalittoral rock	Atlantic and Mediterranean low energy circalittoral rock	Sublittoral coarse sediment	Sublittoral sand	Sublittoral mud	Sublittoral mixed sediments	Non-specific habitat designation**	Unknown	Total number broad-scale habitats covered in each SMZ
M	Kyles of Bute	8	3	1	3	*	1		11	41	2	7	22	9
N	The Cumbraes	1	3	8	2	10	9			54				7
O	North Arran	3	*	*	3	*	11		40	39				8
P	South Arran (Overall)	5	2	5		*	4	13	28	37			7	8
P	*South Arran: Creel and Dive Only Areas*	5	2	4		*	3	17	32	29	*			
P	*South Arran: Trawl, Creel and Dive Only Areas*			*			*	*	3	96				
P	*South Arran: Restoration Areas*			37			12	23	6		21			
Q	Ailsa Craig			6		1	7			85				4

SMZ Key
Creel and Dive Only
Trawl, Creel and Dive Only
Restoration Area

* presence is less than 1% of the site area

**High energy infralittoral seabed; low energy circalittoral seabed; Low energy infralittoral seabed; moderate energy circalittoral seabed; moderate energy infralittoral seabed; high energy circalittoral seabed and deep circalittoral seabed.

Historic Fishing Activity

In order to minimise the socio-economic impacts of the proposed SMZs, areas with historically high fishing activity within the SMZs where fishing restrictions apply, were minimised. In this way, the SMZs aimed to protect the most important grounds, whilst minimising the displacement of fishing activity in accordance with Design Objective 4 (Minimising impacts on the fishing industry).

Two key fishing activity data sets were analysed when developing the SMZs:

1 Vessel Monitoring Systems (VMS) data, which provides movement data for all registered fishing vessels exceeding 15 metres in overall registered length, and;
2 ScotMap data, which provides fishing activity data for registered vessels of less than 15 metres in overall registered length.

The most recent useable detailed data from VMS was used. However this only covered the years 2010-2012. Furthermore, not all vessels participated in ScotMap. As a result, values are assumed to be an under estimate of total fleet activity. Accordingly our analysis also took into account additional personal communications from members of the fishing industry.

Over 15m Vessels

With the exception of very high scallop dredging activity in parts of the proposed Mull of Kintyre SMZ and very high trawling activity in the South Arran SMZ, the SMZs have been designed to largely avoid the areas of dense fishing activity for over 15m vessels. Most of the SMZ network is located in areas which (from VMS data) are subject to very low mobile gear activity.

Whilst it might seem superfluous to prohibit gears which are rarely used, it should be recognised that even very low fishing density can cause harm to substrates and habitats. So the cessation of all mobile gear fishing activities will help meet the Design Objectives. Figure 9 shows the SMZs overlaid with the over-15 metre *Nephrops* trawl and scallop dredge fishing fleet fishing data.

For more information on the data analysis and methodology, see Appendix B.

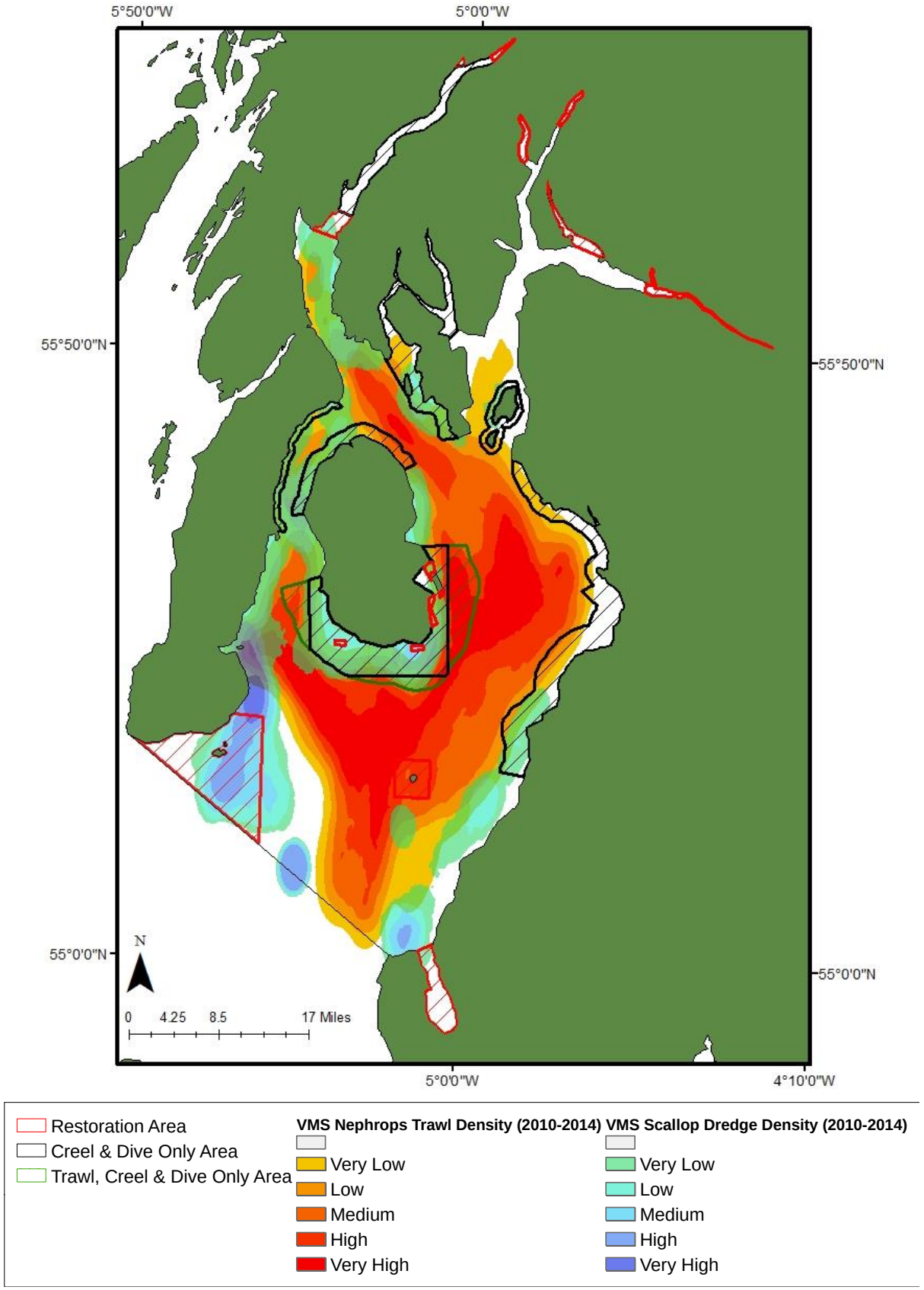


Figure 9| Interaction between the SMZs and the over 15m scallop and *Nephrops* fishing activity

Under 15m Vessels

There are significant anomalies in the under 15m data: for example ScotMap indicates that there is monetary value from creeling in some polygons where no creeling activity occurs (see Figure 11). Nevertheless, in the absence of superior data, efforts have been made to minimise inclusion of areas which are densely fished by under 15m vessels within the SMZs. Figures 10 to Figure 13 show the SMM overlaid with the under 15 metre *Nephrops* and scallop fishing fleet fishing data.

Interaction with current spatial management measures

There are already a number of spatial management measures in the Clyde. Where possible, the SMM takes these current spatial management measures into account. These are set out in Table 13 which sets out the extent that the existing measures are aligned with the SMM.

Figure 14 illustrates the interaction between the Spatial Management Measures and the current management measures in place.

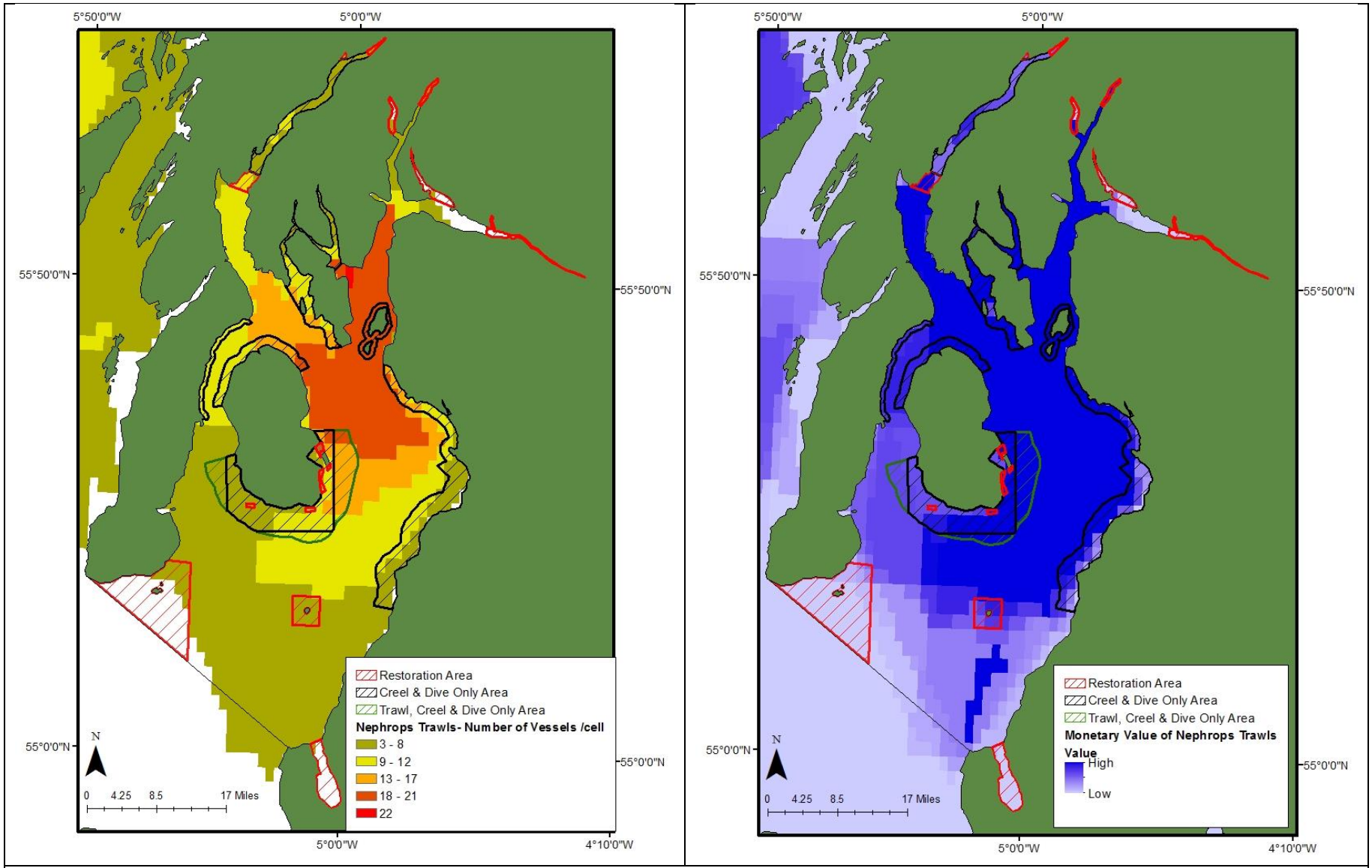


Figure 10 | Interaction between the proposed Spatial Management Measures and a) number of *Nephrops* trawls (>15m) and b) monetary value of *Nephrops* trawls.

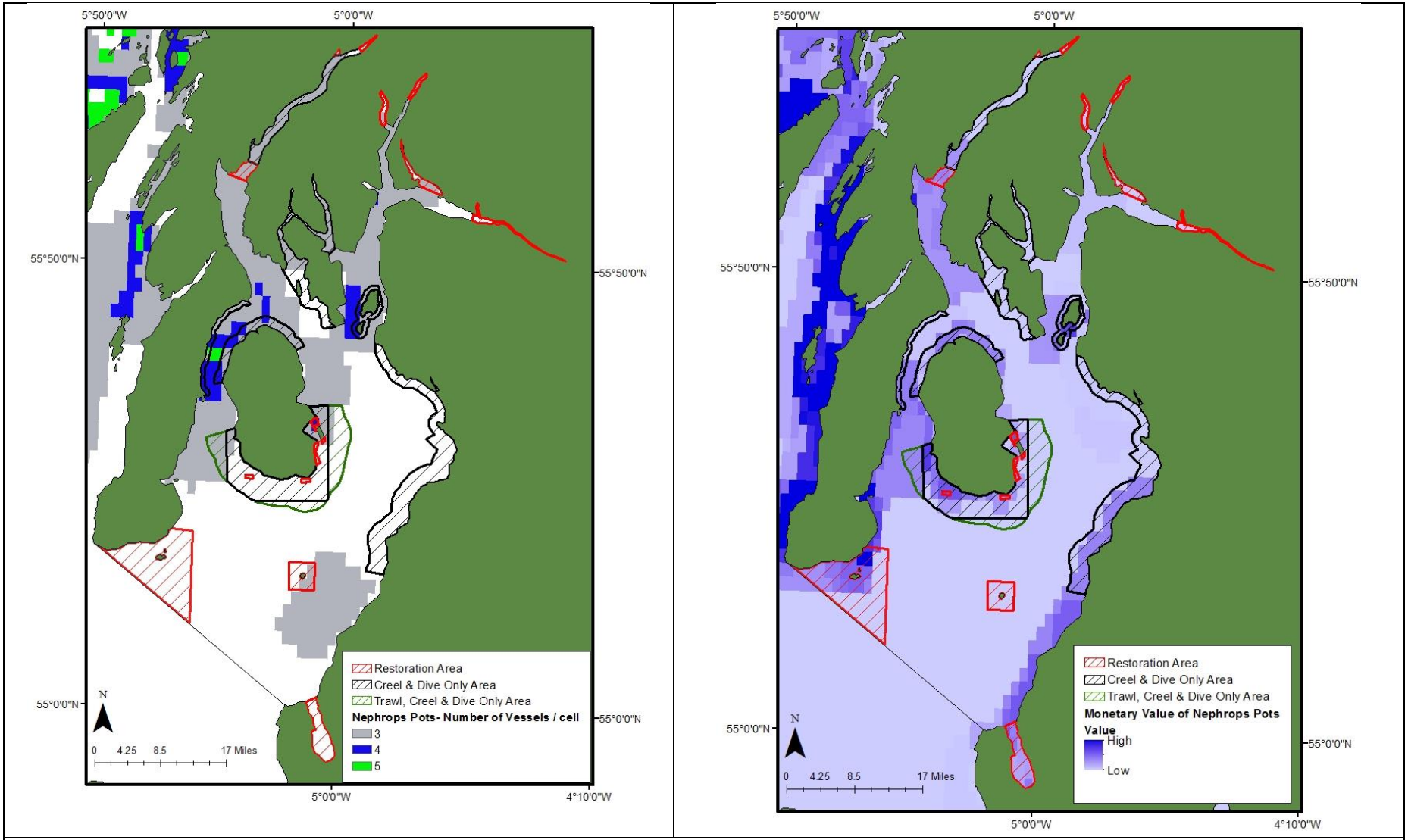


Figure 11 | Interaction between the proposed Spatial Management Measures and a) number of *Nephrops* creels (>15m) and b) monetary value of *Nephrops* creels.

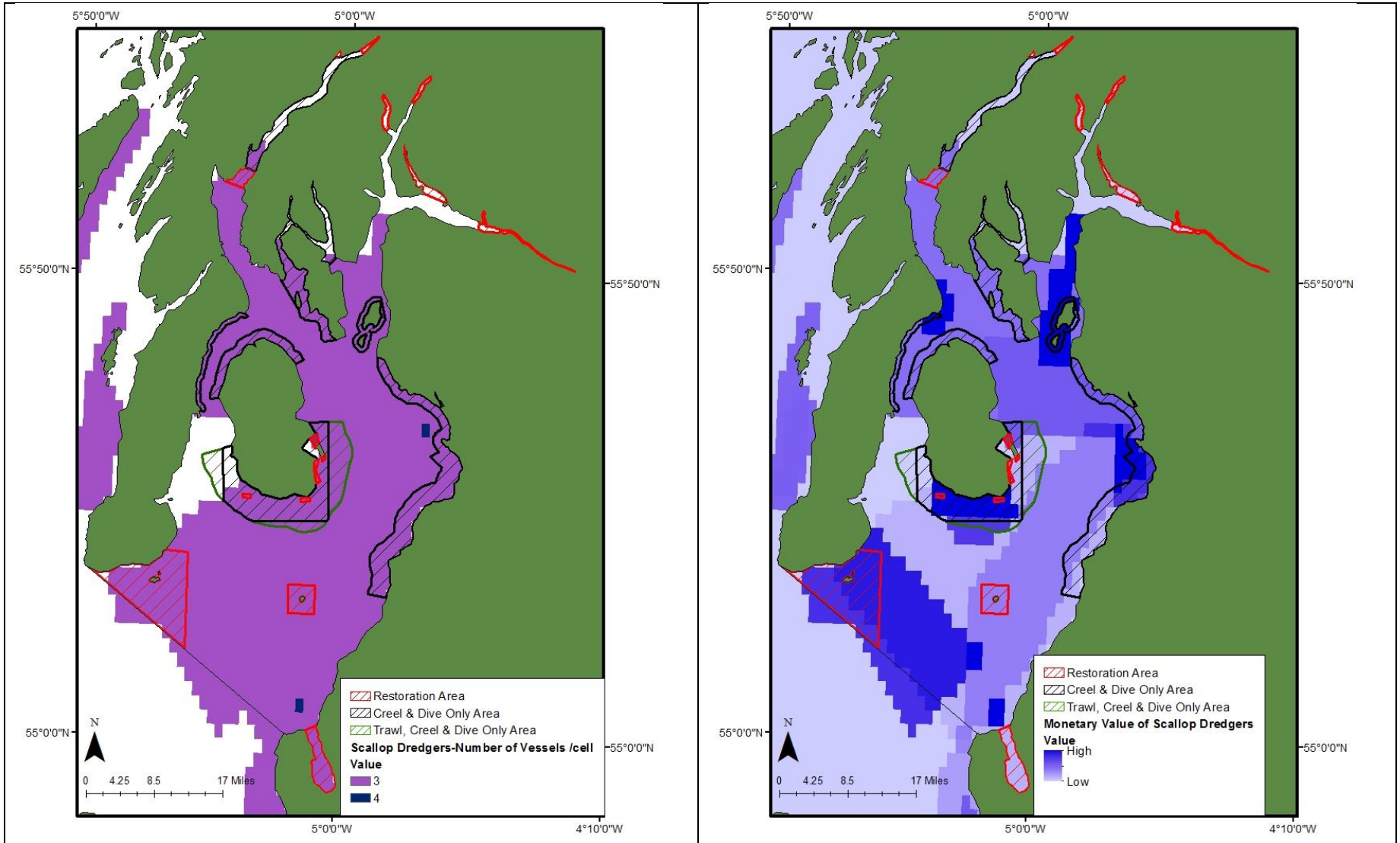


Figure 12| Interaction between the proposed Spatial Management Measures and a) number of scallop dredgers (>15m) and b) monetary value of scallop dredgers.

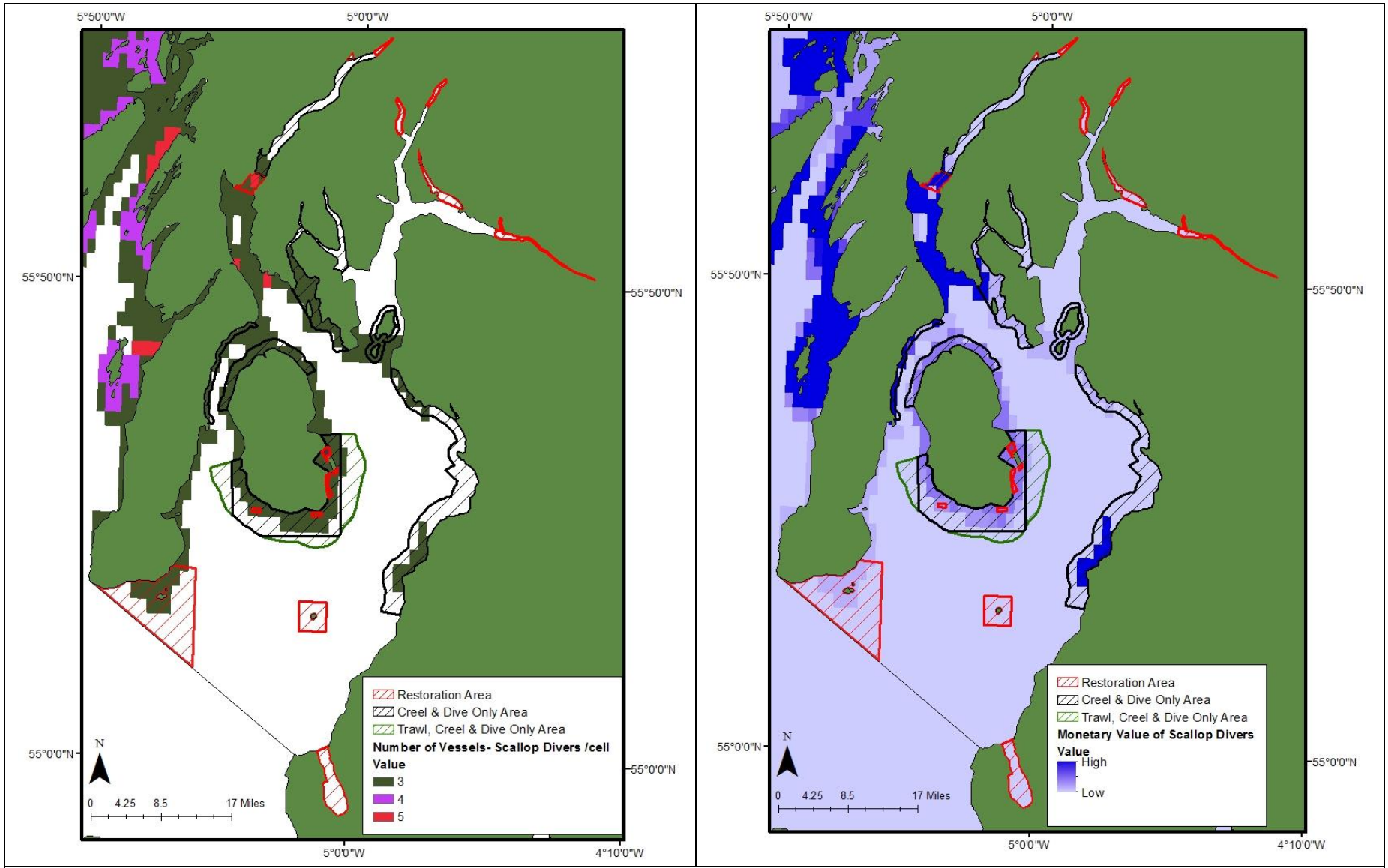
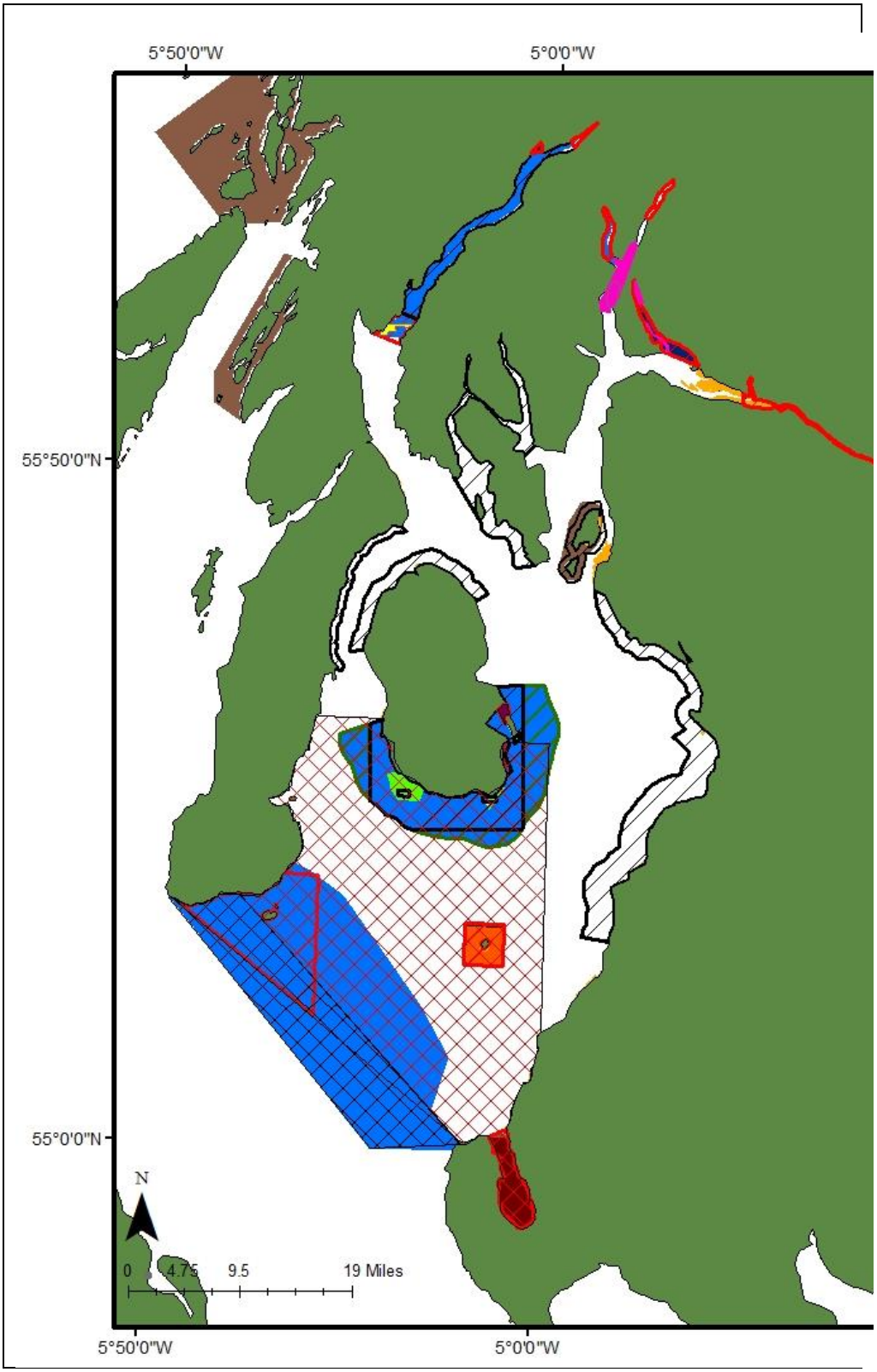


Figure 13 | Interaction between the proposed Spatial Management Measures and a) number of scallop divers (>15m) and b) monetary value of scallop divers.


5°50'0"W
5°0'0"W
55°50'0"N
55°0'0"N
N
0
4.75
9.5
19 Miles
5°50'0"W
5°0'0"W

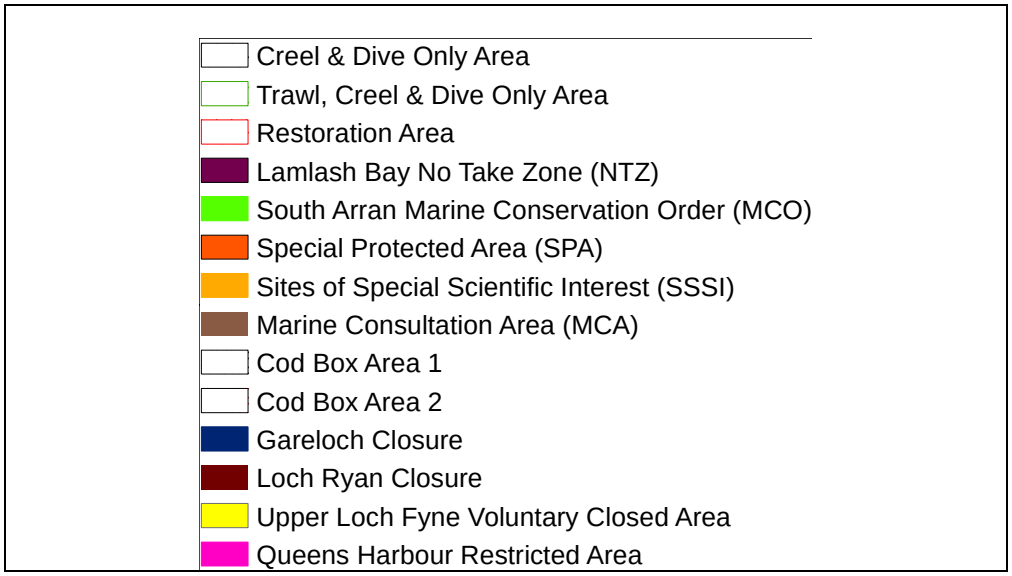


Figure 14| Interaction between the proposed Spatial Management Measures and the current spatial management measures in place in the Clyde.

Table 13 | Interaction between SMZs and current spatial measures.

Spatial management measure	Site	Interaction with SMM	% covered within SMM
Marine Protected Area (MPA)	South Arran	Full management replication	100
	Upper Loch Fyne and Loch Goil	Full management replication	100
	Clyde Sea Sill	Full management replication	100
No Take Zone (NTZ)	Lamlash Bay	Full management replication	100
Marine Conservation Order	South Arran	Management replication	100
Special Protection Area (SPA)	Inner Clyde Estuary	Restoration Area	100
	Ailsa Craig	Restoration Area	100
Site of Specific Scientific Interest (SSSI)	Ballochmartin Bay	Creel & Dive Only	100
	Kames Bay	Creel & Dive Only	100

Marine Consultation Area (MCA)	Cumbraes	Creel & Dive Only	83
Cod Box	Area 1	Restoration Area	25
	Area 2	South Arran	19
Gareloch		Restoration Area	100
Loch Ryan		Restoration Area	100
Upper Loch Fyne Voluntary Closures	Loch Shira	Restoration Area	100
	Upper Loch Fyne	Restoration Area	100
	Otter Spit	Restoration Area	100

Spatial Management Zones; Detailed Analysis

The following section contains detailed analysis of each of the 17 SMZs proposed under the Clyde Regulating Order.

Spatial Management Zone A, Mull of Kintyre; Restoration Area

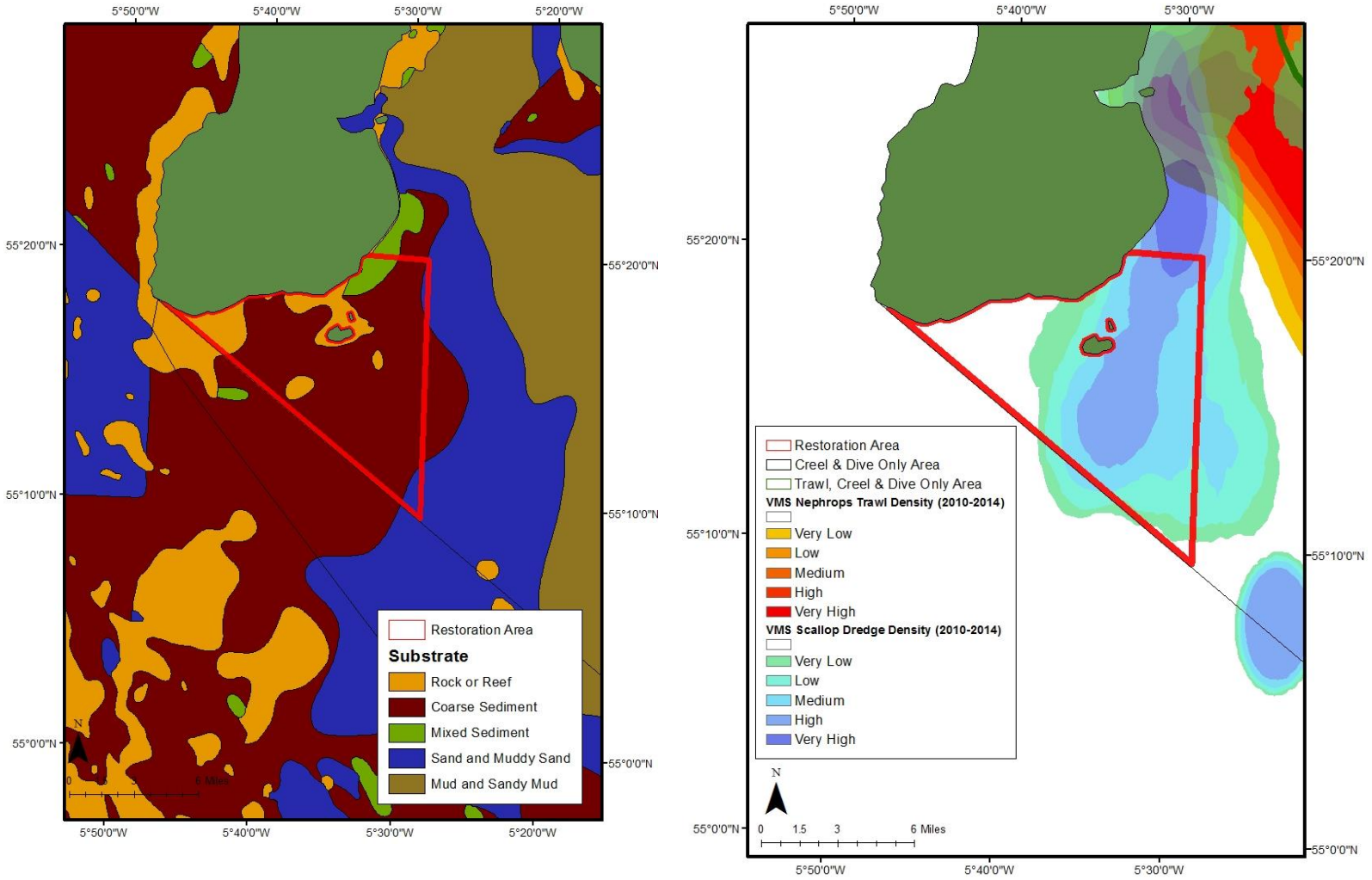


Figure 15 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the Mull of Kintyre SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Location

The Mull of Kintyre Restoration Area is located at the southern end of the Kintyre peninsula. The landward boundary follows the mean low water springs, from the Mull of Kintyre (55°18.127”N, 5°48.036”W) in the west to Macharioch in the east (55°20.138”N, 5°33.026”W). The seaward boundary runs eastwards on a bearing of 90° from Macharioch for 4.8km and then 180° to intersect with a southern seaward boundary running from Mull of Kintyre along the Clyde Regulating Order closing line) (**Figure 15**). The zone covers 178km^2.

Physical characteristics

The SMZ contains a mixture of substrates, predominantly coarse sediment with areas of rock and reef (Table 9). The SMZ covers seven broad-scale habitats. Sublittoral coarse sediment is the most widespread habitat within the zone, occupying 80% of the proposed Restoration Area (Table 12).

The deepest point in the zone is 105 metres below Chart Datum with the deepest section running parallel to the Clyde Regulating Order closing line.

Fishing Activity

Fishing Data indicate that scallop dredging is the main method of fishing within the SMZ (Table 14).

Table 14| Summary of assumed commercial scallop and *Nephrops* fishing activity within the Mull of Kintyre Restoration Area SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	0.04% of VMS *Nephrops* polls were located within the SMZ.
	Under 15m	ScotMap Data indicate; Fishing Activity: 3-8 vessels fish the north east corner of the SMZ Monetary Value: low
Nephrops creel	Under 15m	ScotMap Data indicate; Fishing activity: none Monetary Value: (null)
Scallop Dredge	Over 15m	20.13% of VMS scallop dredge polls were located within the SMZ
	Under 15m	ScotMap Data indicate; Fishing activity: throughout the SMZ Monetary value: high
Scallop diving	Under 15m	ScotMap Data indicate; Fishing activity: 3 scallop divers fish around Monetary value: low

Interaction with existing spatial management measures

The SMZ interacts with two existing management measures:

1 Clyde Sea Sill Nature Conservation Marine Protected Area Order 2014
2 The Sea Fish (Prohibited Methods of Fishing) (Firth of Clyde) Order 2007

Proposed Management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The specific Design Objectives considered when designing the Mull of Kintyre SMZ are set out below (Table 15).

Table 15 | Design Objectives rationale relating to the Mull of Kintyre Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- N/A
2	**Promoting scallop fishery sustainability**	- Potential for larval export - Limited flow of water across the Clyde sea sill indicates larvae should be retained in the Clyde. - Encourage spat settling due to improved habitat protection - Sublittoral coarse sediment
3	**Promoting finfish recovery**	- 27% of the Clyde's complex substrates are found within the SMZ. - 82% of the SMZ is covered by Subtidal coarse sediment which provides important nursery grounds for many ecologically and commercially important fish and supports seabirds. - The zone is located within an area of productive tidal fronts and is an area of additional ecological importance to pelagic species, and as a spawning and nursery area for fish species. - Proposed features such as rock habitats are characterised by high species diversity and support commercial fisheries species.
4	**Minimising impacts on the fishing industry**	- No ports located in the immediate vicinity of the SMZ. - Analysis of the potential displacement effects of the SMZ on the *Nephrops* and scallop fishing fleet indicates that there will be minimal potential for displacement on the *Nephrops* fishery and on scallop diving. Data indicate that scallop dredging will be displaced. - Straight boundary lines will make the SMZ easier to enforce
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The zone is covered by the Clyde Sea Sill MPA. The SMZ encompasses the following MPA priority features; • Circalittoral sand • Coarse sediment communities - The SMZ cover 5% of the Cod Box under The Sea Fish (Prohibited Methods of Fishing) (Firth of Clyde) Order 2007 - The SMZ contains 27% of the Clyde's complex substrates and seven broad-scale habitats which with further protection can contribute to ecosystem resilience.

Spatial Management Zone B, Skipness, Creel and Dive Only

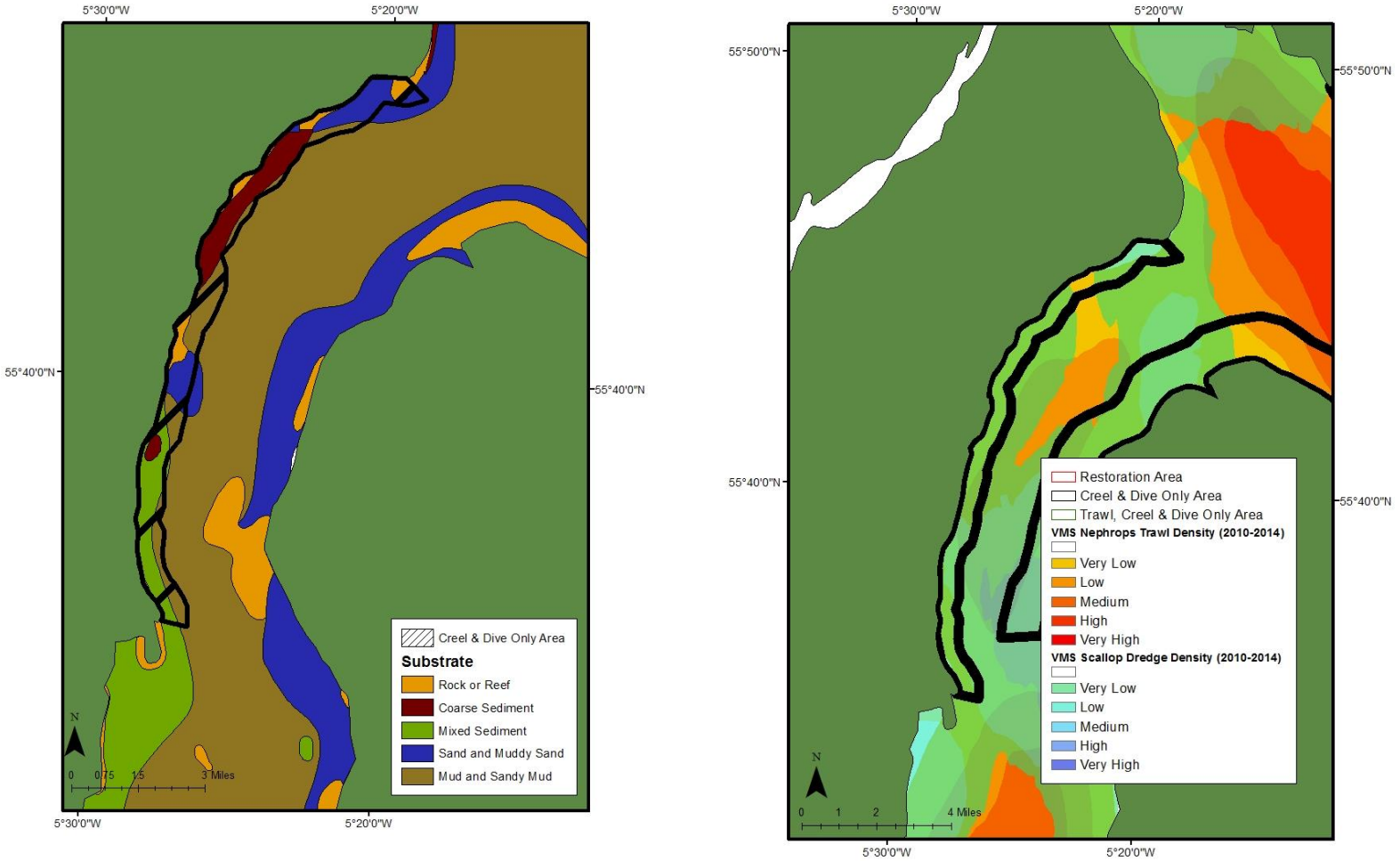


Figure 16 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the Skipness SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Location

The Skipness Creel and Dive Only SMZ is located on the Kintyre coast. The SMZ extends from mean low water springs mark approximately 0.5 NM offshore and extends 24km from Skipness Point (55°45.933”N, 5°19.477”W) in the north to Carradale (55°35.254”N, 5°27.31”W) in the south (**Figure 16**). The SMZ covers 23km$^{2.}$

Physical characteristics

The SMZ contains a range of substrates with 55% of the SMZ covered by complex substrate (Table 9). The SMZ covers six broad-scale habitats. Sublittoral mud, sublittoral mixed sediments and sublittoral coarse sediments are the most widespread occupying 79% of the proposed SMZ (Table 12).

The SMZ is relatively shallow with the deepest point at 23 metres below Chart Datum. The deepest section runs parallel to the eastern boundary down the Kilbrannan Sound. Bathymetric Data indicate that the SMZ slopes steeply away from the shore.

Fishing activity

Fishing Data indicate that the SMZ is fished by scallop dredge, *Nephrops* trawls, creels and divers. See Table 16 for details.

Table 16 | Summary of assumed commercial scallop and *Nephrops* fishing activity within the Skipness Creel and Dive Only SMZ

Activity	Sector	Possible displacement
Nephrops Trawl	Over 15m	0.08 %of VMS *Nephrops* trawl polls were located within the SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing activity: fished by 9-12 vessels throughout Monetary value: high
Nephrops creel	Under 15m	**ScotMap Data indicate;** Fishing Activity: fished by 3-5 vessels throughout Monetary Value: low- medium
Scallop Dredge	Over 15m	2.84% of scallop dredge polls were located within the SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing Activity: throughout Monetary Value: medium
Scallop divers	Under 15m	**ScotMap Data indicate;** Fishing Activity: scallop diving takes place throughout this area. Monetary Value: high

Interaction with existing spatial management measures

The SMZ does not interact with any existing spatial management measures.

Proposed management

Prohibition on the use of all commercial mobile fishing gear and practices for *Nephrops,* king and queen scallop throughout the SMZ.

Rationale

The specific Design Objectives considered when designing the Skipness SMZ are set out below (Table 17).

Table 17| Design Objectives relating to the Skipness Creel and Dive Only SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- Potential for larval export - Encourage spat settling due to improved habitat protection - 45% of the SMZ is covered by muddy substrates - 33% of the SMZ is covered by sublittoral mud habitat
2	**Promoting scallop fishery sustainability**	- Potential for larval export which will assist recruitment in the adjacent scallop fishing grounds - Complex substrate suitable for encouraging scallop spat settlement covers 54% of the area - 22% of the SMZ is covered by sublittoral coarse sediment
3	**Promoting finfish recovery**	- 24 % of the SMZ is covered by sublittoral mixed sediments which can provide shelter for associated communities. - Encourage fish spawn to settle due to improved habitat protection
4	**Minimising impacts on the fishing industry**	- No ports are located within the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on the fishing fleet indicates that the under 15m scallop dredge and *Nephrops* trawl fleet may be displaced from the SMZ. - Follows 0.5 NM boundary
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ covers a range of complex substrates and broad scale habitats which with additional management can contribute to ecosystem resilience.

Spatial Management Zones; Upper Loch Fyne Network

Within Upper Loch Fyne, four SMZs are proposed (Figure 17).

- ZONE D: Upper Loch Fyne, Creel and Dive Only SMZ
- ZONE E: Loch Shira, Restoration Area SMZ
- ZONE F: Cairndow, Restoration Area SMZ

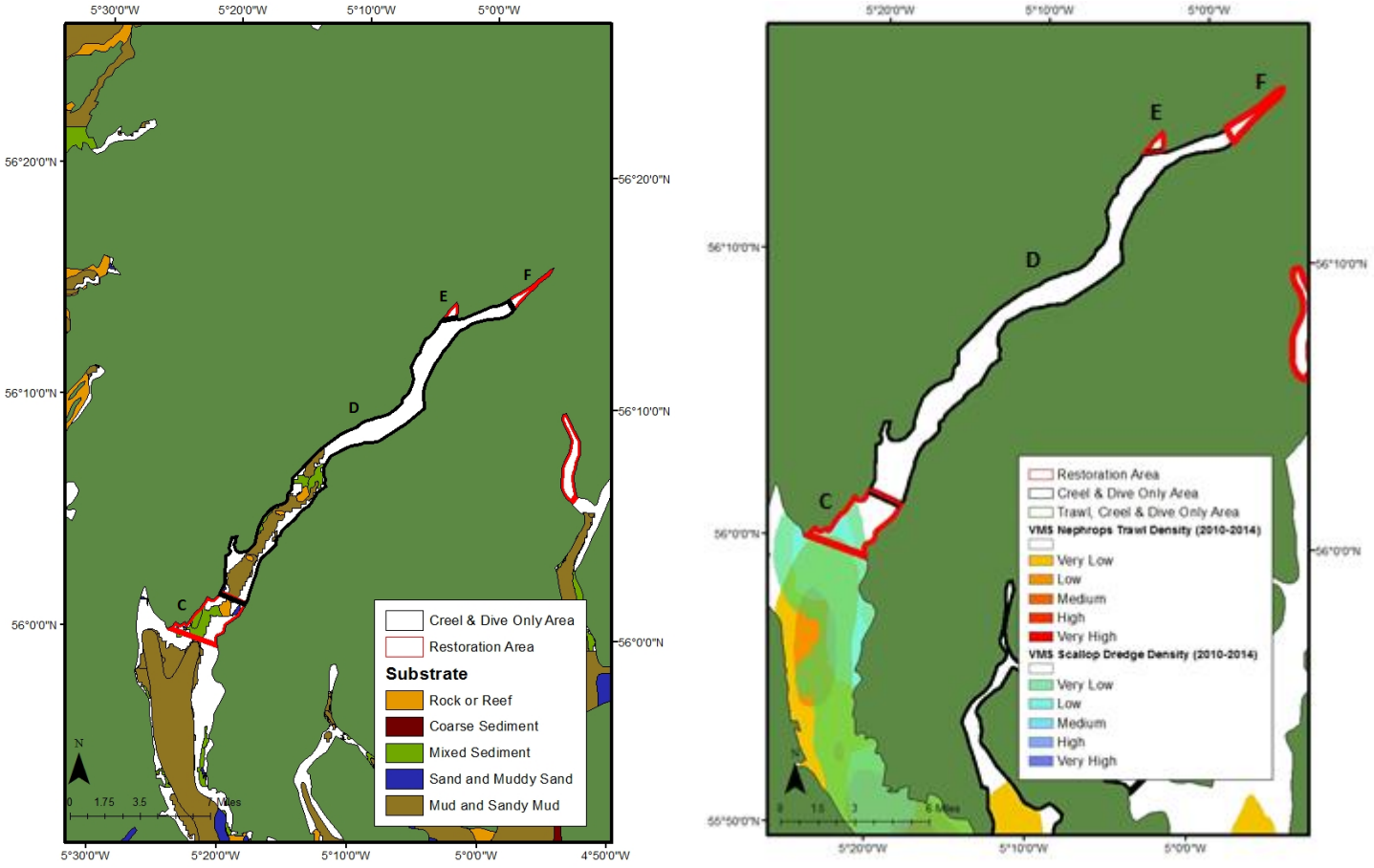


Figure 17 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the Upper Loch Fyne SMZs. The landward boundary of the SMZs follow mean low water springs (MLWS).

Spatial Management Zone C, Otter Narrows, Restoration Area SMZ

Location

The Otter Narrows Restoration Area SMZ is located in Upper Loch Fyne. The northern limit of the SMZ runs in a straight line from Silver Craigs (55°59.827”N, 005°23.340”W) to Ballimore (55°59.762”N, 005°50.512”W) and the southern limit runs in a straight line from Largiemore (56°1.141”N, 005°18.334”W) to Port Ann (56°1.641”N, 005°26.405”W). The landward boundaries of the SMZ follow mean low water springs. The SMZ covers 12km^2.

Physical characteristics

The majority of the known substrate in the SMZ is complex (Table 9). The SMZ covers six broad-scale habitats. Sublittoral mixed sediment is the most widespread habitat occupying 28 % of the SMZ (Table 12).

Bathymetric Data indicate that the SMZ slopes down steeply towards the middle. The deepest point in the SMZ is 74 metres below Chart Datum.

Fishing activity

Fishing Data indicate that this SMZ is fished by *Nephrops* trawls, scallop dredgers and scallop divers (Table 18).

Table 18 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the Otter Narrows Restoration Area SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity : there are up to 12 under 15m *Nephrops* trawlers that fish the SMZ Monetary value: high
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing activity : none Monetary value: null
Scallop Dredge	Over 15m	0.56% of the VMS scallop dredge polls were located within the Otter Narrows SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing activity : throughout Monetary value: medium
Scallop Divers	Under 15m	**ScotMap Data indicate;** Fishing activity : throughout Monetary value: high

Interaction with existing spatial management measures

The SMZ interacts with two existing management measures;

1 The Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014. The management measures associated with this Marine Protected Area have not

been finalised but it is proposed that within certain areas of the MPA, no suction dredge, mechanical dredge, beam trawl, demersal trawl and static gear is permitted.

2 Otter Narrows Scottish Fishermen's Federation (SFF) voluntary closed areas (2014): Members of the SFF have implemented a voluntary agreement that prohibits the use of all commercial gear within the proposed SMZ.

Proposed management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops,* king and queen scallop throughout the SMZ.

Rationale

The Design Objectives considered for the Otter Narrows Restoration Area SMZ are set out below (Table 19).

Table 19 | Design Objectives relating to the Otter Narrows Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- N/A
2	**Promoting scallop fishery sustainability**	- N/A
3	**Promoting finfish recovery**	- 41% of the SMZ is covered by complex substrates - Six broad-scale habitats are covered - 28% of the SMZ is covered by Sublittoral mixed sediment which is an important nursery habitat.
4	**Minimising impacts on the fishing industry**	- There are no ports located in the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on the *Nephrops* and scallop fishing fleet indicates that there may be no displacement on scallop diving and the under 15m scallop and *Nephrops* vessels. - Straight boundary line
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ falls within the Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014 boundary. - The SMZ encompasses the following MPA protected habitats and priority features (Howson et al, 2012): • Burrowed mud habitat • Flame shell beds habitat • Horse mussel beds habitat • Ocean quahog aggregations • Low or limited mobility species Sublittoral mud and specific mixed sediment communities - The SMZ contains several priority features and vulnerable habitats which with additional management can contribute to ecosystem resilience.

Spatial Management Zone D, Upper Loch Fyne; Creel and Dive Only

Location

The Upper Loch Fyne Creel and Dive Only SMZ is located in the upper region of Loch Fyne. The zone extends approximately 33km from Port Ann (56°1.641”N, 005°26.405”W) to south of Carindow (56°14.641”N, 004°58.59”W). The landward boundary of the SMZ follow the mean low water springs mark. The SMZ covers 60km^2.

Physical characteristics

The British Geological Society (BGS) dataset does not provide information on substrate coverage in the SMZ. Data from Marine Scotland indicate it predominantly comprises burrowed mud. There are six broad scale habitats within the SMZ and the sublittoral mud and sublittoral mixed sediment are widely distributed within Upper Loch Fyne.

Bathymetric Data indicate that the SMZ slopes steeply away from the shore. This SMZ is one of the deepest in the network with the deepest point at around 132 metres below Chart Datum.

Fishing activity

Fishing Data indicate that the SMZ is fished by *Nephrops* trawls, creeling, scallop dredgers and scallop divers (Table 20).

Table 20 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the Upper Loch Fyn SMZ

Fishing gear	Sector	Fishing activity within the SMZ
Nephrops trawl	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity : fished throughout Monetary value: medium-high
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing activity :fished throughout Monetary value: low-medium
Scallop Dredge	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity : fished in the south Monetary value: low-medium
Scallop Divers	Under 15m	**ScotMap Data indicate;** Fishing activity : fished in the south Monetary value: low

Interaction with existing spatial management measures

The Upper Loch Fyne Creel and Dive Only SMZ interacts with The Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014. The management measures associated with this Marine Protected Area have not been finalised however it is proposed that within certain areas of the MPA, no suction dredge, mechanical dredge, beam trawl or demersal trawl will be permitted.

Proposed management

Prohibition on the use of all commercial mobile fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives considered for the Upper Loch Fyne Creel and Dive Only SMZ (Table 21).

Table 21 | Design Objectives relating to the Upper Loch Fyne Creel and Dive Only SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- Potential for larval export - Encourage spat settling due to improved habitat protection - Majority of the SMZ is covered by burrowed mud - 19% of the zone is covered by sublittoral mud habitat
2	**Promoting scallop fishery sustainability**	- Potential for larval export - According to the location of known substrates, 8% of the SMZ is comprised of complex substrates
3	**Promoting finfish recovery**	- Sheltered loch - According to the location of known substrates, 8% of the SMZ is comprised of complex substrates - 4% of the SMZ is sublittoral mixed sediment
4	**Minimising impacts on the fishing industry**	- There are no ports located in the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on the fishing fleet indicates that there may be displacement on all forms of *Nephrops* and scallop fishing. - Straight closing line
5	**Minimising user conflicts**	- Area known for inter-gear conflict.
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ is included within the Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014 boundaries. - The SMZ encompasses the following MPA protected habitats and priority features (Howson et al, 2012): • Burrowed mud Habitat • Flame shell beds Habitat • Horse mussel beds Habitat • Ocean quahog aggregations • Low or limited mobility species Sublittoral mud and specific mixed sediment communities - The SMZ contains several priority features and vulnerable habitats which with additional management can contribute to ecosystem resilience.

Spatial Management Zone E, Loch Shira; Restoration Area

Location

The Loch Shira Restoration Area SMZ is located in Upper Loch Fyne. The landward boundary follows mean low water springs from Inverary (56°13.667”N, 005°3.965”W) in the west to Strone Point

(56°13.81”N, 005°2.551”W) in the east. The seaward boundary runs in a straight line 1.5km from Inverary to Strone Point. The SMZ is the smallest in the network and covers 1km^2.

Physical characteristics

The BGS dataset does not provide information on substrate coverage for the SMZ. Data from Marine Scotland indicate it predominantly comprises burrowed mud. Due to a lack of high resolution data, it is unknown if there are any broad scale habitats within the SMZ. The deepest point in the proposed SMZ is 100 metres below Chart Datum.

Fishing activity

Fishing data indicts that there is no commercial fishing taking place within the SMZ (Table 22).

Table 22 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the Loch Shira Restoration Area SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	**Over 15m**	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: null
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing activity : none Monetary value: null
Scallop Dredge	Over 15m	No activity
	Under 15m	**ScotMap Data indicate**; Fishing activity : none Monetary value: null
Scallop Divers	Under 15m	**ScotMap Data indicate;** Fishing activity : none Monetary value: null

Interaction with existing spatial management measures

The SMZ interacts with two existing management measures;

1 The Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014: The management measures associated with this Marine Protected Area have not been finalised but it is proposed that within certain areas of the MPA, no suction dredge, mechanical dredge, beam trawl or demersal trawl will be permitted.

2 Loch Shira Clyde Fishermen’s Association (CFA) voluntary agreement: Members of the Clyde Fishermen’s Association have implemented a voluntary agreement which prohibits the use of mobile gear in waters less than 15m depth within Loch Shira (SNH, 2014)

Proposed management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

e. Rationale

The Design Objectives considered for the Loch Shira Restoration Area SMZ are set out below (Table 23).

Table 23 | Design Objectives relating to the Loch Shira Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- N/A
2	**Promoting scallop fishery sustainability**	- N/A
3	**Promoting finfish fishery recovery**	- Sheltered upper loch
4	**Minimising impacts on the fishing industry**	- There are no ports located in the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on the fishing fleet indicates that there will be no displacement on the scallop or *Nephrops* fishery. - Straight closing line
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ is included within the Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014 boundary. - The zone encompasses the following MPA protected habitats and priority features (Howson et al, 2012): • Burrowed mud Habitat • Flame shell beds Habitat • Horse mussel beds Habitat • Ocean quahog aggregations • Low or limited mobility species Sublittoral mud and specific mixed sediment communities - The SMZ covers all of the Loch Shira voluntary closure agreement area - The SMZ contains several priority features vulnerable habitats which with additional management can contribute to ecosystem resilience.

Spatial Management Zone F, Cairndow; Restoration Area

Location

The Cairndown Restoration Area SMZ is located in Upper Loch Fyne. The landward boundary follows mean low water springs from Ardgenavan (56°14.641”N, 004°58.59”W) in the west to Cairndow (56°14.223”N, 004°58.215”W) in the east. The seaward boundary is a straight line that runs 1.1km from Ardgenavan to Cairndow. The SMZ covers 2.3km^2.

Physical characteristics

The BGS dataset does not provide information on substrate coverage in the SMZ. Data from Marine Scotland indicate is comprised predominantly of burrowed mud. Due to a lack of high resolution data, it is unknown if there are any broad scale habitats within the SMZ. The deepest point in the proposed SMZ is 48 metres below Chart Datum.

Fishing activity

According to fishing data, a small number of *Nephrops* trawlers fish within the proposed SMZ (Table 24).

Table 24| Summary of assumed commercial scallop and *Nephrops* fishing activity within the Cairndow Restoration Area SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops trawl	**Over 15m**	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity: throughout the SMZ Monetary value: high throughout
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing activity : none Monetary value: null
Scallop Dredge	Over 15m	No activity
	Under 15m	**ScotMap Data indicate**; Fishing activity : none Monetary value: null
Scallop Divers	Under 15m	**ScotMap Data indicate;** Fishing activity : none Monetary value: null

Interaction with existing spatial management measures

The SMZ interacts with two existing management measures;

1 The Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014: The management measures associated with this Marine Protected Area have not been finalised but it is proposed that within certain areas of the MPA, no suction dredge, mechanical dredge, beam trawl or demersal trawl will be permitted.

2 Upper Loch Fyne voluntary agreement between Argyll Fisheries Trust and CFA: Members of the CFA and the Argyll Fisheries Trust have implemented a voluntary agreement not to trawl in waters shallower than 50m at the head of the loch, north of Dunderave Point.

Proposed management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives used when designing the Cairndow Restoration Area SMZ are set out below (Table 25).

Table 25 | Design Objectives relating to the Cairndow Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- N/A
2	**Promoting scallop fishery sustainability**	- N/A
3	**Promoting finfish fishery recovery**	- Sheltered upper loch
4	**Minimising impacts on the fishing industry**	- There are no ports located in the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on the fishing fleet indicates that there will be no displacement on the scallop fishery. Data indicate that the under 15m scallop trawl fleet may be displaced. - Straight closing line
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ is included within the Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014 boundaries. • The SMZ encompasses the following MPA protected habitats and priority features (Howson et al, 2012): • Burrowed mud Habitat • Flame shell beds Habitat • Horse mussel beds Habitat • Ocean quahog aggregations • Low or limited mobility species Sublittoral mud and specific mixed sediment communities - The SMZ covers part of/if not all of the voluntary closure agreement area - The SMZ contains several priority features vulnerable habitats which with additional management can contribute to ecosystem resilience.

Spatial Management Zone; Upper Clyde Network

Within the Upper Clyde, four SMZs are proposed (Figure 18);

- ZONE G: Loch Goil, Restoration Area
- ZONE H: Upper Loch Long, Restoration Area
- ZONE I: Gareloch, Restoration Area
- ZONE J: Inner Clyde Estuary, Restoration Area

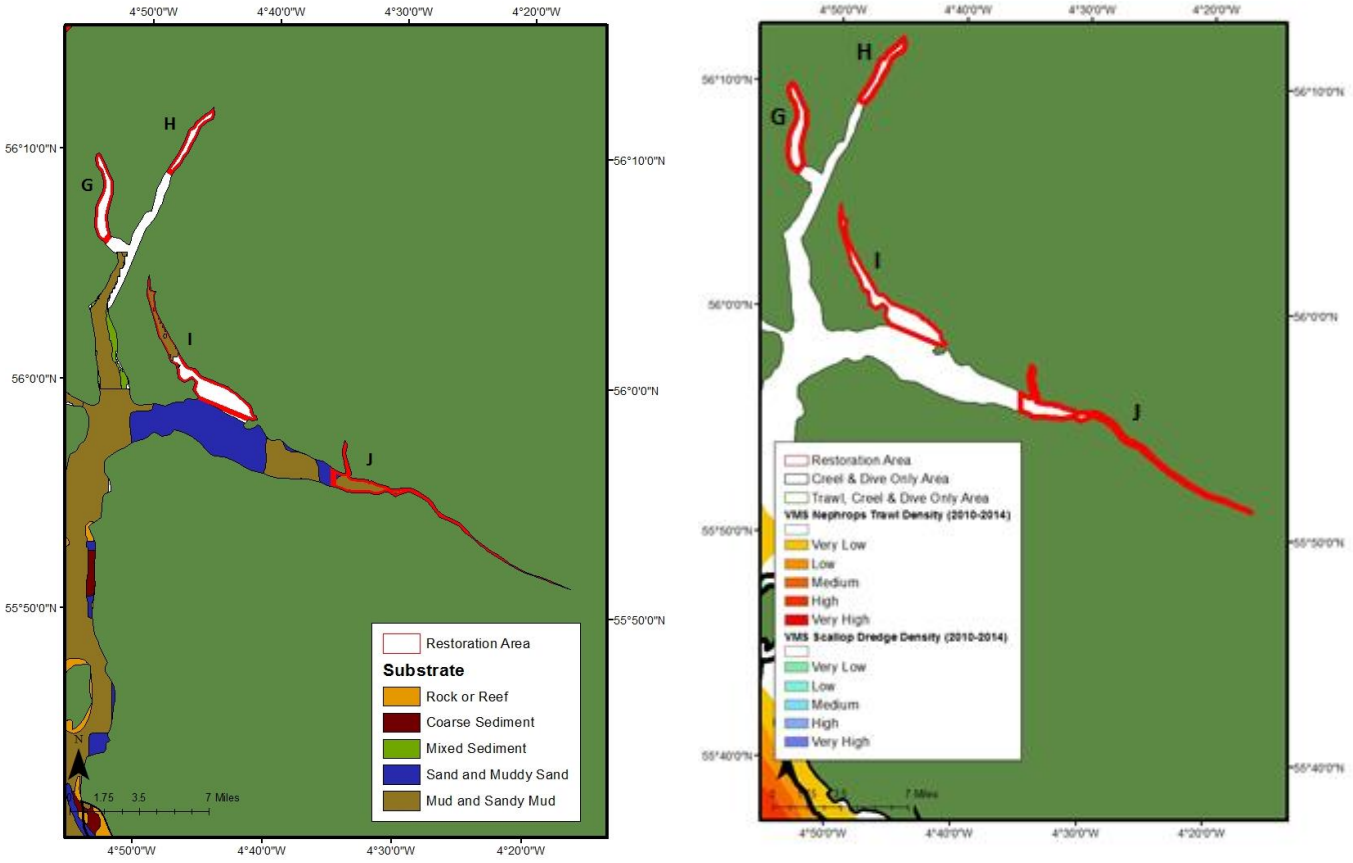


Figure 18 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the Upper Clyde SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Spatial Management Zone G, Loch Goil, Restoration Area

Location

The Loch Goil Restoration Area SMZ is located in the Upper Clyde. The landward boundary follows mean low water springs from Ardnahien (56°6.261”N, 004°53.027”W) in the west to Carraig na Mariag (56°5.998”N, 004°53.423”W) in the east. The seaward boundary is a straight line running 0.8km from Ardnahien to Carraig na Maraig. The SMZ covers 6km^2 .

Physical characteristics

The BGS dataset does not provide information on substrate coverage within the SMZ. Data from Marine Scotland indicate it is comprised of predominantly burrowed mud. Marine Scotland data also indicate that the broad-scale habitat sublittoral mud is present within the SMZ.

Bathymetric Data indicate that the SMZ slopes steeply away from the shore in the northern section of the SMZ. The deepest point in the proposed SMZ is 81 metres below Chart Datum.

Fishing activity

Fishing Data indicate that there is little commercial fishing activity undertaken throughout the SMZ (Table 26).

Table 26 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the Loch Goil Restoration Area SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity: the southern half of the SMZ is fished by 3-8 vessels Monetary value: high
Nephrops creel	Under 15m	**ScotMap Data indicate;** Fishing activity: the southern half of the SMZ is fished by 3 scallop creel vessels Monetary value: low
Scallop Dredge	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: null
Scallop divers	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: null

Interaction with existing spatial management measures

The proposed Loch Goil Restoration Area SMZ is subsumed within the Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014. The management measures associated with this Marine Protected Area have not been finalised but it is proposed that within certain areas of the MPA, no suction dredge, mechanical dredge, beam trawl or demersal trawl is permitted.

Proposed management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives considered for the Loch Goil Restoration Area SMZ are set out below (Table 27).

Table 27 | Design Objectives relating to the Loch Goil Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- N/A
2	**Promoting scallop fishery sustainability**	- N/A
3	**Promoting finfish fishery recovery**	- Sheltered loch - Encourage fish spawn to settle due to improved habitat protection
4	**Minimising impacts on the fishing industry**	- There are no ports located in the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on the fishing fleet indicates that there will be no displacement on the scallop fishery. Data indicate that the under 15m scallop trawl fleet and the *Nephrops* creel fleet may be displaced. - Straight closing line
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ is subsumed within the Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014 boundaries. - The SMZ encompasses the following MPA protected habitats and priority features (Howson et al, 2012): • Sea cucumbers • Firework anemone • Horse mussel beds • Ocean quahog - The SMZ contains several priority features which with additional management can contribute to ecosystem resilience.

Spatial Management Zone H, Upper Loch Long; Restoration Area

Location

The Upper Loch Long Restoration Area SMZ is located in the Upper Clyde. The landward boundary follows mean low water springs from Glenmallan (56°9.078”N, 004°48.135”W) on the east to 56°9.221”N, 004°48.561”W on the west. The seaward boundary is a straight line that runs 0.5km from Gelnmallan to 56°9.221”N, 004°48.561”W. The SMZ covers 4km^2.

Physical Characteristics

The BGS dataset does not provide information on substrate coverage within the SMZ. Data from Marine Scotland indicate that the SMZ is comprised of predominantly burrowed mud. Due to a lack of high resolution data, it is unknown if there are any broad scale habitats within the SMZ.

Bathymetric data indicate that sections of the SMZ slope steeply away from the shore. The deepest point in the SMZ is 58 metres below Chart Datum.

Fishing Activity

Fishing data indicate that under 15m *Nephrops* trawl and creel vessels are the main methods of fishing within the SMZ (Table 28).

Table 28 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the Upper Loch Long Restoration Area SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity: 3-8 vessels throughout the SMZ Monetary value: medium to high
Nephrops creel	Under 15m	**ScotMap Data indicate;** Fishing activity: 3 vessels fishing in the south of the SMZ Monetary value: low
Scallop dredge	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity: None Monetary value: Nil
Scallop divers	Under 15m	**ScotMap Data indicate;** Fishing activity: None Monetary value: Nil

Interaction with existing spatial measures

The SMZ interacts with the Upper Loch Long Queens Harbour Fishing Exclusion Zone, a site under the Clyde Dockyard Ports of Gareloch and Loch Long Act, 2011.

Proposed management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives considered when designing the Upper Loch Long Restoration Area SMZ are set out below (Table 29).

Table 29 | Design Objectives relating to the Upper Loch Long Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- N/A
2	**Promoting scallop fishery sustainability**	- N/A
3	**Promoting finfish fishery recovery**	- Sheltered loch - Encourage fish spawn to settle due to improved habitat protection
4	**Minimising impacts on the fishing industry**	- There are no ports located in the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on the *Nephrops* and scallop fishing fleet indicates that there will be minimal displacement on the scallop fishery. Data indicate that the under 15m scallop trawl fleet and the *Nephrops* creel fleet may be displaced - Straight closing line
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ contains burrowed mud which with additional management can contribute to ecosystem resilience.

Spatial Management Zone I, Gareloch; Restoration Area

Location

The Gareloch Restoration Area is located in the Upper Clyde. The landward boundary follows the mean low water springs mark from Rosneath Point (55°59.303”N, 4°45.817”W) in the west to Ardmore (55°58.423”N, 4°41.777”W) in the east. The seaward boundary is a straight line that runs 4.5km from Rosneath Point to Ardmore Head. The SMZ covers 15km^2.

Physical characteristics

The BGS dataset does not provide information on substrate coverage within the SMZ though it is thought that it is comprised of predominantly muddy substrate (Tuck *et al*., 1998). The SMZ covers two broad-scale habitats. Sublittoral mud is the most widespread habitat within the zone, occupying 22% of the proposed Restoration Area (Table 12). 23% of the SMZ is not associated with a habitat type.

Bathymetric Data indicate that there is a very shallow slope. The deepest point is 42 metres below Chart Datum.

Fishing Activity

Fishing data indicate that *Nephrops* creeling is the only active fishing methods carried out within the SMZ (Table 30).

Table 30 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the Gareloch Restoration Area SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity: low at the southern reaches Monetary value: low
Nephrops creel	Under 15m	**ScotMap Data indicate;** Fishing activity: 3 vessels fish at the southern end of the SMZ Monetary value: low
Scallop Dredge	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: nil
Scallop divers	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: nil.

Interaction with existing spatial management measures

The SMZ interacts with the Clyde Dockyard Port of Gareloch and Loch Long Order (2011) which prohibits of use of mobile or active gear from 1st January to 31st December.

Proposed Management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives that were considered for the Gareloch Restoration Area SMZ are set out below (Table 31).

Table 31 | Design Objectives relating to the Gareloch Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- N/A
2	**Promoting scallop fishery sustainability**	- N/A
3	**Promoting finfish recovery**	- Sheltered loch - Encourage fish spawn to settle due to improved habitat protection
4	**Minimising impacts on the fishing industry**	- There are no ports located in the immediate vicinity of the SMZ - Analysis of the potential displacement effects on the SMZ on the *Nephrops* and scallop fishing fleet indicates that there will minimal potential displacement on the *Nephrops* mobile fishing fleet and on the scallop fishing fleet. - Data indicate that *Nephrops* creel vessels will be displaced - Straight closing line
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ overlaps with the Clyde Dockyard Port of Gareloch and Loch Longer Order (2011) - The SMZ covers two known broad-scale habitat which with further protection can contribute to ecosystem resilience.

Spatial Management Zone J, Inner Clyde Estuary; Restoration Area

Location

The Inner Clyde Estuary Restoration Area SMZ is located within the Upper Clyde. The landward boundary follows mean low water springs from west Dumbarton (55°56.31”N, 4°35.076”W) in the north to Langbank (55°55.551”N, 4°35.106”W) in the south. The seaward boundary runs 1.4km across the Inner Clyde estuary from west Dumbarton in the north to Langbank in the south. The SMZ covers 9.4km^2.

Physical characteristics

The BGS dataset does not provide information on substrate coverage within the SMZ. Due to a lack of high resolution data, it is unknown if there are any broad scale habitats within the SMZ. The deepest point in the proposed SMZ is 7metres below Chart Datum.

Fishing activity

Fishing Data indicate there is no commercial fishing activity in the Inner Clyde Estuary SMZ (Table 32)

Table 32 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing Activity: none Monetary Value: null
Nephrops creel	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: null
Scallop Dredge	Over 15m	No activity
	Under 15m	**ScotMap Data indicate;** Fishing Activity: none Monetary Value: null
Scallop divers	Under 15m	**ScotMap Data indicate;** Fishing Activity: none Monetary Value: null

Interaction with existing spatial management measures

The SMZ interacts with a Special Protection Area (SPA) located in the Inner Clyde Estuary. The SPA is designated for migratory birds.

Proposed management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives considered when designing the Inner Clyde Estuary Restoration Area SMZ are set out below (Table 33).

Table 33 | Design Objectives relating to the Inner Clyde Estuary Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- N/A
2	**Promoting scallop fishery sustainability**	- N/A
3	**Promoting finfish recovery**	- As an estuarine habitat it provides wider ecological importance in terms of productivity and ecological function as a fish nursery area
4	**Minimising impacts on the fishing industry**	- No main ports in the vicinity - Analysis of the potential displacement effects of the SMZ on the fishing fleet indicates that there will be no displacement of *Nephrops* or scallop fishing vessels. The SMZ is located away from fishing hotspots - Straight closing line
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ coincides with the Inner Clyde Estuary Special Protection Area - The estuarine environment provides a mix of fresh and sea waters combined with tidal movement which create changing levels of salinity and nutrients that can provide a fertile environment for fish species.

Spatial Management Zone K, Ayrshire Coast, Creel and Dive Only

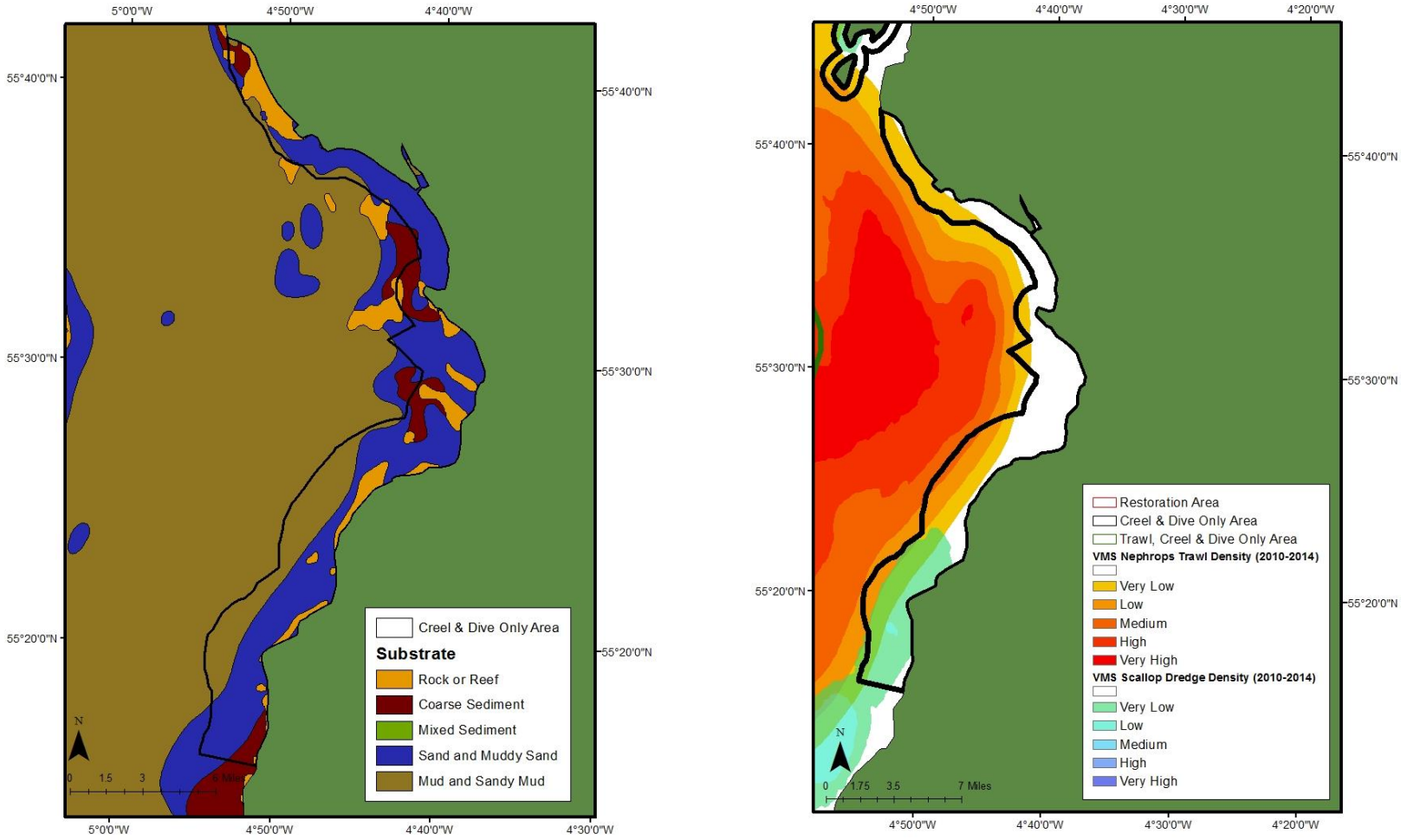


Figure 19 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the Ayrshire coast SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Location

The Ayrshire Coast Creel and Dive Only Area SMZ is located along the Ayrshire coastline. The landward boundary follows mean low water springs, from Farnland Head (55°41.631”N, 4°53.92”W) in the north to Chapeldonan (55°15.636”N, 4°50.899”W) in the south. The seaward boundary extends out to the 1NM zone in the north from Farnland Head for 26km and then extends out to the 2NM south at Turnberry Bay for 35km to Chapeldonan in the south. The SMZ covers 192km^2.

Physical Characteristics

The SMZ contains a mixture of substrates, predominantly muddy substrate (Table 9). The SMZ covers eight broad-scale habitats. Sublittoral sand is the most widespread habitat within the zone, occupying over 53% of the proposed Creel and Dive Only SMZ (Table 12).

The SMZ is relatively shallow, reaching a depth of approximately 55 metres below Chart Datum.

Fishing Activity

Fishing Data indicate that the proposed SMZ is predominantly fished by the under 15m *Nephrops* trawl fleet (Table 34).

Table 34 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the Ayrshire Coast Creel and Dive Only SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	0.95%of VMS *Nephrops* trawl polls were located within the SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing activity: throughout the area. Fishing intensity higher in the north with between 18- 21 vessels. Fishing intensity in the south 3-8 vessels. Monetary value: low to high with the higher values to the north
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing Activity: none Monetary value: low-medium
Scallop Dredge	Over 15m	2.88% of scallop dredge polls were located within the Ayrshire Coast CDO SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing activity: Throughout the area Monetary value: low to high. Higher in the north.
Scallop Diving	Under 15m	**ScotMap Data indicate;** Fishing activity: some scallop diving occurs towards the north and south limits of the SMZ Monetary value: high in the south, low elsewhere

Interaction with existing spatial management measures

The SMZ does not interact with any existing spatial management measures.

Proposed Management

Prohibition on the use of all commercial mobile fishing gear and practices for *Nephrops*, king and queen scallops throughout the SMZ.

Rationale

The Design Objectives considered when designing the Ayrshire Coast Creel and Dive Only SMZ are set out below (Table 35).

Table 35 | Design Objectives relating to the Ayrshire Coast Creel and Dive Only SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- Promote larval dispersal - 80% of the SMZ is covered by muddy substrate - 21% of the SMZ is covered by sublittoral mud habitat
2	**Promoting scallop sustainability**	- Potential for larval export - Encourage spat settling due to improved habitat protection - 21% of the SMZ is covered by complex habitat - 7% of the SMZ is covered by sublittoral coarse sediment
3	**Promoting finfish recovery**	- 21% of the SMZ is covered by complex habitat - 10% of the SMZ is covered by Atlantic and Mediterranean high energy infralittoral rock - Encourage fish spawn to settle due to improved habitat protection
4	**Minimising impacts on the fishing industry**	- No ports are located within the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on *Nephrops* and scallop fishing fleet indicates that there will be minimal potential for displacement on the over 15m sector. Data indicate that the under 15m scallop dredgers and *Nephrops* trawlers will be displaced- - The SMZ has a high perimeter to area ratio which can encourage spillover into adjacent fishing grounds, thus provide more opportunity for fishing. - Follows 1 and 2 NM boundaries
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ contains a mixture of substrates and broad scale habitats which with additional protection can contribute to ecosystem resilience

Spatial Management Zone L, Loch Ryan; Restoration Area

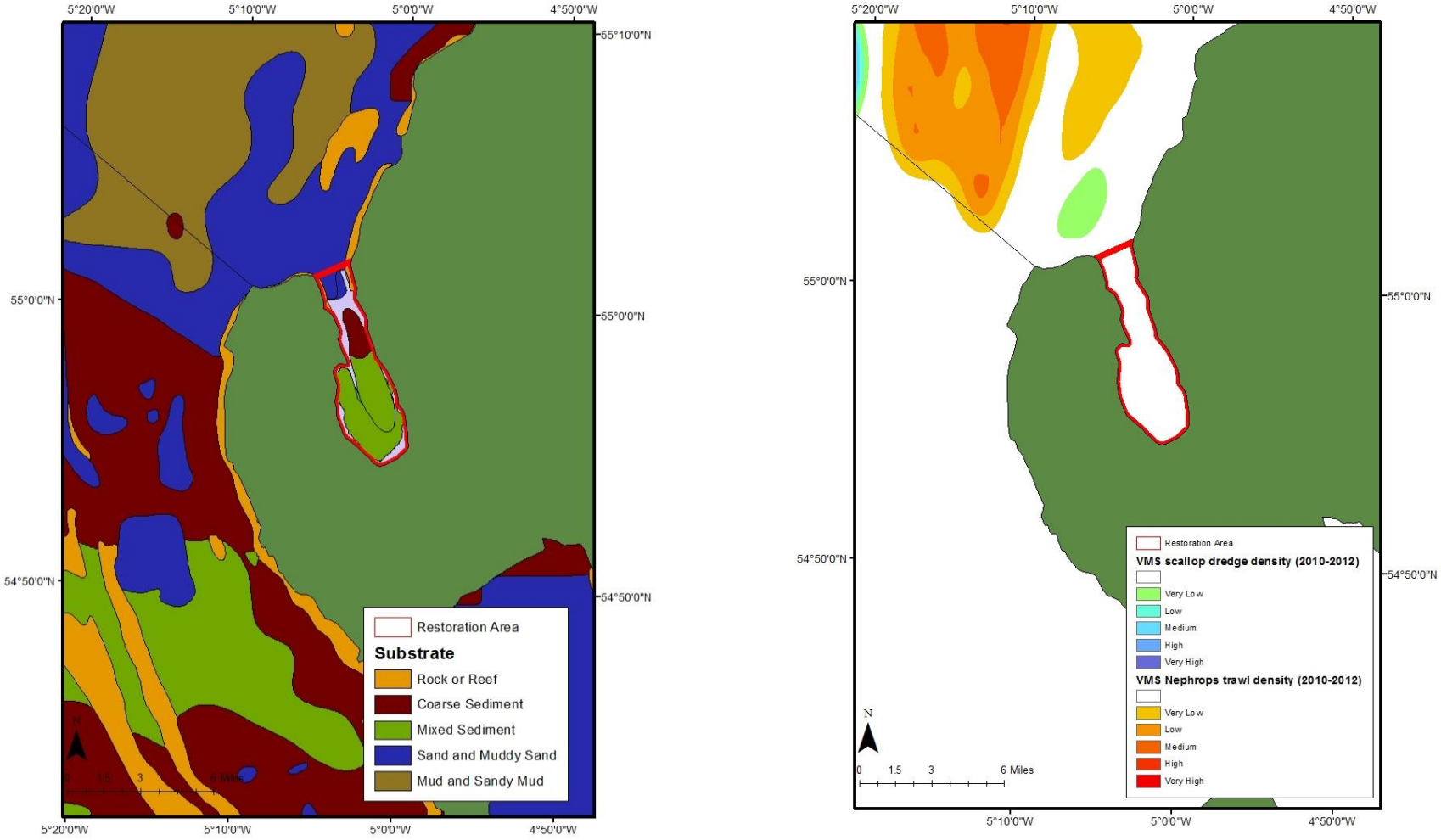


Figure 20 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the Loch Ryan SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Location

The Loch Ryan Restoration Area SMZ is located between Mull of Galloway and South Ayrshire. The landward boundary follows mean low water springs from Milleur Point (55°1.091”N, 005°5.701”W) in the west to Finnart’s Point (55°1.74”N, 005°3.413”W) in the east. The seaward boundary is a straight line that runs 2.7km from Milleur Point to Finnart’s Point. The SMZ covers 39km^2.

Physical Characteristics

The SMZ contains a range of substrates, predominantly mixed sediment with areas of rock or reef and coarse sediment (Table 9). The SMZ covers five broad scale habitats. Sublittoral mixed sediment is the most widespread habitat within the SMZ, occupying 48% (Table 12).

The Loch Ryan SMZ is one of the shallowest in the network with the deepest point at 16 metres below Chart Datum.

Fishing Activity

Due to the existing spatial measures, targeted commercial fishing for scallop and *Nephrops* do not occur (Table 36).

Table 36 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the Loch Ryan Restoration Area SMZ

Fishing Activity	Sector	Possible displacement
Nephrops Trawl	Over 15m	0.04% of the VMS *Nephrops* trawl polls were located within the Loch Ryan Restoration Area SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: null.
Scallop Dredge	Over 15m	0.6 % of the VMS scallop dredge polls were located within the Loch Ryan Restoration Area SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing activity: throughout***** Monetary value: low *****_It is assumed that this is data error and it is assumed that there would be no displacement from the SMZ._
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: null. .
Scallop Divers	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: null.

Interaction with existing spatial management measures

The SMZ interacts with Scottish Statutory Instrument (SSI) The Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Order 2004. The SSI prohibits all mobile or active gear (except dredging for mussels and oysters) from fishing within Loch Ryan from January 1st to December 31st. The Loch Ryan oyster fishery is operated by The Loch Ryan Oyster Fishery Company who fish for Native Oysters. The right to fish Loch Ryan oysters was given to the Wallace Family in 1701, by King William

III. The Loch Ryan Oyster Fishery Company Ltd. have been working in partnership with the family since 1996, and breed grow and harvest oysters every year.

Proposed management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives relating to the Loch Ryan Restoration Area SMZ are set out below (Table 37).

Table 37 | Design Objectives relating to the Loch Ryan Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- N/A
2	**Promoting scallop fishery sustainability**	- N/A
3	**Promoting finfish recovery**	- Sheltered areas with suitable nursery habitats - 67% of the SMZ known substrates are complex. - 48% of the SMZ is covered by the broad-scale habitat, sublittoral mixed sediment.
4	**Minimising impacts on the fishing industry**	- Currently closed under SSI Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Order 2004. - Analysis of the potential displacement effects of the SMZ on the fishing fleet indicates that there will no displacement of *Nephrops* and scallop fishing.
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- Currently closed under SSI Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Order 2004. - 67% of this SMZ is covered by complex substrates and 48% is covered by sublittoral mixed sediment which with additional management can contribute to ecosystem resilience.

Spatial Management Zone M, Kyles of Bute, Creel and Dive Only

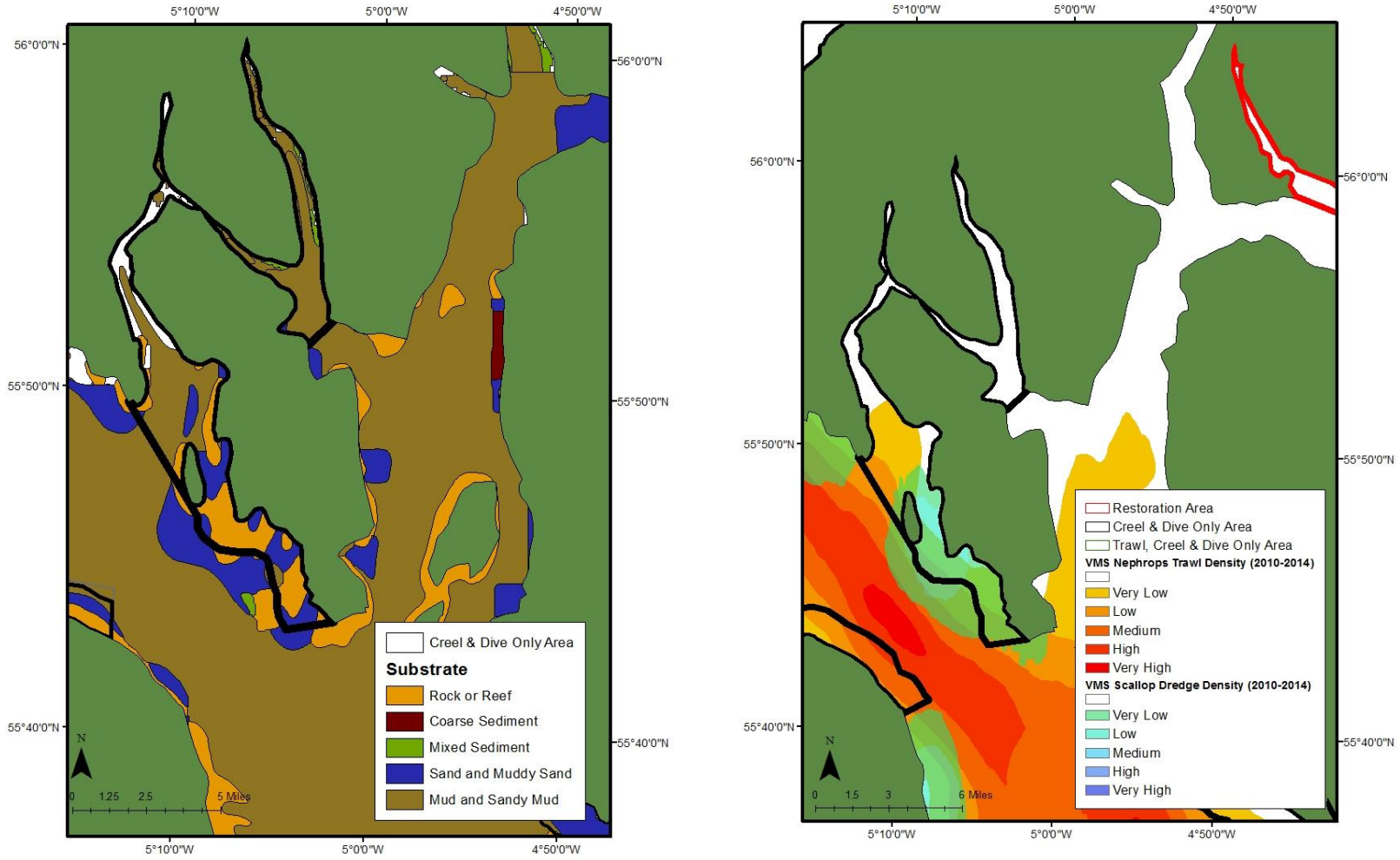


Figure 21 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the Kyles of Bute SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Location

The Kyles of Bute Creel and Dive Only SMZ is located around the Isle of Bute in the Upper Clyde. The landward boundary follows mean low water springs from Garroach Head (55°43.294”N, 5°1.784”W) for 15km to Ardmaleish (55°51.424”N, 5°3.618”W). The seaward boundary extends out to 1NM and runs along the 1NM zone. The zone covers 90km^2.

Physical characteristics

The SMZ contains a mixture of substrates, predominantly muddy substrates (Table 9). The SMZ covers 9 broad scale habitat types. Sublittoral mud is the most widespread habitat within the SMZ occupying over 40% of the proposed SMZ (Table 12).

Bathymetric Data indicate that the SMZ slopes steeply away from the shore. The deepest point in the Kyles of Bute Restoration Area is 68 metres below Chart Datum.

Fishing activity

Fishing Data indicate that the SMZ is predominantly fished by the under 15m *Nephrops* and scallop fleet (Table 38).

Table 38 | Summary of assumed commercial scallop and *Nephrops* fishing activity within the Kyles of Bute Creel and Dive Only SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	0.6% of VMS polls associated with *Nephrops* trawls were located within the SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing activity: low to medium fishing intensity throughout the SMZ Monetary value: high throughout
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing activity: none in southern reaches and low in upper reaches Monetary value: nil
Scallop dredge	Over 15m	2.39% of VMS polls associated with scallop dredger were located within the SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing activity: throughout the southern part of the SMZ. No recorded activity within Loch Riddon and Loch Striven Monetary value: medium throughout
Scallop Divers	Under 15m	**ScotMap Data indicate;** FA Fishing activity: takes place throughout the south west of the SMZ Monetary value: medium- high

Interaction with existing spatial management measures

There are no existing spatial management measures in place within the SMZ.

Proposed management

Prohibition on the use of all commercial mobile fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives considered when designing the Kyles of Bute Creel and Dive Only SMZ are set out below (Table 39).

Table 39 | Design Objectives relating to the Kyles of Bute Creel and Dive Only SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- Potential for larval export - Encourage spat settling due to improved habitat protection - 59% of the SMZ is covered by muddy substrates - 41% of the SMZ is covered by sublittoral mud habitat
2	**Promoting scallop fishery sustainability**	- Potential for larval export - Complex substrates which is suitable for encouraging scallop spat settlement covers 25% of the SMZ - 4% of the Clyde's complex substrates are found within the SMZ
3	**Promoting finfish recovery**	- 25% of the SMZ is covered by complex substrates - 12% of the SMZ is covered by infralittoral rocky habitat - Encourage fish spawn to settle due to improved habitat protection
4	**Minimising impacts on the fishing industry**	- Analysis of the potential displacement effects of the SMZ on the fishing fleet indicates that there will be little displacement of *Nephrops* and scallop fishing.
5	**Minimise user conflicts**	- Area known for inter-gear conflict.
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ contains a mixture of both muddy and complex substrates and a range of broad scale habitats which with additional management can contribute to ecosystem resilience.

Spatial Mangement Zone N, The Cumbraes; Creel and Dive Only

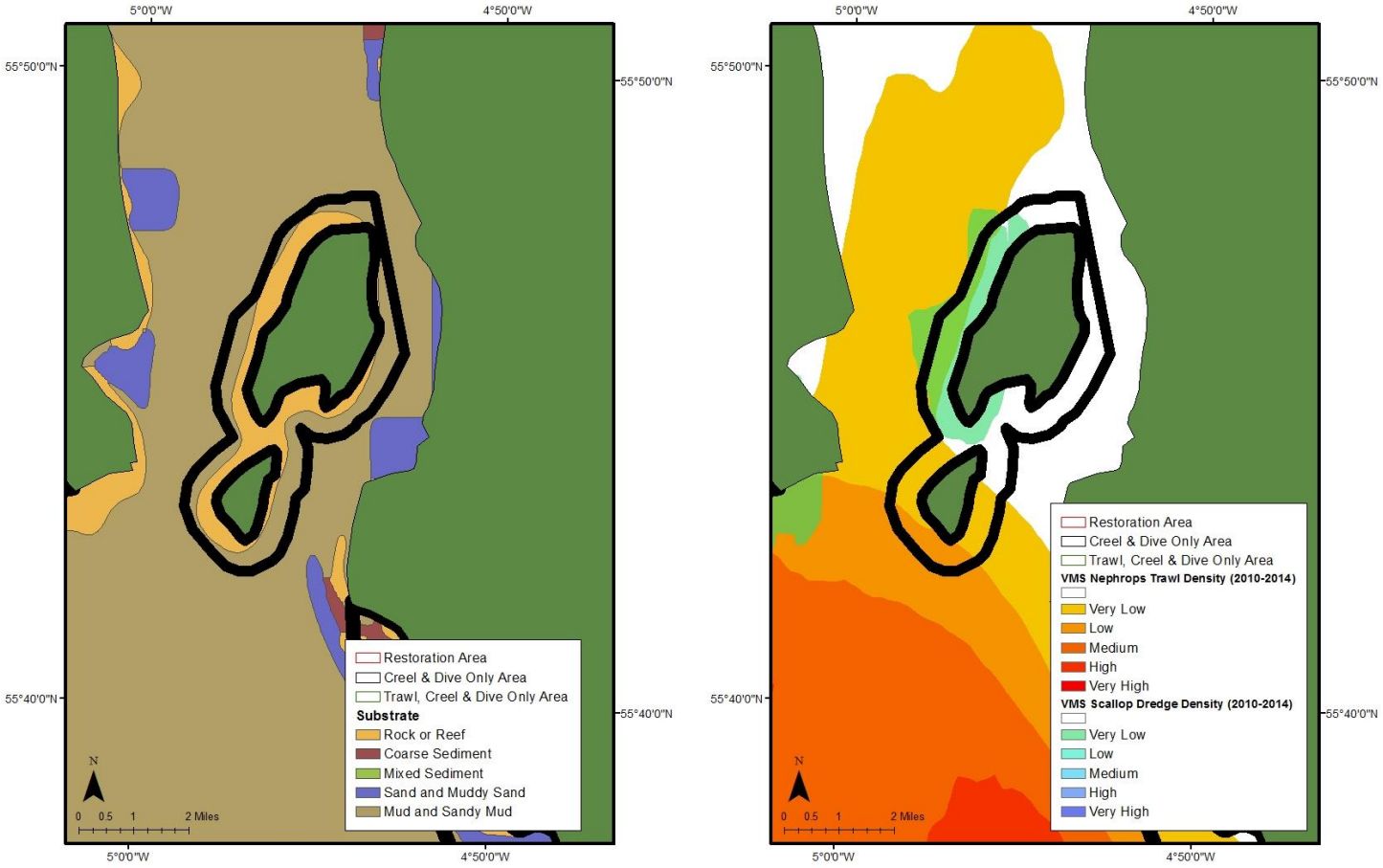


Figure 22 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for The Cumbraes SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Location

The Cumbraes Creel and Dive Only SMZ is located in Upper Firth of Clyde. The seaward boundary extends out to the 0.5NM zone around The Cumbraes. The landward boundaries of the SMZ follow mean low water springs. The SMZ covers 24km^2.

Physical characteristics

The SMZ cover both complex and muddy substrates. The SMZ covers seven broad-scale habitats. Sublittoral mud is the most widespread habitat occupying 54 % of the SMZ.

Bathymetric Data indicate that the SMZ slopes down steeply towards the middle. The deepest point in the SMZ is 100 metres below Chart Datum.

Fishing activity

Fishing Data indicate that this SMZ is fished by *Nephrops* trawls, scallop dredgers and scallop divers (Table 40).

Table 40 | Summary of assumed commercial *Nephrops* and scallop fishing activity within The Cumbraes SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	0.08% VMS *Nephrops* trawl polls were located within the SMZ
	Under 15m	**ScotMap Data indicate;** Fishing activity: high throughout the SMZ with between 18- 21 vessels fishing Monetary value: high
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing activity : fished throughout the SMZ with between 3-4 vessels fishing Monetary value: medium
Scallop Dredge	Over 15m	0.75% VMS scallop dredge polls were located within the SMZ
	Under 15m	**ScotMap Data indicate;** Fishing activity : fished throughout the SMZ Monetary value: medium-high
Scallop Divers	Under 15m	**ScotMap Data indicate;** Fishing activity : scallop diving takes place in the south of the SMZ Monetary value: low

Interaction with existing spatial management measures

The SMZ interacts with the following three existing management measures:

3 Ballochmartin Bay SSSI
4 Kames Bay SSSI
5 Cumbraes Marine Consultation Areas (MCA)

Proposed management

Prohibition on the use of all commercial mobile fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives considered for the Cumbraes Creel and Dive Only SMZ are set out below (Table 41)

Table 41 | Design Objectives relating to the Cumbraes Creel and Dive Only SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- Potential for larval export - Encourage spat settling due to improved habitat protection - 47% of the SMZ is covered by muddy substrates - 64% of the SMZ is covered by sublittoral mud habitat
2	**Promoting scallop fishery sustainability**	- N/A
3	**Promoting finfish recovery**	- 53% of the SMZ is covered by complex substrates - seven broad-scale habitats are covered - 28% of the SMZ is covered by Sublittoral mixed sediment which is an important nursery habitat.
4	**Minimising impacts on the fishing industry**	- There are no ports located in the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on the *Nephrops* and scallop fishing fleet indicates that there may be no displacement on the over 15m scallop and *Nephrops* vessels.
5	**Minimising user conflicts**	- N/A

6	**Conserving biodiversity and promoting ecosystem resilience**	- The Ballochmartin Bay SSSI, Karmes Bay SSSI and the Cumbraes Marine Consultation Areas (MCA) fall within the SMZ - The SMZ contains vulnerable habitats which with additional management can contribute to ecosystem resilience.

Spatial Management Zone O, North Arran; Creel and Dive Only

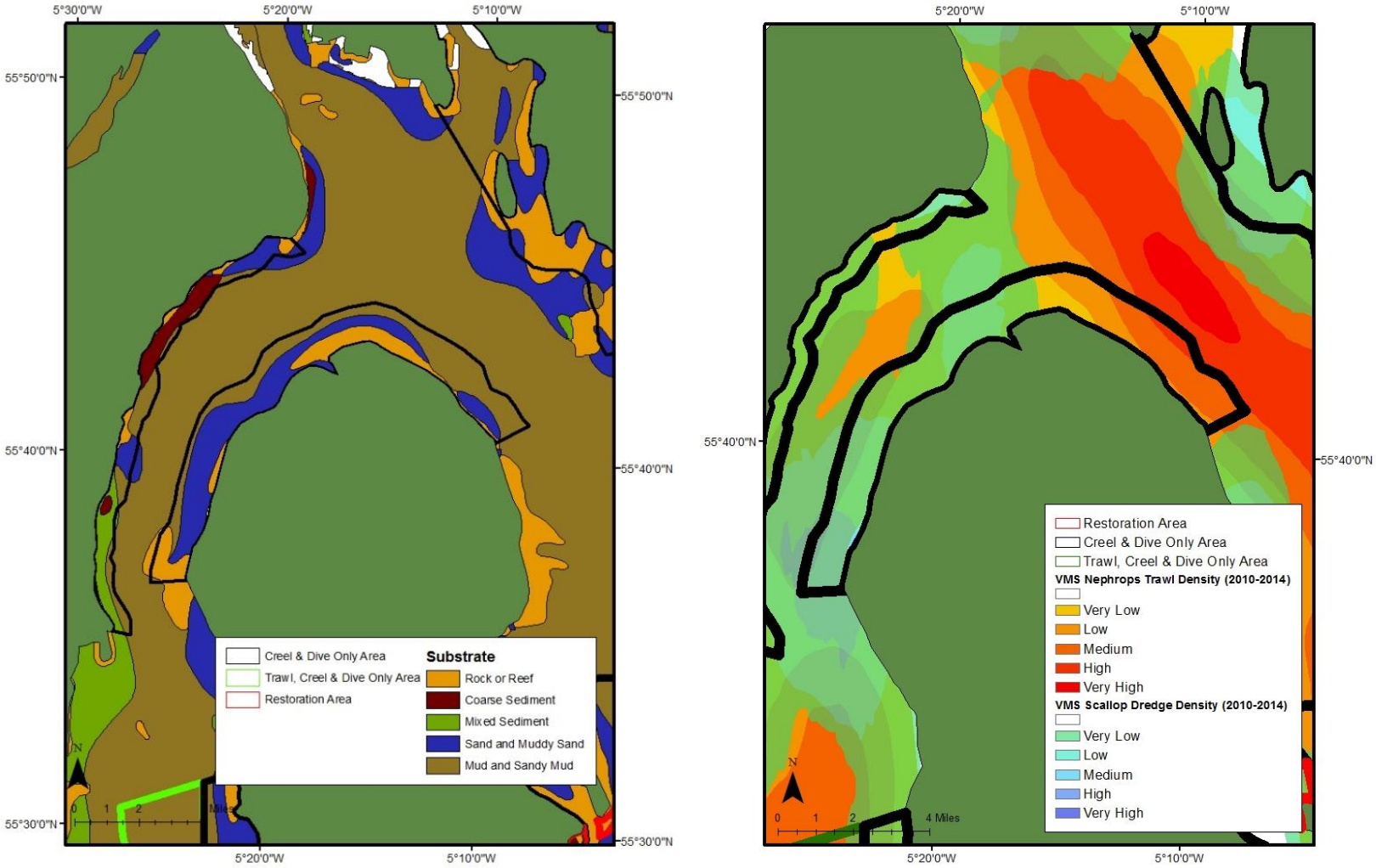


Figure 23 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the North Arran SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Location

The North Arran Creel and Dive Only zone is located at the northern tip of the Isle of Arran. The landward boundary follows mean low water springs from Imachar (55°36.656”N, 005.23.906”W) in the west to Sannox (55°40.566”N, 5°9.47”W) in the east. The seaward boundary extends out to 1NM and runs from Imachar in the west to Sannox. The SMZ covers 50km^2.

Physical characteristics

The SMZ contains a range of substrates, predominantly sand and muddy sand (Table 9). Within this SMZ there are five broad scale habitats. Sublittoral sand is the most widespread habitat within the SMZ, occupying 50% of the SMZ (Table 12).

Bathymetric data indicate that the SMZ slopes steeply away from the shore. The deepest point in the SMZ is 125 metres below Chart Datum.

Fishing Activity

Fishing Data indicate that scallop dredge and *Nephrops* trawls fish the SMZ (Table 42).

Table 42 | Summary of assumed commercial scallop and *Nephrops* fishing activity within the North Arran Creel and Dive Only SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	1.33% of VMS *Nephrops* trawl polls were located within the SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing activity: fished throughout. Fished more intensively in the west Monetary value: high
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing Activity: fished throughout Monetary value: medium
Scallop dredge	Over 15m	3.88% of VMS scallop dredge polls were located within the SMZ.
	Under 15m	**ScotMap Data indicate;** Fishing Activity: fished throughout Monetary value: medium
Scallop Divers	Under 15m	**ScotMap Data indicate;** Fishing Activity: fished throughout Monetary value: medium

Interaction with existing spatial management measures

There are no current spatial management measures or legislation in place within this SMZ.

Proposed management

Prohibition on the use of all commercial mobile fishing gear and practices for *Nephrops,* king and queen scallop throughout the SMZ.

Rationale

The Design Objectives considered when designing the North Arran Creel and Dive Only SMZ are set out below (Table 43).

Table 43 | Design Objectives relating to the North Arran Creel and Dive Only SMZ.

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- Potential for larval export - Encourage spat settling due to improved habitat protection - 80% of the SMZ is covered by muddy substrates - 39% of the SMZ is covered by sublittoral mud habitat
2	**Promoting scallop sustainability**	- Potential for larval export which will assist recruitment in the adjacent scallop fishing grounds - Complex substrates suitable for encouraging scallop spat settlement covers 21% of the area
3	**Promoting finfish recovery**	- 11% of the SMZ is covered by low energy circalittoral rock which can provide shelter for associated communities**.** - Encourage fish spawn to settle due to improved habitat protection
4	**Minimising impacts on fishing industry**	- No ports are located within the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on fishing activity indicates that all *Nephrops* and scallop fishing will be displaced from the SMZ. - Follows 1NM boundary
5	**Minimise user conflicts**	- Area known for inter-gear conflict.
6	**Conserving biodiversity and promoting ecosystem resilience**	- The majority of the SMZ is covered by muddy substrates and contains eight broad scale habitats which with additional management can contribute to ecosystem resilience.

Spatial Management Zone P, South Arran; Creel and Dive Only, Trawl, Creel and Dive Only and Restoration Area

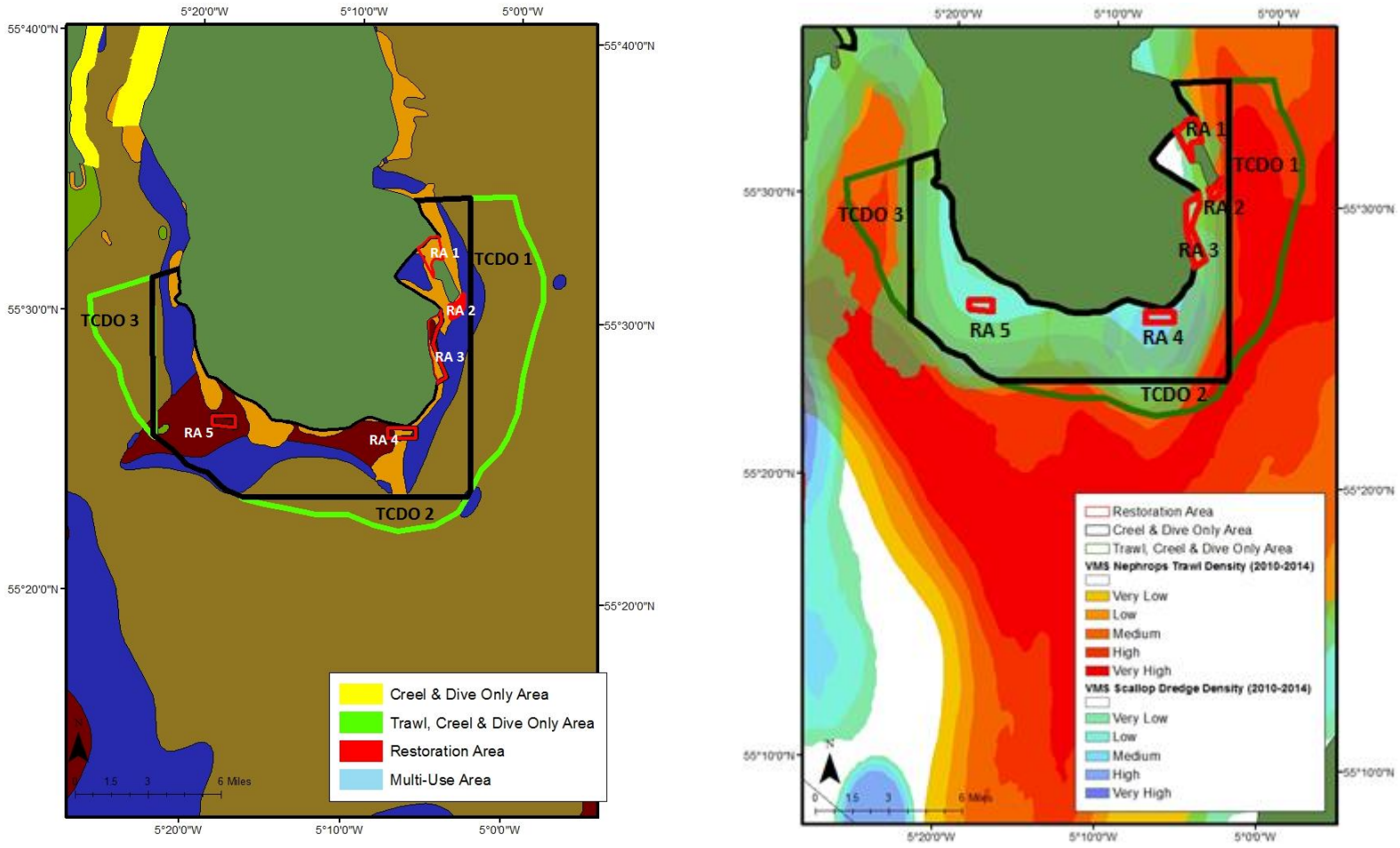


Figure 24 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the South Arran SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Within the South Arran SMZ, there are three separate zone designations; Creel and Dive Only, Trawl, Creel and Dive Only and Restoration Areas. The size of these zones and associated percentage coverage within the South Arran SMZ are shown in Table 44.

Table 44 | Composition of Creel and Dive Only, Trawl, Creel and Dive Only and Restoration Areas within the South Arran SMZ

SMZ	Area (km^2)	Percentage of South Arran SMZ (%)
Creel and Dive Only	165.28	59
Trawl, Creel and Dive Only	107.35	38
Restoration Area	7.46	3

Location

The South Arran SMZ is located on the southern coast of the Isle of Arran. The landward boundary follows mean low water springs to Corriegills Point (55°34.283”N, 5°6.466”W) on the east, to north of Drumadoon Point (55°31.591”N, 5°21.113”W) on the west coast. The seaward boundary extends out to, and runs along, the 3NM line, encompassing Holy Isle and Pladda Island. The zone covers 280km^2.

Physical characteristics

The SMZ contains a range of substrates, predominantly muddy substrates (Table 9). The SMZ covers eight broad scale habitats. Sublittoral mud and sublittoral sand are the most widespread habitats covering 65% of the SMZ (Table 12).

The deepest point in the South Arran zone is 124 metres below Chart Datum with the deepest section of the zone along the northern boundary of the SMZ.

Fishing Activity

Fishing Data indicate that scallop dredging, *Nephrops* trawling, *Nephrops* creeling and scallop diving take place within the SMZ (Table 45).

Table 45 | Summary of assumed commercial *Nephrops* and scallop fishing activity within the South Arran SMZ

Fishing gear	Sector	Fishing activity within the Creel & Dive Only (CDO) SMZs	Fishing activity within the Trawl, Creel & Dive Only (TCDO) SMZs	Fishing activity within the Restoration Area (RA) SMZs
Nephrops Trawl	Over 15m	VMS Data indicate that 2.81% of *Nephrops* dredge polls were located within the South Arran CDOs	VMS Data indicate that 6.37% of *Nephrops* dredge polls were located within the South Arran TCDOs	VMS Data indicate that 0.04% of *Nephrops* dredge polls were located within the South Arran RAs
	Under 15m	**ScotMap Data indicate;** Fishing activity: throughout with greatest intensity in	**ScotMap Data indicate;** Fishing activity: throughout all three TCDOs with greatest intensity in the TCDO 1	**ScotMap Data indicate;** Fishing activity: throughout all 4 RAs Monetary value: medium in RA 1 ,

Fishing gear	Sector	Fishing activity within the Creel & Dive Only (CDO) SMZs	Fishing activity within the Trawl, Creel & Dive Only (TCDO) SMZs	Fishing activity within the Restoration Area (RA) SMZs
		the eastern areas of the CDO Monetary value: medium in the western area, increasing to high in the eastern area	Monetary value: medium in TCDO 3, increasing to high in TCDO 1 & 2	increasing to high in RA 2, 3 & 4
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing activity; occurs in the north east around Holy Isle and in the north west Monetary value; indicates a range of values from low to high throughout the area. This does not appear to correlate with the fishing activity data.	**ScotMap Data indicate;** Fishing activity: throughout TCDO 3 and within the north west section of TCDO 1 Monetary value: indicates a range of values from low to high throughout the TCDOs. This does not appear to correlate with the fishing activity data.	**ScotMap Data indicate;** Fishing activity: occurs in RAs located in the north east of the South Arran Monetary value: indicates a range of values from low to high throughout the RAs. This does not appear to correlate with the fishing activity data.
Scallop Dredge	Over 15m	VMS data indicated that 11.73% of scallop polls were located within the South Arran CDOs	VMS data indicated that 0.3% of scallop polls were located within the South Arran TCDOs	VMS data indicated that 0.67% of scallop polls were located within the South Arran RAs
	Under 15m	**ScotMap Data indicate;** Fishing activity; takes place throughout the CDO, except Lamlash Bay and the north eastern extreme. Monetary value; highest in the southerly region of the CDO	**ScotMap Data indicate;** Fishing activity; takes place throughout TCDOs 2 and 3. Monetary value; low in TCDO 1 and highest in TCDO 2	**ScotMap Data indicate;** Fishing activity; takes place throughout all RAs Monetary value: highest in **RAs 3 and 4**
Scallop Divers	Under 15m	**ScotMap Data indicate;**	**ScotMap Data indicate;** Fishing activity: none	**ScotMap Data indicate;**

Fishing gear	Sector	Fishing activity within the Creel & Dive Only (CDO) SMZs	Fishing activity within the Trawl, Creel & Dive Only (TCDO) SMZs	Fishing activity within the Restoration Area (RA) SMZs
		Fishing activity: throughout the CDO. Particularly shoreward Monetary value: low to medium throughout. Higher shoreward	Monetary value: null	Fishing activity: throughout all RAs Monetary value: medium throughout

Interaction with existing spatial management measures

The SMZ interacts with four existing spatial management measures;

1 The No Take Zone under The Inshore Fishing (Prohibition on Fishing) (Lamlash Bay) (Scotland) Order 2008
2 The MPA under The South Arran Marine Conservation Order 2015 (coming into force 1st October 2015).
3 The three Marine Conservation Orders under The South Arran Marine Conservation (Amendment) Order 2014 (SSI 2014 / 297)
4 The Sea Fish (Prohibited Methods of Fishing) (Firth of Clyde) Order 2007

Proposed Management

Prohibition on the use of all commercial mobile fishing gear and practices for *Nephrops*, king and queen scallops throughout the SMZ.

Rationale

The table below sets out the specific Design Objectives that were considered when designing the South Arran SMZ (Table 46).

Table 46 | Specific Design Objectives relating to the South Arran SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- Potential for larval export - 75% of the SMZ is covered by muddy substrates - 37% of the SMZ is covered by sublittoral mud habitat
2	**Promoting scallop sustainability**	- Potential for larval export - 25% of the SMZ is covered by complex substrates - 10% of the Clyde's complex substrates are found within the SMZ
3	**Promoting finfish recovery**	- 10% of the Clyde's complex substrates are found within the SMZ - Herring spawning grounds have been identified within the SMZ - Encourage fish spawn to settle due to improved habitat protection

	Design Objectives	Rationale
4	**Minimising impacts on the fishing industry**	- Analysis of the potential displacement effects of the CDO on the *Nephrops* and scallop fishing fleet indicates that there will be no displacement of *Nephrops* creel and scallop diving. - There will be displacement of *Nephrops* trawl and scallop dredge.
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ mirrors The South Arran Marine Conservation Order 2015 boundaries and exhibits identical management. The SMZ encompasses the following MPA protected habitats (Howson et al, 2012): • Burrowed mud • Kelp and seaweed communities on sublittoral sediment • Maerl beds • Maerl or coarse shell gravel with burrowing sea cucumbers • Seagrass beds • Shallow tide-swept coarse sands with burrowing bivalves - The SMZs encompasses the Lamlash NTZ which prohibits all commercial fishing. - The SMZs align with the South Arran Marine Conservation Order - The SMZs cover 14% of the Cod Box under The Sea Fish (Prohibited Methods of Fishing) (Firth of Clyde) Order 2007 - The SMZ is covers 8 broad-scale habitats, a range of substrates and several priority features which, with additional management, can contribute to ecosystem resilience.

Spatial Management Zone Q Ailsa Craig; Restoration Area

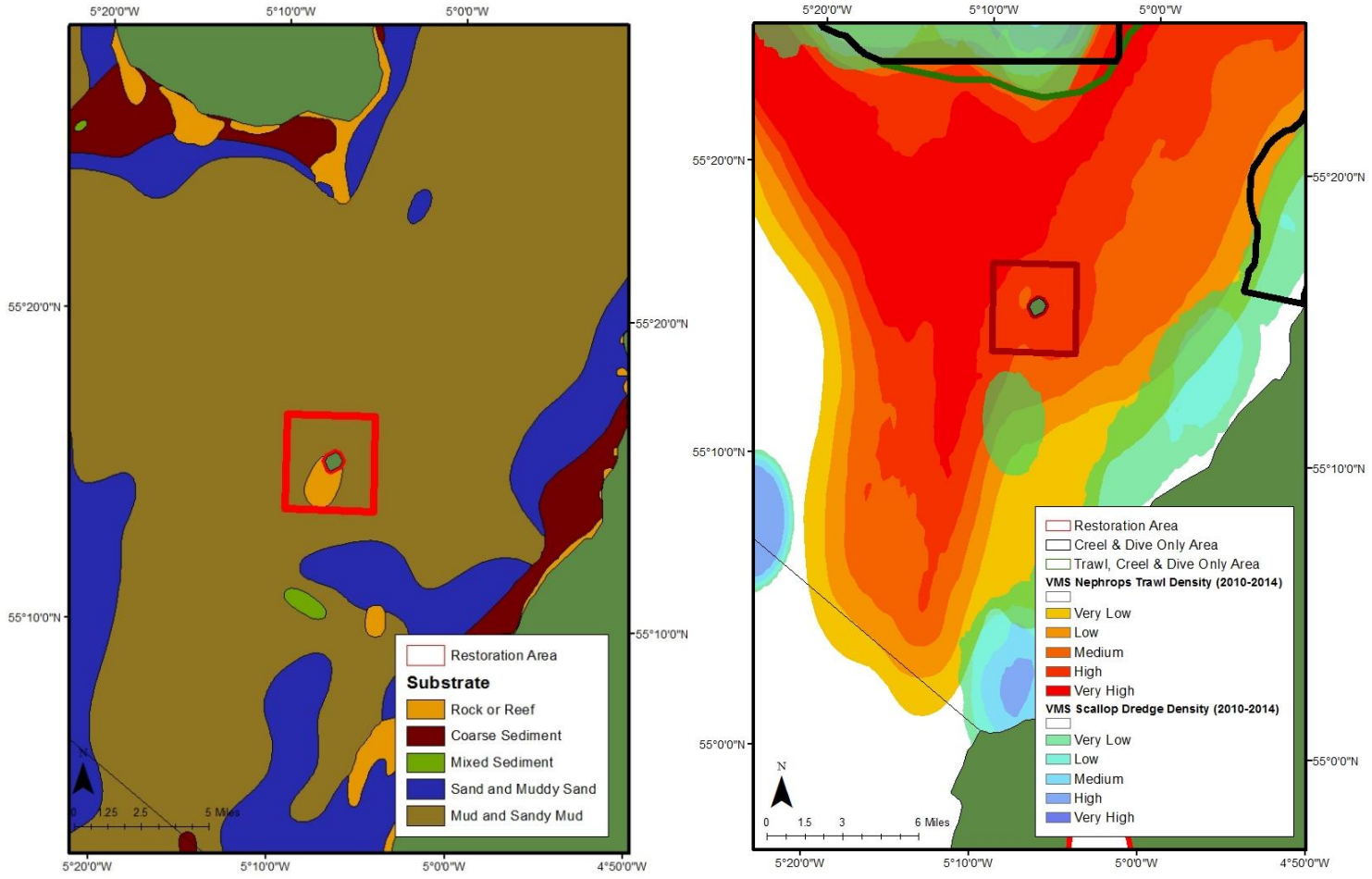


Figure 25 | a) Substrate and b) fishing activity overlaid with the spatial management proposed for the Ailsa Craig SMZ. The landward boundary of the SMZ follow mean low water springs (MLWS).

Location

The Ailsa Craig Restoration Area SMZ is located around Ailsa Craig Island. The landward boundary follows mean low water springs around Ailsa Craig. The seaward boundary is shaped as a rectilinear polygon extending out to approximately 1.8NM in the corners. The SMZ covers 30km^2

Physical characteristics

The SMZ contains a mixture of substrates, predominantly mud and sandy mud (Table 9). The SMZ covers four broad-scale habitats. Sublittoral mud is the most widespread habitat, occupying 85% of the SMZ (Table 12).

The Ailsa Craig Restoration Area SMZ reaches a depth of approximately 80 metres below Chart Datum.

Fishing activity

Fishing Data indicate that *Nephrops* trawling is the main method of fishing that takes place within the SMZ. According to fishing data, *Nephrops* creeling and scallop dredging occur but at very low intensities (Table 47).

Table 47 | Summary of assumed commercial scallop and *Nephrops* fishing activity within the Ailsa Craig Restoration Area SMZ

Fishing Gear	Sector	Fishing activity within the SMZ
Nephrops Trawl	Over 15m	1.44% of VMS *Nephrops* polls were located within the SMZ
	Under 15m	**ScotMap Data indicate;** Fishing activity: 3-8 vessels fishing throughout Monetary value: medium to high
Nephrops Creel	Under 15m	**ScotMap Data indicate;** Fishing activity: low and confined to the southeast Monetary value: low
Scallop Dredge	Over 15m	0.11%of VMS scallop dredge polls were located within the SMZ
	Under 15m	**ScotMap Data indicate;** Fishing activity: fished by 3 vessels throughout Monetary value: low
Scallop Diving	Under 15m	**ScotMap Data indicate;** Fishing activity: none Monetary value: nil

Interaction with existing spatial management measures

The SMZ interacts with a Special Protection Area (SPA) which covers the SMZ. The Ailsa Craig SPA is protected for birds and extends out into the marine environment in order to protect the colony of northern gannet and common guillemot.

Proposed management

Prohibition on the use of all commercial fishing gear and practices for *Nephrops*, king and queen scallop throughout the SMZ.

Rationale

The Design Objectives considered when designing the Ailsa Craig Restoration Area SMZ are set out below (Table 48).

Table 48 | Specific Design Objectives relating to the Ailsa Craig Restoration Area SMZ

	Design Objectives	Rationale
1	**Promoting *Nephrops* fishery sustainability**	- Potential for larval export - Encourage spat settling due to improved habitat protection - 82% of the SMZ is covered by muddy substrates - 85% of the SMZ is covered by sublittoral mud habitat
2	**Promoting scallop fishery sustainability**	- Potential for larval export which will assist recruitment in the adjacent scallop fishing grounds - Complex substrates, which are suitable for encouraging scallop spat settlement, cover 18% of the SMZ
3	**Promoting finfish recovery**	- 6% of the SMZ is covered by low energy infralittoral rock is often associated with areas of shallow water rock, below the tides, sheltered from waves and currents. A suitable fish nursery habitat. - Encourage fish spawn to settle due to improved habitat protection
4	**Minimising impacts on the fishing industry**	- No ports are located within the immediate vicinity of the SMZ - Analysis of the potential displacement effects of the SMZ on the fishing fleet indicates that there will be minimal impact on the scallop diving fishery and on *Nephrops* creelers. Data indicate that *Nephrops* trawling and scallop dredging will be displaced. - Boundary is a simple shape
5	**Minimising user conflicts**	- N/A
6	**Conserving biodiversity and promoting ecosystem resilience**	- The SMZ mirrors the boundaries of the Ailsa Craig SPA which has been recognised as an important habitat for seabirds. - The majority of the SMZ is covered by muddy substrates and sublittoral mud habitat which with additional management can contribute to ecosystem resilience.

Section 3: Technical Measures & Licensing Arrangements

Introduction

This section sets out the proposed technical measures and licensing arrangements for the RO.

The technical measures have been developed drawing on advice by academics and fisheries specialists and by reference to published reports on shellfish fishery management. These measures are designed to supplement the spatial management measures that lie at the core of this proposal.

Overview

By 2019 at the latest, the Clyde *Nephrops* fishery will be obliged to adopt measures to ensure it conforms to the EU Landing Obligation. In summary the Landing Obligation will require fishing vessels to retain all catch on board. The specific plans to implement the Landing Obligation are under development; however it is anticipated that quota management will become more flexible in its application and that technical conservation rules will be reviewed.

In light of these changes, the Clyde *Nephrops* fishery will be subject to significant alterations in quota management and technical conservation rules. It is expected that quotas will increase by the estimated amount of discards. Although, under Relative Stability the increases may not be as large as the Scottish fleet's recorded discards for the species.

Accordingly, the RO application does not make recommendations for quota or for gear specifications for the *Nephrops* trawl fishery. With regard to the *Nephrops* creel fishery, only one recommendation; that the CSMO consider implementing creel limits, is made.

It is proposed that the scallop fisheries, which is in principle unaffected by the Landing Obligation, be subject to technical measures.

The proposal does not make recommendations for quota for the king and queen scallop dredge and dive fisheries from the outset of the RO, but does make technical measures recommendations for these fisheries. However, it is anticipated that Total Allowable Catch limits may be set by the CSMO for the scallop fisheries once formal stock assessments have been undertaken.

Technical recommendations for the king scallop dive fishery are also made.

Summary of Technical Measures

Table 49 provides a summary of the proposed gear restrictions and effort controls being recommended under the SMP.

Table 49| Summary of the Strategic Management Plan (SMP) Proposed Technical Measures (by Gear Type)

Gear Type	SMP Technical Measure	Note
***Nephrops* Trawl**	N/A	
***Nephrops* Creel**	Creel Limits by vessel length	To be developed by CSMO
Scallop Dredge	Increase MLS	Year 1 to 105mm, year 2 to 110mm
	Carriage Restriction	To aid compliance with MLS
	Dredge Number	Maximum 6 standard (75cm) dredges per side
	Bar Length	Restricted to that which can accommodate 6 standard (75cm) dredges per side
	French Dredge Prohibition	
	Night time Curfew	Fishing restricted to hours between 6am and 9pm
Scallop Diving	Increase MLS	Increase to 110mm
	Carriage Restriction	To aid compliance with MLS
	Night time Curfew	Fishing restricted to hours between 6am and 9pm

Technical Measures: *Nephrops* Trawl

The proposed SMP will restrict Clyde *Nephrops* trawl operations, although 76% of the Clyde will remain open to *Nephrops* trawling. Significant alterations to *Nephrops* trawl management are also expected as a result of the Landing Obligation.

In light of anticipated fisheries management alterations outlined above, the proposal does not make recommendations for quota limits or technical measures for the Clyde *Nephrops* trawl fishery.

Technical Measures: *Nephrops* Creel

Creel Limits

The Clyde IFG (Clyde IFG, 2011) agreed to scaled creel limits assigned by vessel length for all creeling fisheries in the area, although details on the number of creels for any vessel were not agreed. To date, this proposal has not been implemented.

In 2012, Scottish Government undertook a consultation exercise on new controls for the *Nephrops* and crab creel fisheries, including proposals for the introduction of creel limits (following proposals from five of the six IFGs). A number of other Government sponsored initiatives have examined the issue and proposals remain outstanding.

The SIFT Clyde Creeler Consultation Exercise (2012) identified a range of views within industry. Some respondents recommended a single maximum (for example 1000 creels per boat) and

others suggested a scaled approach. SIFT believes that creel limits are appropriate for the Clyde and should be determined by vessel length. One reasonable example of the scaled approach is suggested in Table 50.

Table 50| An example of possible creel limits by vessel length

Vessel Size (m)	Recommended creel limit
> 6	Maximum of 300 creels
6 - 8	Maximum of 600 creels
8 - 12	Maximum of 1000 creels

Further information on creel fishing activity and creel numbers currently in use is required before precise limits can be set. Such information would also inform any decision on whether creel limits should be applied throughout the RO area or be restricted to Creel and Dive Only areas.

In the event of creel limits being implemented, it is anticipated that all creels deployed will be tagged.

The proposal does not make recommendations for quota limits or technical measures for the Clyde *Nephrops* creel fishery. However, the proposal does recommend the CSMO set creel limits based on vessel length within the first two years' of the RO. It is anticipated these limits could be informed by the outcome of final proposals from the SW IFG and any other relevant Government initiatives.

Technical Measures: King Scallop Dredge Fishery

The technical measures for the king scallop fishery have been designed to supplement the spatial management measures. As such, the measures have been developed with a view to:

- Reducing the impact of dredging, particularly in those complex areas of the seabed not protected by the spatial measures;
- Provide stock conservation and market benefits, mostly through better management of fishing effort;
- Enable the continued economic viability of smaller vessels in the king scallop fleet.

The proposed technical measures for the king scallop fleet are as follows:

Minimum Landing Size (MLS)

It is proposed the MLS be increased as follows: Year 1 to 105mm, year 2 to 110mm. This measure is designed to provide stock conservation and market benefits. The staged increase is designed to reduce the short-term economic impacts of an immediate move to 110mm.

Carriage Restriction

RO licence holders will be restricted from retaining on board any king scallop of less than the MLS within the area of the RO. This measure is designed to aid compliance with MLS increase proposals, particularly where scallop vessels fish outside and inside the RO jurisdiction during the course of one fishing trip.

Dredge Number

It is proposed the number of dredges be restricted to six standard 75cm ('Newhaven') dredges per side. This measure is designed to reduce the impact of dredging on complex areas of seabed. This measure is also designed to enable the continued economic viability of smaller vessels in the king scallop fleet.

Bar Length

Bar length will be restricted to that which can only accommodate 6 standard 75cm ('Newhaven') dredges per side. This measure is designed to aid compliance with the dredge number limit proposals.

Night Time Curfew

Scallop dredge fishing will be restricted to the hours between 6am and 9pm. Some flexibility will be agreed in the case of tide-limited harbours. This measure is designed to better manage fishing effort. Additionally, this measure may reduce inter-sector gear conflict.

Technical Measures: King Scallop Dive Fishery

In line with the Scottish King Scallop Fishery Review (Cappell *et al.*, 2013), this proposal recommends joined-up management for the scallop dredge and dive fishery. This is vital given that both sectors target the same resource. Consequently, the proposed scallop dive fishery technical measures complement those proposed for the dredge fishery.

Minimum Landing Size

It is proposed the MLS be increased; Year 1 to 105mm, year 2 to 110mm.

Carriage Restriction

To aid compliance with the proposed increase in MLS, RO scallop- dive licence holders will be restricted from retaining on board king scallop of less than the MLS within the area of the RO.

Night Time Curfew

The scallop dive fishing will be restricted to those hours between 6am and 9pm.

Licensing arrangements

Introduction

This section outlines the proposed licensing arrangements for the RO.

Under RO legislation, the CSMO as the Grantee of the proposed Clyde RO will issue licences to all commercial fishers wishing to fish in the area for any of the specified species[8]. An individual vessel may hold licences for all of the species licensed under the RO. Separate licences will be issued for each species. Licences will have general licence conditions attached, governing the terms under which a licence must operate and the terms of revocation or suspension of a licence. The CSMO will also issue restrictions and regulations on at least an annual basis, further regulating the fishery. The RO legislation will also set licence qualifying criteria laying out the conditions under which a licence will be issued. Licence contravention penalties will also be set.

Licence Fees and Levies

Annual licence fees will be payable prior to any licence being issued. Separate fees will be set for each species regulated under the RO. It is proposed that initially the annual licence fee will be set at £250 per species. The CSMO will reserve the right to vary the licence fee on an annual basis. The CSMO will also be able to impose a levy per tonne of shellfish landed under the terms of an RO licence. It is not anticipated that a levy be set for the first three years of operation of the RO. Any proposed alteration to licence and/or levies will require the consent of Scottish Ministers.

General Licence Conditions

General licence conditions will include:

- Details of the vessel to which the licence is attached;
- The person(s) nominated to skipper the licensed vessel;
- The species and geographical area(s) and period of time for which the licence is valid;
- Allowable fishing gears and any other technical requirements;
- Transfer rules for an RO licence (e.g. in the event of the vessel being sold or the vessel owner dying/retiring);
- The compliance requirements attached to the licence.

Restrictions and Regulations

One merit of an RO is the ability to quickly implement or remove management measures to suit changing circumstances. Changes to management measures are also expected at the start of each annual fishing season following consideration of latest management advice, not least

[8]The species specified under the terms of the proposed Clyde RO will be:- Prawns (*Nephrops norvegicus*), Scallop - King (*Pecten maximus*), Scallop- Queen (*Aquepecten opercularis*)

the latest stock assessments. In the main, such measures will be implemented through restrictions and regulations attached to each RO licence.

Licence Qualifying Criteria

The CSMO, through the Licensing Sub-Committee (Chapter 13) will be responsible for deciding the number of licences issued. The number of licences issued will be determined on an annual basis. Licences will be issued according to strict criteria including:

- Licences will only be issued to the majority shareholder in the vessel. The majority shareholder will skipper the vessel at all times when operating under the terms of the RO. (Exception- Deputy Skippers);
- Vessel operators can nominate up to two Deputy-Skippers who will need to produce all necessary documentation as laid out for majority shareholders;
- The majority shareholder must hold a valid Shellfish Entitlement[9] UK fishing licence;
- Any vessel named in a licence application must be a British registered Fishing Vessel and in possession of the relevant license issued by any one of the UK Fisheries Departments applicable to its length. The production of the Registration Certificate and the relevant Fisheries Departments licence must accompany any application by the owner for a licence. The vessel's name, port letters and number shall be clearly displayed as provided for in the Merchant Shipping Regulations;
- The owner of any vessel named in a licence application must have valid certificates for crewmembers;
- The applicant must provide evidence satisfactory to CSMO that as owner of the vessel in respect of which the licence application has been made, he has fished commercially (i.e. if any part of the catch has been sold, traded or otherwise exchanged for benefit) either with that vessel or with one of similar size, capacity and fishing power, for one of the listed species in the Regulated Area at any time between day/month/ year and day/month/ year;
- A new entrant to the fishery shall be entitled to have a licence issued to it only if CSMO, having particular regard to the scientific advice on the desirability of limiting the level of exploitation of the prescribed fishery or any part thereof, is satisfied that the new entrant can demonstrate to CSMO its intention and ability to purchase or otherwise obtain a vessel and crew all of which meet the relevant licence criteria. New entrants to the shellfish fisheries in the Regulated area will be exempt from paying the licence charge in the first year of the new entrant's commercial operation;
- In the event of oversubscription, licences will be allocated following a further prioritisation process.

[9]Shellfish Entitlement UK Licence - Category 3

Licence Contravention Arrangements

Any person who fails to pay Licence Fees or Levies, or contravenes Licence conditions or Restrictions and Regulations is guilty of an offence. In such circumstances CSMO will prosecute under the terms of Section 3(3) of the Sea Fisheries (Shellfish) Act 1967. A conviction under this Act will result in cancellation of the existing Licence and/or the refusal of a Licence in subsequent seasons. No person will be named on a licence if he/she has been convicted of a relevant offence[10] within the period of 24 months immediately preceding the date of the application.

[10] A "relevant offence" is an offence under Section 3(3) of the Sea Fisheries (Shellfish) Act 1967 as amended.

Section 4: Enforcement Strategy

Introduction

A comprehensive enforcement strategy will be required to ensure compliance. Under the terms of any RO in Scotland, both the RO Grantee (in this case the CSMO) and Marine Scotland: Compliance (MS: C) can enforce the RO fisheries. It is proposed that this will be the case in this instance.

In order to facilitate collaboration, it is proposed that the CSMO and MS:C will agree a Memorandum of Understanding (MoU). This will outline enforcement procedures (including inspection targets, patrol frequencies etc.) and responsibilities. The MoU may also agree a risk assessment process ensuring resource prioritisation for the highest risks. All information gathered on the RO fisheries, by either body, will be shared. As MS:C operational enforcement priorities can alter, the precise details of an MoU regarding enforcement responsibilities have yet to be finalised. It is expected a MoU will be agreed prior to the RO coming into force. This follows the process implemented for the Solway RO.

CSMO

The CSMO Fisheries Manager will be a warranted British Sea Fisheries Officer and as such will have powers of enforcement under the terms of the RO. It is anticipated that the CSMO Fisheries Manager will lead on day to day enforcement and will be responsible for coordinating the enforcement strategies of the two bodies.

MS:C

MS:C will also have responsibilities for enforcement of the RO. Presently, MS:C operates from two district offices in the area of the proposed RO. These offices are staffed by X land-based compliance officers, who's responsibilities currently include enforcement of the *Nephrops* and scallop fisheries in the Clyde.

The Enforcement Strategy and the Monitoring Programme

The enforcement strategy has been designed in conjunction with the fisheries performance and ecosystem status monitoring programme and in particular is informed by fisheries dependent data (both spatial and with regard to effort).

In particular, a key feature of the enforcement strategy will be a fishing vessel monitoring system, otherwise known as iVMS (**inshore Vessel Monitoring System**). The use of a fully functioning iVMS system will be a condition of licence for all vessel types.

The main feature of the system is high frequency (1 per minute) position reporting. As such remote sensing technologies are continuing to develop rapidly, there are numerous potential benefits for marine managers, fishermen and conservation interests, as well as for the furtherance of fisheries and marine science. Given this rapidity, decisions on the system to be implemented within the RO will be made following the granting of the Order, however the features of the system chosen will need to include:

- Setting of geo-fence boundaries (with associated buffer zones);
- Real-time Email alert facilities to enforcement officers of the CSMO;
- Automated upload capabilities to the CST.

11 Benefits

Introduction

The proposed RO aims to benefit the shellfish fishery and to provide additional benefits to other fishery and non-fishery stakeholders. The biggest threat to these stakeholders is to continue with business as usual. The finfish fishery has already collapsed, the majority of scallop divers have left the Clyde, sea angling charterers have gone out of business, creelers are hemmed into small pockets, and the mobile shellfisheries depend upon stocks that are either unassessed or heavily exploited. All these activities could have prosperous long term futures if the changes proposed in the RO are put into place.

This chapter summarises the intended benefits arising from the RO. An economic analysis of the benefits is given in chapter 12.

Shellfish Fishery Benefits

SIFT's proposed changes would bring benefits to the scallop fishery. The dredging sector would benefit because effective spatial management leads to increases in scallop populations, (as evidenced by multiple studies from other sites). So although there would be a loss in the area of dredging grounds, this would be more than compensated for by the increasing richness of the remaining grounds. The scallop diving industry would also benefit from increased stocks and from being able to operate without fear of interaction with the dredging sector.

In the *Nephrops* fishery, whilst there is no doubt that there would be short term costs on the trawling sector, economic analysis indicates the measures would have less of a negative impact than the declines that frequently already occur from one year to the next. The fishing activity analysis shows that the great majority of the areas that SIFT proposes for Spatial Management Zones are not intensively fished by trawlers. These are marginal *Nephrops* trawling areas which have significant ecosystem value. Their protection would bring considerably greater societal benefits than losses to the trawl fishery. Conversely, the *Nephrops* creeling sector would benefit from having large new areas where it could operate without any interaction with the trawl fishery.

It is expected that **over a 20 year period the gains in the *Nephrops* fishery would exceed losses**. Nevertheless, compensation for some vessels incurring short term losses may be appropriate. SIFT believes this should be assessed on a case-by-case basis in line with previous fisheries compensation payments.

More specifically, evidence from spatial management measures elsewhere indicates that the proposed RO is likely to directly enhance the commercial shellfish fisheries as follows:

Stock Enhancement

Spatial management measures in the Isle of Man scallop fishery resulted in the following impacts:

- Increased biomass;
- Increased abundance;
- Increased density;

- Increased age and size structure.

It is important to note that the Isle of Man fishing industry is now strongly supportive of the spatial management measures imposed on the king scallop fishery and is now actively involved in related research, monitoring and stock enhancement exercises (Beukers-Stewart & Brand 2007).

The rapidity of any resultant stock increase is difficult to predict but it is notable that the New England Sea Scallop Fishery (see Box 2) experienced a 10 fold increase in stock biomass in a period of 6 years (Hart *et al*., 2013).

Spillover Effects

In essence, spillover effects occur when an area, by being protected from certain forms of fishing activity (or some other measure), experiences increased production of larvae, juveniles and adults which then disperse to and enrich adjacent fishing grounds. The Spatial Management Zones in this proposal have the potential to provide significant spillover benefits to the commercial king and queen scallop fisheries.

Non-RO-Shellfish Species Benefits

The proposals have the potential to directly enhance the commercial shellfish fisheries not covered by the RO. In particular, it is expected that stock enhancement benefits (such as greater fecundity and larger sizes) will occur in the crab and lobster fisheries. There is important local evidence that spillover benefits arose from spatial management of the Lamlash NTZ. (Howarth, 2015; Hoskins *et al.,* 2009). This is an important finding as it substantiates the premise that the Clyde is capable of experiencing population recoveries that result in spillover of a variety of commercial species.

Reduction in Gear Conflict Benefits

Another benefit to the existing shellfish fishery (affecting both the static and mobile gear sectors), would be the contribution the proposal will make to reducing gear conflict. The proposed spatial measures will keep gear types apart, and contribute to ongoing efforts by Scottish Ministers to reduce the costs of gear conflict to industry.

Finfish Fishery Benefits

Recent research indicates that closed areas of the type proposed under the RO can encourage the recovery of seafloor habitats so that increases in the recruitment of finfish such as cod and other commercially valuable species can be recorded (Howarth, 2015). For example, following the introduction of spatial management measures off New England, there has been some reduction of groundfish fishing mortality, and haddock biomass has increased to record-high levels (O'Boyle, 2011).

Diversification of Target Species

The proposed Spatial Management Measures would diversify the number of finfish species available to the commercial fishery through:

- Improved spawning protection;
- Improved protection of critical groundfish habitats;
- Improved refuge for critical life history stages;

- Improved access to both the use and non-use benefits arising from closed area management across gear types, fisheries and stakeholder groups. EH?

Parity between the Sectors

The mandatory nature of the RO proposals is expected to reduce unfair competition. There is substantial evidence that voluntary agreements are ineffective at restricting some fishing activities, particularly by those coming into the fishery from other territories. Those who ignore voluntary agreements can gain a competitive advantage over those who honour voluntary agreements. Accordingly a statutory basis for fisheries management, as is proposed here, accompanied by appropriate enforcement, will ensure fair access for all.

Policy Benefits

The proposals are expected to support public policy objectives on a range of levels. These are set out below:

Overarching sustainable development objective

The Scottish Government has the ambition to create "*a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth.*" The RO proposals are consistent with this objective, being designed to support sustainable economic growth on and around the Clyde.

2015 Inshore Fisheries Strategy

The Scottish Government's 2015 Inshore Fisheries Strategy focuses on:

- Improving the evidence base on which fisheries management decisions are made;
- Streamlining fisheries governance, and promoting stakeholder participation; and
- Embedding inshore fisheries management into wider marine planning.

The RO proposals are consistent with these strategic objectives.

EU alignment

The RO proposals will also help bring the Clyde fisheries into line with the wider objectives of the revised EU Common Fisheries Policy. This requires Member States to have "*action plans for the development, competitiveness and sustainability of small scale coastal fishing*", to create the "*environmental conditions capable of being sustained long term which are necessary for economic and social development*", and to achieve an "*exploitation of living marine biological resources that restores fish stocks to and maintains them above levels which can sustain Maximum Sustainable Yield (MSY) by 2020 at the latest*".

Marine Strategy Framework Directive (MSFD)

More specifically, the RO proposals complement the objectives of the MSFD, which is the environmental pillar of Europe's maritime policy, designed to create a framework for sustainable use of Europe's marine waters (European Union, 2013). Its purpose is to promote an ecosystem approach to marine management as a means of achieving Good Environmental Status (GES) by 2020. This approach, which focuses on management on an ecosystem wide basis, rather than on the management of target species underpins the rationale for the proposed measures in the RO.

National Marine Plan

The RO proposals are specifically designed to assist the Clyde fishery to conform with the objectives of Scotland's National Marine Plan[11], which endorses the "*eco-system-based management of inshore fisheries at local level, on the basis of participative management with interested stakeholders*" so that the fleet "*is seen as an exemplar in global sustainable fishing practices and is confident in securing a long-term income*" and uses an "*evidence-based approach to fisheries management which is underpinned by a responsible use of sound science and is supported by the whole sector*".

The Marine Scotland Act (2010)

The Marine Scotland Act (2010) provides legislation to enhance the management and stewardship of Scotland's seas. Amongst other powers, the Bill provides opportunities to legislate with respect to:

1. The creation of **Scottish Marine Regions** (SMRs);
2. The designation of a network of **Marine Protected Areas** (MPAs).

Scotland's Marine Regions

The proposed RO will provide a sound basis for fisheries management under the SMR proposals. Also, the governance structures provided through the creation of the Clyde Shellfisheries Management Organisation align with the SMR principles of local ownership and decision-making.

Marine Protected Areas

SIFT recognises that it is potentially confusing to introduce new management measures under the proposed RO at the same time as new management measures are proposed for Clyde's three Marine Protected Areas (Table 65, Appendix C).

The purpose of the MPA management measures is to meet the conservation objectives for the protected features they contain. But, for the purposes of *fishery recovery*, additional measures have been proposed where necessary.

The rationale for the specific fishery measures within the 3 Clyde-based MPAs has been set out in Chapter 9.

Other designations

Other existing protected areas which were taken into account in the design of the RO proposals including the Lamlash Bay (Arran) No-Take Zone (NTZ), two Special Areas of Conservation (SACs) and some existing voluntary fishery management measures. Further details on these measures can be found in Chapter 7, Table 1.

Clyde 2020

The Scottish Government's Clyde 2020 initiative's current Action Plan does not contain any specific fishery management measures, but rather focuses on the delivery of additional

[11] December 2014

science. Whilst additional scientific research is a high priority, SIFT concurs with the *Clyde Ecosystem Review* that it should not delay the implementation of practical measures.

The RO proposals have been designed so that they could form the basis of a wider fisheries action plan, under the Clyde 2020 initiative, capable of delivering fishery management proposals for the Clyde.

In respect of the Clyde 2020's focus on scientific research, the Clyde Scientific Trust's remit and priorities have been specifically designed to integrate with those of the Clyde 2020 Research Sub-Group.

Wider socio economic benefits

The proposed RO has the potential to provide wider socio-economic benefits including to the tourism, recreational sea angling and recreational diving sectors. These are summarised below.

Tourism

The proposals' beneficial impacts upon the health of the marine ecosystem are expected to provide the conditions for growth of the wildlife tourism industry within the Clyde. This would align the proposals with The Scottish Government's Economic Strategy (Scottish Government, 2011) which identifies Sustainable Tourism as a key growth sector.

Recreational sea angling

By restoring a diverse stock of large finfish, the RO would enable the Clyde to regain its former status as one of Scotland's most productive recreational sea angling waters. In addition to the additional employment and local income arising from this (described in Chapter Z), it is expected that there would be significant but unquantifiable health, well-being, personal development and community benefits from a revival of RSA.

Recreational diving

Recreational diving is also expected to benefit from a better-managed Clyde. The Clyde's long maritime history means that it has numerous wreck sites. Wrecks which can be safely dived and have not been degraded by fishing gears attract recreational divers, who also prefer clear waters (unaffected by disturbed sea floor sediments) and richer and more abundant biodiversity. The measures introduced by the RO proposals would help achieve these conditions. The value of these benefits are set out in the economic benefits Chapter 12.

Ecosystem benefits

The RO proposals' intended improvements to the Clyde marine ecosystem are expected to have positive effects on the delivery of ecosystem services. These services, in addition to the fishery oriented food-web benefits, may range from nutrient cycling to scenery.

Biodiversity

Studies in the Lamlash Bay NTZ have shown that spatial management involving the prohibition of mobile gear heightens biodiversity - both the number of species and abundance: live maerl, macroalgae, sponges, hydroids, and total epifauna were all significantly more abundant within

the NTZ than on neighbouring fishing grounds (Howarth *et al*., 2012), (Howarth, 2015). The spatial prohibitions under the RO would be expected to further increase biodiversity.

Ecosystem Resilience

The Regulating Order proposals are designed to protect and enhance ecosystem elements and so to improve the overall ecosystem resilience in the face of ongoing threats to the Clyde's marine ecosystem.

Public interest

The Clyde fishery is a public resource. It is owned by the people of Scotland, and should be managed for the common good. There is clear evidence that the Clyde communities are strongly supportive of calls for new and fairer fisheries management. The RO is the only proposal which addresses these calls and enables the public to take a greater interest in the management of their resource.

12 Economic Impacts

This chapter summarises the assessment of the economic impacts of implementing the RO proposals (the 'policy on' option), and compares these with the impacts of not implementing the proposals (the 'policy off' option). It is a summary of the full Economic Impact Report undertaken by Bridge Economics on behalf of SIFT, which is appended to this document. Impacts are considered in quantitative and qualitative terms. Inevitably, the assessments of impacts are estimates, but they are based upon best available information about the Clyde fishery and scientific knowledge of ecosystem responses to spatial and other management measures.

The quantitative assessment has three main elements. The first is a cost benefit analysis of the policy's implementation on the commercial fishing sector. The commercial fishery is divided into three parts - *Nephrops*, scallops and whitefish, with annual costs and benefits for each fishery netted off and discounted at a rate of 3.5% over 20 years. The 20 year time period was selected because it forms the anticipated duration of the initial RO application and its subsequent extension.

Overall impacts are then expressed as a Net Present Value (NPV) figure, so that all future monetised costs and benefits are expressed in today's money. The second element of the quantitative assessment is an estimation of the impact of the expenditure in the Clyde region associated with recreational sea angling. Recreational sea angling is influenced by species diversity and stocks and is expected to recover in line with the biodiversity benefits taking place under the 'policy on'. This is an ongoing activity and therefore generates annual expenditure (supporting regional employment in the retail/chartering/services sector) on a recurring basis. Indicative estimates of the jobs associated with the predicted changes in recreational sea angling, as well as those created in the commercial fishing sector, have been made.

The final quantitative component is an estimate of the non-use value to regional residents of an improvement in biodiversity in the Clyde. The latter draws on Defra's research into the public's willingness to pay for Marine Conservation Zones and is a one-off figure.

It is anticipated that the RO will also have beneficial impacts on other sectors – for example ecosystem benefits and recreational diving. These have been omitted from the quantitative assessment, but are included in a qualitative assessment. Consequently, the quantitative assessment of benefits of 'policy on' is at the conservative end of the range.

Methodology and Inputs

The approach employed draws on standard HM Treasury Green Book methodologies for undertaking economic appraisals, and also makes use of best practices used in the completion of economic impact assessments.

Key inputs for impact assessment on commercial fisheries include prices, landings, revenues, costs, splits in gear types and vessel sizes and future recovery rates of fish and shellfish species. These have been obtained from Marine Scotland, the Marine Maritime Organisation and the International Council for the Exploration of the Sea (ICES), as well as from independent fisheries scientists, Seafish (a non-departmental public body set up to improve efficiency and raise standard in the seafood industry), industry contacts and published scientific evidence.

The results from the quantitative assessments have been estimated for a particular level of landings, shown in Tables 51 and 52 below.

Table 51| Assumed Annual *Nephrops* Landings (Tonnes)

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 20**
'Policy off' catch	5,150	5,150	5,150	5,150	5,150	5,150
of which, by trawl	4,959	4,959	4,959	4,959	4,959	4,959
by creel	191	191	191	191	191	191
'Policy on' catch	5,150	5,150	5,150	5,150	5,150	5,150
of which, by trawl	4,948	4,936	4,924	4,912	4,900	4,900
by creel	202	214	226	238	250	250
Source: Consultant estimates						

The table above demonstrates that the total level of *Nephrops* catch under the two options is not expected to differ, and in each case is set at 5,150 tonnes per annum. Between each option there is a small difference in the split between trawl and creel, with trawl caught *Nephrops* landings under 'policy off' expected to be about 1% lower (over the 20 year assessment period) compared to the landings envisaged under 'policy on'.

Annual scallops landings are summarised below. In this case, landings under the two options are quite different, with an initial cap in landings under 'policy on' resulting in lower landings for this option until year 6, after which scallops harvests increase rapidly until by year 13, they are more than twice as high as they would have been under the counterfactual.

Table 52| Assumed Annual Scallops Landings (Tonnes)

	'Policy off'			'Policy on'		
Year	**Dredged**	**Hand dived**	**Total**	**Dredged**	**Hand dived**	**Total**
Year 1	332	18	350	266	14	280
Year 2	332	18	350	266	14	280
Year 3	332	18	350	266	14	280
Year 4	332	18	350	293	15	308
Year 5	332	18	350	322	17	339
Year 6	332	18	350	354	19	373
Year 7	332	18	350	389	20	410
Year 8	332	18	350	428	23	451
Year 9	332	18	350	471	25	496
Year 10	332	18	350	518	27	546
Year 11	332	18	350	570	30	600
Year 12	332	18	350	627	33	660
Year 13	332	18	350	690	36	726
Source: Consultant estimates						

Finally there are also significant differences in finfish catches. 'Policy off' assumes no additional whitefish catch over the (predominantly) bycatch already landed, while 'policy on', which has the objective of restoring biodiversity and providing a more diverse fishery, is associated with the return of commercially viable whitefish stocks. Under this option, landings start at the same level as 'policy off' and gradually rise to a conservatively estimated 2,500 tonnes pa. With landings as described above, and the other inputs set out in Annex B of the main Economic Impact Report, the outputs are presented as follows.

Economic Assessment

Commercial Fishery

Table 53 summarises the results of implementing the proposed policy on the commercial fishing sector in the Clyde. The results indicate that in NPV terms, the cumulative impact on

the commercial fishery as a whole is expected to be positive at £2.5m, implying that from a monetary stand point alone, 'policy on' should be preferred to 'policy off'. Total NPVs of 'policy on' (£37.3m) and 'policy off' (£34.8m) are however relatively close, meaning that although 'policy on' is expected to create more value, the difference between the two options is relatively small. This is partly due to relatively narrow profit margins reducing the scope for large benefits in both cases, and partly due to the relatively minor changes in *Nephrops* catches predicted.

Table 53| Commercial Fishery Results, £000s

Test Results, full period, discount rate @3.5%	**'Policy on'**	**'Policy off'**	**Net impact of 'Policy on'**	**% change**
NPV of *Nephrops* fishery	32,200	33,200	-940	-2.8
NPV of scallops fishery	2,400	1,600	740	45
NPV of whitefish fishery	2,700	0	2,700	n/a
Total NPV of commercial fisheries	37,300	34,800	2,500	7
Notes: Figures cover the whole appraisal period (20 years). Net present values (NPVs) discounted over the appraisal period and shown in £ thousands. Any apparent arithmetical errors are explained by rounding in the figures. **Source: Consultants estimates**				

Table 53 shows that within the overall benefit, the *Nephrops* fishery would be expected to experience additional costs of some £940k (i.e. there is a cost of £940k to this sector of implementing the policy). For its part, the scallops fishery would benefit by an amount estimated at £740k, while the whitefish sector would grow from a neutral position to one in which additional revenues of some £2m pa are generated, creating a benefit which in NPV terms would be equivalent to some £2.7m.

There is some flexibility in these figures, most notably due to the attribution of additional annual management costs of £150k pa that do not accrue under the 'policy off' option. The total NPV cost of these additional annual fisheries management costs is equivalent to £2.2m, a cost currently apportioned wholly to the *Nephrops* fishery, resulting in the *Nephrops* fishery showing a 'loss' under 'policy on' equal to £940k over 20 years. However, were this cost to be distributed across the commercial fishing sector as a whole, this would allow a more equitable distribution of the regulatory regime costs and permit the *Nephrops* sector to break even (or better), whilst still retaining the policy's positive impacts on the other sectors. Any such

redistribution would not affect the final NPV to commercial fisheries (£2.5m) but merely redistributes the total benefits between the different commercial fishing sectors.

Sensitivity testing indicates that in most cases changing the underlying assumptions would not result in 'policy off' displacing 'policy on' as the preferred option. The exception is if landings under 'policy on' were tightly constrained, with landings under 'policy off' increasing. However, should conditions favour increased catches under 'policy off', such conditions would presumably also apply under 'policy on', and with landing limits currently conservatively set under the RO option, some relaxation to fisheries management in the face of better conditions could realise higher benefits for this option too, without prejudicing the return of sustainable whitefish stocks.

Employment Impacts

Employment in the commercial fishing fleet is difficult to judge for many reasons, not least because it is unclear how skippers and fishermen would react to increased opportunities of work within the Clyde. They may choose to work more intensively and/or increase hours, shift locations from other fishing grounds, or employ new people (i.e. create genuine new jobs). However, the following estimate, based on standard industry employment /turnover ratios for each fishery type, is suggested as indicative of employment impact. Figures are quoted as full time equivalent jobs:

- *Nephrops* trawler employment – negligible effect;
- *Nephrops* creeler employment – creation of up to 27 jobs;
- Scallops dredger employment – potentially losing up to 4 jobs in the first five years, and rising by up to 21 jobs by year 13;
- Scallops hand diving – rising by up to 4 jobs by year 13
- Commercial white fishing operations – up to 6 jobs in year 3, rising to 65 by year 13.

Using these figures it is estimated that in excess of 100 new jobs could potentially be created in the fishery under 'policy on'.

Sea Angling

Expenditure and employment from recreational sea angling is the second of the three quantitative impacts assessed. Table 54 shows the estimated effect of implementing the policy on recreational sea angling in the Clyde during the first 13 years following the introduction of the policy. The annual impacts of operating the policy during years 14-20 of the study period are expected to be the same as the annual impacts shown for year 13, though these are not explicitly shown.

Table 54| Economic Contribution of Sea Angling to Glasgow and the West (£m)

Year	Additional Spend under 'Policy on', £m	Additional Employment under 'Policy on'
Year 1	-	-
Year 2	-	-
Year 3	-	-
Year 4	3.6	64
Year 5	3.7	67
Year 6	4.5	80
Year 7	4.8	85
Year 8	5.7	102
Year 9	6.1	107
Year 10	6.1	107
Year 11	6.9	122
Year 12	6.9	122
Year 13	7.5	134
Source: Consultants estimates		

Additional spend is the net additional spend under 'policy on' compared to 'policy off', and includes an allowance for deadweight, displacement and the effects of a regional multiplier. Spend is expressed in current prices. Employment shows the number of full time equivalent jobs expected to be supported by the additional spend; therefore these jobs too are additional to those which might be expected under the 'policy off' option.

Willingness to Pay

Willingness to Pay is a means of assessing the benefits associated with a particular policy aimed at providing benefits that are not measurable in the normal way – i.e. via market prices. A measure of how much better off a non-user would be from improvements to the Clyde's ecosystem can be expressed as their 'willingness to pay' to make the improvements. This WTP is obtained through 'stated preference' survey techniques.

The total estimate of local people's WTP for improvements in the Clyde ecosystem is £11.4m. This is a one off or 'windfall' figure which can be added to the other benefits associated with the policy.

Qualitative Results

As well as quantitative impacts, the introduction of the proposed RO is likely to have significant qualitative impacts, which cannot be monetised but are nonetheless important to include in an economic assessment. Considering qualitative impact involves some element of subjectivity. In order to mitigate the extent of subjectivity involved, impact has been assessed through a three stage process. Firstly, the sensitivity of the receptor was assessed; secondly, the magnitude of the effect was assessed; and finally, significance was assessed based on the outcomes of these first two stages. In this final stage, qualitative impact is then assessed according to a scale of impacts extending from major adverse through moderate adverse, minor adverse, negligible, minor beneficial, moderate beneficial and major beneficial.

The elements assessed were biodiversity; economic resilience; gear conflict; recreational sea angling (partial); diving; and management of the fishery by all stakeholders. The qualitative impacts of 'policy on' (relative to the 'policy off' option) were all judged to be significant and positive. Impacts varied between 'minor beneficial' effects (which applied to gear conflict and diving) and 'major beneficial' effects (which applied to biodiversity, economic resilience and recreational sea angling). The effect of managing the fishery by all stakeholders was assessed as 'moderately beneficial'. The qualitative assessment therefore supported the proposed introduction of the policy.

Conclusions

The analysis undertaken as part of the economic assessment supports the following conclusions:

- In quantitative terms, introducing the policy will have a positive overall effect on the Clyde's commercial fisheries. Over the 20 year period of the appraisal, introduction of the RO (compared to the alternative of not introducing the policy) is expected to produce:
    - Additional monetised benefits to commercial fishing equivalent to £2.5m NPV;
    - 1,000 fewer tonnes of *Nephrops* landed from trawl;
    - 1,000 more tonnes of *Nephrops* landed from creel;
    - 3,800 additional tonnes of scallops landed;
    - 35,000 additional tonnes of whitefish landed;
    - Up to 134 new fishing jobs, if standard industry ratios of turnover/job are applied, and if new workload is converted into new FTE jobs.
- A small negative impact on the revenues of the *Nephrops* trawl sector, estimated at around £2m (undiscounted) over the whole 20 year period (i.e. a fall of about 1%), and a larger positive impact on the revenues of the *Nephrops* creel sector, estimated at around £8.5m (undiscounted) over the 20 year period (i.e. a rise of over 25%);
- Spatial management of trawling within the *Nephrops* sector is expected to promote a short to medium term recovery in biodiversity, creating additional whitefish stocks

which will support new commercial fishing activities. Such activities will resulting in an estimated £2.7m worth of benefits to the commercial fishing sector in NPV terms;

- *Nephrops* trawlers, if able to adapt to the changing fisheries environment, may therefore be able to mitigate any losses and/or reduce their dependency on a single species by fishing for a wider range of species, including cod, saithe, whiting and haddock;

- The improved biodiversity and environmental prospects for the Clyde (as evidenced by the recovery of some whitefish species), will in turn have beneficial economic impacts through tourism, driven by increased recreational sea angling and (to a lesser extent) diving opportunities;

- Additional expenditure from angling visits generated under 'policy on' is expected to begin in year four with some £3.5m of net additional spend per annum being generated, forecast to rise to £7.5m pa in year 13, and remain at that level thereafter. This level of expenditure will support an additional 60 -130 jobs in the region, compared to 'policy off';

- In addition, a one-off Willingness to Pay figure of £11.6m has been estimated in respect of 'policy on', reflecting improvements in environmental habitat and biodiversity.

Current management measures have failed to halt declines of stocks. A new solution is needed, to agree specific areas for *Nephrops* trawling and scallop dredging, to better manage these fisheries to facilitate the return of the Clyde's whitefish biomass, and to provide habitat and environmental improvement.

The implementation of an effective policy, carefully managed and in collaboration with all local stakeholders, can provide the catalyst for the return of a commercial viable whitefish population; and in doing so, increase employment, create value and build resilience in the local fishing fleet by reducing its dependency on *Nephrops* and scallops.

13 Governance

Introduction

A new organisation, the Clyde Shellfisheries Management Organisation (CSMO), will be formed to act as Grantee for the RO. The CSMO will comprise of a Board and an executive team. For the avoidance of doubt, SIFT will not be the Grantee.

A second new organisation, the Clyde Scientific Trust (CST), will also be constituted to provide the scientific information necessary to support the CSMO's delivery of its fisheries management objectives. The CST will comprise of a Board and an executive team.

Funding

Draft business plans for the CSMO (included at Appendix E) and for the CST have been developed. These plans will be completed when the governance, enforcement and monitoring requirements of the proposals are finalised following the conclusion of the formal consultation process. Funding applications for the CSMO and the CST will subsequently be made to EU and private sources, with whom preliminary discussions have already been held.

Clyde Shellfisheries Management Organisation (CSMO)

Aims

This application includes the details that form the core of the Strategic Management Plan. The CSMO's aims are to implement the Strategic Management Plan and to develop and implement subsequent Annual Management Plans, which will be developed by the CSMO board in conjunction with the advice of external stakeholders. More specifically, the CSMO will:

- sustainably manage the shellfisheries in the Clyde by opening fisheries whenever scientific advice indicates that it is prudent so to do;
- maximise the socio-economic benefits arising from well managed fisheries.

Functions

The CSMO's main functions are to:

- regulate the shellfisheries as indicated by scientific advice;
- set spatial and non-spatial management measures for each species;
- issue licences and collect levies;
- monitor and manage the fishing effort;
- Collaborate with Marine Scotland: Compliance to enforce the RO.

CSMO interaction with the Marine Planning Partnership (MPP) & the South West Inshore Fisheries Group (SWIFG)

It will be a priority for the CSMO to interact with both the MPP and the SWIFG, both of which have remits over the management of the Clyde marine environment. Uncertainty surrounding the future governance structures and strategies of the MPP and SWIFG remain and so it is not possible to fully articulate the potential mechanisms for informing and reflecting each of the

respective plans of the three organisations. The CSMO will work with MPP and SWIFG to agree joint fisheries management measures. To achieve this, the CSMO will:

- Make available all relevant fisheries data held as a consequence of the RO;
- In due course the proposals in the RO would be adopted as at least the basis of any fisheries plan for the Clyde under the MPP;
- Regularly engage over the lifetime of the RO with the MPP and SWIFG to align management measures where possible, to ensure duplication and/or conflict is avoided;
- Have representation at board level which will include many of the fishing industry bodies already represented on the SWIFG Executive Committee.

The CSMO Board

It is proposed that there be 12 members of the CSMO Board formed from a mix of local fishing and non-fishing interests. This is similar to the Board of the Shetland Shellfish Management Organisation, which draws 50% of its members from the fishing industry. The remaining 50% of the CSMO Board will represent the wide breadth of other local community interests in the Clyde fishery and reflects the fact that the fishery is a public asset.

Table 55 below sets out the proposed composition of the Board, and which stakeholder groups are represented.

Table 55| Clyde Shellfisheries Management Organisation Board Composition

Sector	Board representations
Independent Chair	1
Mobile gear fishermen	3
Static gear fishermen	3
Local Authority representatives	2
Clyde Scientific Trust representative	1
Environmental NGO representative	1
Marine Scotland: Policy, Non-voting	1
C2020 Steering Group representative	1

The CSMO board will be composed of multiple local stakeholder representatives. There will be 12 directors in addition to the independent Chair.

Fishing industry representation

Half of the Board members will be drawn from within the fishing industry. It is vital that industry provides the largest single group within the Board; as these representatives will be

able to offer expert advice on the practical implications of fishery management decisions. Of these six directors, three will represent the mobile gear sector of the fishery and three will represent the static gear sector. This balance between the two sectors reflects the equal rights that the two types of fishery have to operate in the Clyde's waters.

Other stakeholder representation

The remainder of the Board members will be drawn from the public sector and non-governmental organisations. This balance reflects the fact that the fishery is a public asset which must be managed in the interests of the public. The following organisations will be invited:

- ***Local Authorities***

In order to ensure that the interests of local communities are taken into account and to collaborate effectively with local integrated coastal management policies around the Clyde, it is proposed that two Board members be drawn from Local Authorities. It is recognised that Local Authorities have responsibility for economic development within their areas and that they are able to provide input to the Board in this regard. It is anticipated that these members will be officers with responsibility for coastal and marine matters, rather than elected members of the Local Authorities. Whilst the Clyde is bounded by five Local Authorities, it is held that two officers could effectively represent this sector.

- ***Clyde Scientific Trust***

It is proposed that the Chairman of the Clyde Scientific Trust is a Board member. This will ensure that there continues to be an emphasis placed upon sound science when setting fishery policy for the Clyde. Whilst it is anticipated that the CSMO and CST will collaborate operationally, it is felt to be important that there is also Board level interaction between the two organisations.

- ***Marine Scotland: Policy***

It is proposed that a representative of Marine Scotland: Policy is a Board member on a non-voting basis. This will ensure effective collaboration between the CSMO and Marine Scotland and facilitate effective communication on matters related to the management of the Clyde, including lessons learned by the CSMO and implications for the Clyde of changes to national fisheries policy.

- ***Environmental Non-Governmental Organisation***

It is proposed that a representative of an environmental Non-Governmental Organisation (NGO) sector is a Board member. This will ensure that the important issue of environmental sustainability is considered in management decisions. The precise identity of the NGO is not predetermined, however it is intended that the representative organisation will be one with close links to the Clyde.

- ***Clyde 2020 Steering Group member***

It is proposed that a representative of Clyde 2020 Steering Group is a Board member. In the first instance it is felt that this should be a member from the Sustainable Inshore Fisheries Trust (SIFT). This will ensure that there is effective coordination between SIFT which drafted

the original RO proposal and the CSMO which is the Grantee of the RO. As primary initiator of the RO, and co-ordinator of the Strategic Management Plan for the Clyde, SIFT will bring a wealth of knowledge about the proposal. It will also ensure that the underlying principles of the RO are not overlooked in the development of subsequent Annual Management Plans.

It is anticipated that once management powers have been transitioned to the CSMO and it is established as an effective body, that the Board place held by SIFT may be offered to another body on the Clyde 2020 Steering Group. It is recommended that this subsequent Board place be allocated to an organisation which is also a member of Clyde Forum, which is the appropriate body, given its anticipated role in the relevant Marine Regional Planning Authority.

The CSMO Chair

The Chair of the CSMO will be independent of any of the interests represented on the Board. The Chair will be an external appointment and elected by the Board. The Chair will be paid a retainer in recognition of the fact that the Chair is the management contact for the Fisheries Manager. The Chair will have a casting vote. This vote would be able to maintain the status quo unless scientific advice indicates that change is necessary. The Chair is free to choose how to vote.

CSMO Executive

The CSMO's executive team will comprise of a Fisheries Manager who will report to the Board and is responsible for delivering strategy set by the Board and an Administrative Officer.

The Fisheries Manager will be a warranted British Sea Fisheries Officer and as such will have powers of enforcement under the terms of the RO. The Fisheries Manager will also be responsible for implementing Board decisions, engage in wider stakeholder liaison and provide day to day management of the fishery.

The Administrative Officer will provide secretariat support to the Board and the Fisheries Manager together with the administration associated with the issuing of licences.

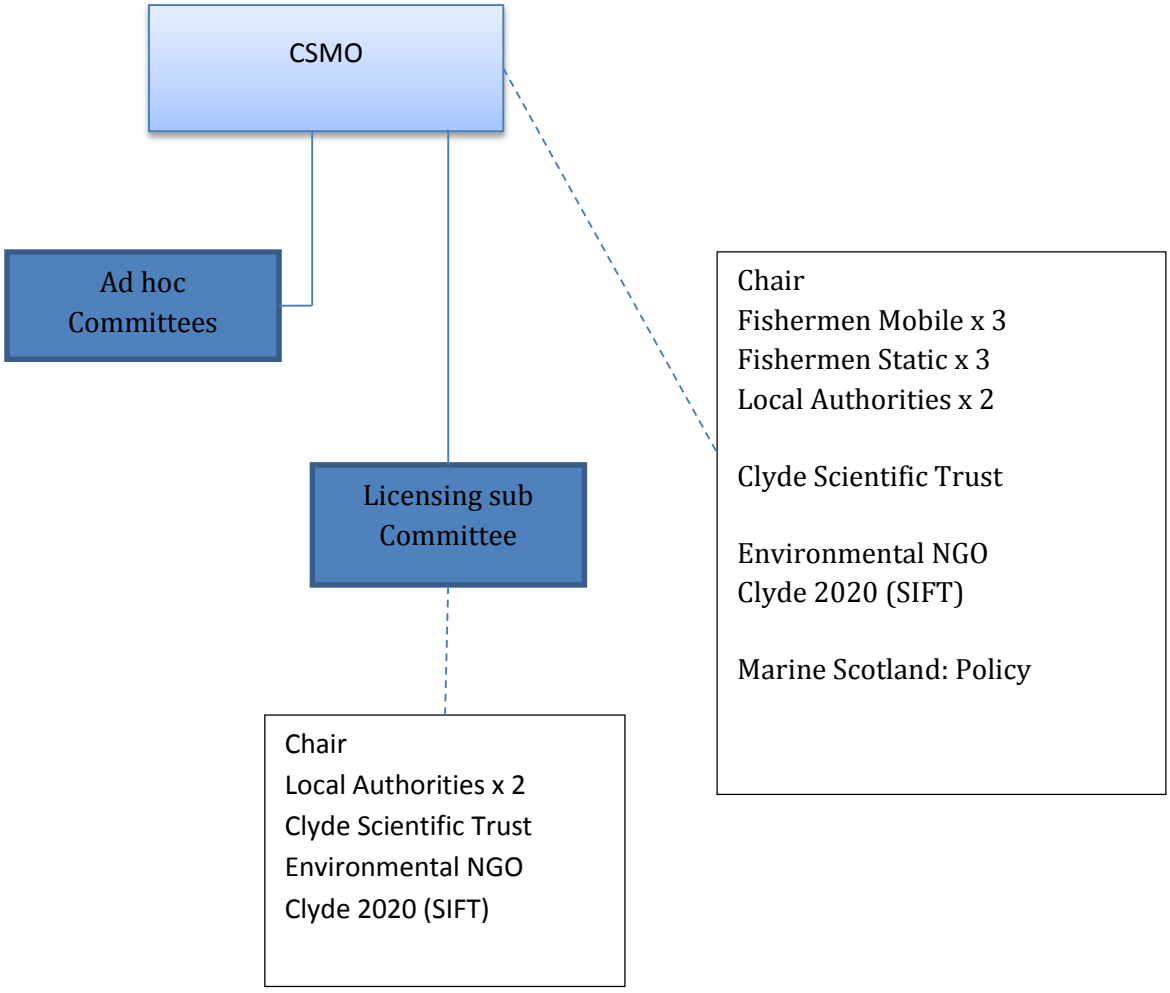


Figure 26| CSMO Governance Structure

Licensing Sub-Committee

In line with best practice a Licensing Sub-Committee (LSC) will be formed to verify and allocate licence applications. Membership of the LSC will be restricted to the non-fishing interests of the CSMO Board, to ensure that only those members of the CSMO without a direct interest in commercial fishing operations will determine licence allocation. This transparent impartiality will be crucial in the (albeit unlikely) event of licence oversubscription. To further enhance this impartiality, verification of licence applications will initially be undertaken by the CSMO Executive and subsequently submitted to the LSC anonymised.

Clyde Scientific Trust (CST)

Introduction

The Clyde Scientific Trust (CST) will be a newly constituted organisation with the remit to commission, undertake, and publish scientific study that supports the management of the Clyde. In so doing it would foster improved collaboration between the fishing industry and fisheries scientists. It is intended that, although initially focused on the fishery, the CST would be constituted to have a wider remit than fisheries, so that in due course it could provide advice on a range of scientific issues associated with the management of the Clyde.

The CST will apply for status as a Scottish Charitable Incorporated Organisation in 2015. The CST's charitable purpose will be to:

- Commission, undertake and publish the findings of research in subjects relating to the sustainable development, protection, enhancement and rehabilitation of the Clyde's marine environment provided that the useful results of such study are disseminated to the public at large;
- Advance the education of the public in such subjects.

In so doing the CST will enable the sustainable development of the Clyde for the benefit of the public by the preservation, conservation and the protection of the marine environment and the prudent use of the natural resources within the Clyde sea area.[12]

The CST intends to draw on the expertise of the marine science community, rather than establishing in-house capacity. It will commission data gathering and analysis in accordance with established competitive tendering procedures. The independence of the CST would ensure that the research it commissions is recognisably independent and not biased in favour of the aims of fishery managers. This is an important consideration in the Clyde Fishery where there are low levels of trust between stakeholders.

Accordingly, the CST's role would be to:

- Engage with the fishing industry, including fishery managers, to identify knowledge gaps affecting fishery management;
- Commission scientific studies that will help to inform sustainable fishery management;
- Ensure that there is no duplication of fisheries research on the Clyde;
- Be a resource for fishery managers in the Clyde, and more widely, by retaining and publishing fishery related data;
- Act as a template for other marine industries that require more coordinated interaction with the scientific community.

[12] For the avoidance of doubt, sustainable development means "development which meets the needs of the present without compromising the ability of future generations to meet their own needs".

Initial Research Priorities

The CST Initial Research Priorities will focus on the Clyde's principal existing commercial fisheries for *Nephrops* and king and queen scallops. At present, data gaps relating to these species hinder their effective management. Indeed, stock assessments are not undertaken for the king scallop population in the Clyde, despite it being the Clyde's second most valuable fishery.

The primary research priority will be to conduct stock assessments in order to ensure that fishery managers, and specifically the Clyde Shellfisheries Management Organisation, have sufficient information to make appropriate management decisions. There are two types of information needed to ensure the effective operation of the proposed Regulating Order:

- Statutory information that has to be collected to meet RO obligations;
- Additional scientific information to underpin long term fisheries management.

More precisely, it is proposed that the CST Initial Research Priorities will include:

- Stock assessments;
- Identification of ecosystem baselines;
- Monitoring the impact of spatial management proposed under the RO;
- Analysing commercial data – e.g. logsheet data.

The CST Board

The proposed membership of the CST Board is as follows:

- Chair - Elected from, and by, the Board membership;
- Scottish Natural Heritage - To ensure a close relationship with the body charged by the Scottish Government to promote care for and improvement of natural heritage and its sustainable use, it is proposed that one representative from SNH takes a seat on the Board;
- Marine Scotland: Science - To ensure that there is adequate collaboration between the CST and the scientific arm of Scottish Government it is proposed that there are two representatives from Marine Scotland: Science;
- Marine science community - At least two independent scientists from leading marine research institutions;
- Clyde 2020 Science Sub-Group - To ensure close collaboration with the Clyde 2020 initiative, one member from the Clyde 2020 Science Sub-Group will sit on the Board;
- CSMO Chair - In order to ensure that there is clear and effective dialogue between the CST and the CSMO it is proposed that the CSMO Chairman takes a seat on the Board;
- SIFT (non-voting) - In order to provide continuity with the initial design stages of the CST and its interaction with the proposed Regulating Order, it is proposed that SIFT take a seat on the Board. This will be a transitional role and it is proposed that this Board member should not have voting rights.

Advisory Groups

It is proposed that a key feature of the CST will be its interaction with stakeholders particularly from the commercial and recreational fishing sectors. The CST will also seek advice from non-governmental organisations and additional (non-Board member) scientists with special interests in the Clyde.

To access this pool of expertise, it is intended that the CST will establish several Advisory Groups to provide a conduit for information to the CST Board.

Executive

Marine Research Programme Manager

A Marine Research Programme Manager, who will be a qualified fisheries scientist, would manage the CST. This post will be responsible for overseeing the research programmes, fisheries monitoring and the collaboration between the fishing industry and scientists from government, private and academic institutions.

Administrator

The part-time Administrative Officer will have a multifunctional role and will carry out a range of data processing and administrative tasks to support the business functions of the CST.

14 Monitoring

Introduction

Enhancing the monitoring of the fisheries and wider ecosystem, in terms of both stock assessments and biodiversity, is a key objective of this proposal. At present monitoring is not comprehensive and a number of Scottish Government monitoring obligations are not being met. Section 1 of this chapter sets out the current monitoring relevant to this proposal. Section 2 sets out the proposed monitoring programme under the Clyde RO.

Section 1: Current Monitoring

Monitoring of the Clyde fisheries and wider ecosystem is required under a variety of EU obligations (Table F2, Appendix F). Current monitoring is primarily undertaken by Marine Scotland Science (MSS) and other public bodies.

The monitoring activity focuses on:

1. **Catch Sampling;**
2. **Stock Assessments** for key commercial species, and;
3. Wider **Ecosystem Assessments.**

An overview of these monitoring activities is provided below. A variety of survey methods are used to carry out this current monitoring.

Survey Methods

On board/ Market Catch Sampling

Observers monitor the amount of each species caught and discarded by commercial fishing vessels, and take measurements of the size composition and, for certain species collect otoliths (ear bones) which are examined to determine the age of the finfish.

Under Water Towed Video (UWTV)

UWTV surveys consist of a video camera and light mounted on a sledge which is then towed over the seabed behind a research vessel. UWTV can be used for stock assessment of wider- ecosystem monitoring.

Dredge and Bottom Trawl Surveys

Dredge and bottom trawl surveys can be used for stock assessment of shellfish and demersal finfish. These surveys can also be used to provide information on biodiversity, although the usefulness of this method tends to be limited.

Acoustic surveys

Acoustic surveys traditionally using echo sounders to locate pelagic species and can be used for stock assessment purposes.

These methods and others are extensively used in comparable fisheries. A summary of survey methods used elsewhere can be viewed at Appendix F, Table F1.

Catch Sampling

Catch sampling is undertaken by MSS throughout the year in the Clyde. Catch sampling, both at market and on-board commercial fishing vessels, is carried out for all of the key commercial species in the Clyde. Catch sampling complements the information gathered by the independent stock assessments.

Stock Assessments

Stock assessments and monitoring of commercial fish and shellfish species around Scotland are primarily carried out by Marine Scotland Science (MSS).

For *Nephrops*, pelagics and groundfish, MSS carry out stock assessments on behalf of the International Council for the Exploration of the Sea (ICES), which is responsible for providing scientific advice on the management of important commercial shellfish and finfish species. For the purposes of stock assessments, ICES divides the sea areas into sub-divisions. The boundaries of the ICES sub-divisions is shown in Figure F1, Appendix F.

Table 56 provides a summary of the key stock assessments carried out carried out by MSS in the Clyde.

Table 56| Marine Scotland Science Stock Assessments (Clyde and ICES Vla West of Scotland division) for Key Species

Survey	Target Species	Overview	Frequency
ICES *Nephrops* UWTV Survey, West of Scotland	*Nephrops*	• Stock assessment survey inform abundance and distribution of *Nephrops* burrow complexes. • UWTV within ICES FU13 (Clyde).	Annually (Quarter 2)
Stock Assessment: West Coast Scallop Research Vessel Survey	Scallop	• Stock Assessment survey to inform stock abundance, distribution and fishery impact. • Dredge survey at sites on the west coast including one site within the Clyde. • See Figure 27 and 28 for Scottish scallop assessment areas in Scotland and the west coast (Marine Scotland, 2014c).	Annually (Quarter 2)
Herring and Sprat Acoustic Survey, West of Scotland	Pelagic (Herring and sprat)	• Survey estimating abundance and distribution of herring and sprat, whilst obtaining samples for biological analysis, including age, length, weight, sex, maturity and ichthyophonus infection. • Acoustic midwater trawl survey • See Figure 29 for location of Clyde acoustic survey (Marine Scotland, 2014c)	Annually (Quarter 4) 2012-present

ICES International Bottom Trawl Survey- Scottish West Coast (IBTS)	Groundfish	• Western groundfish random stratified survey to collect data on the distribution, relative abundance and biological information on a range of fish species • Conducted in ICES areas VI and VII undertaken from 20-400m water depth, with one trawl per ICES rectangle per survey. In practice the FRV Scotia trawls at least one nautical mile from the shore (F.Neat, personal communication).	Annually (Quarter 4) 1991-present

Details of the key stock assessments are provided below.

Nephrops

A Clyde *Nephrops* stock assessment is carried out annually by UWTV. The assessment focuses on the muddy substrates where *Nephrops* predominate. The survey provides a comprehensive assessment of the Clyde *Nephrops* stock.

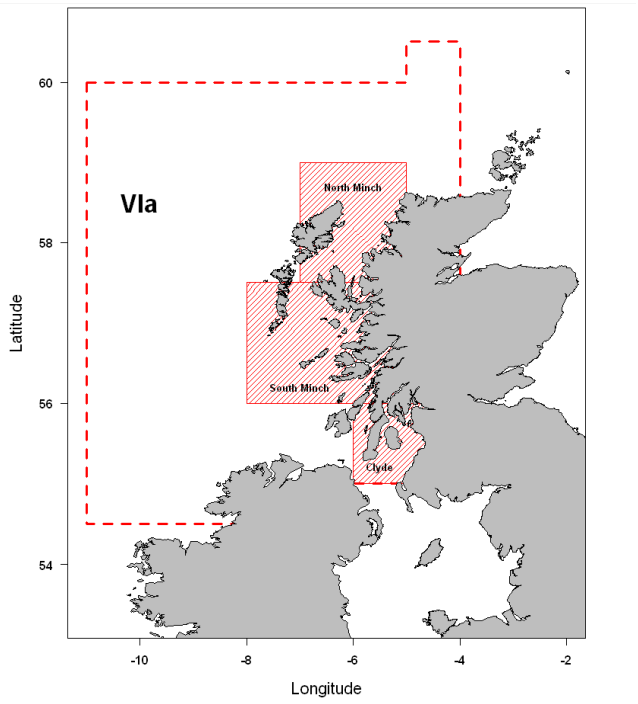


Figure 27| *Nephrops* functional units on the West coast of Scotland (ICES Advice 2014, Book 5)

King and Queen Scallops

Marine Scotland divides Scottish seas into assessment areas for the purposes of king scallop assessment (Figure 28). A West of Scotland stock assessment for king scallops is carried out annually by dredge survey however this assessment includes only one survey site within the Clyde Scottish scallop assessment area (Figure 29). The survey does not provide a comprehensive assessment of the king scallop stock. Queen scallop stocks are not assessed in the Clyde.

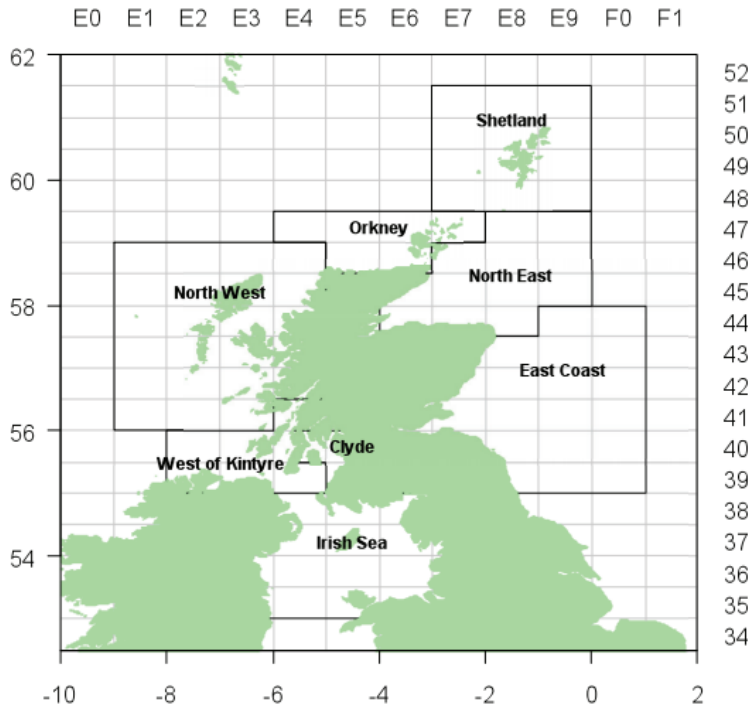


Figure 28 | Scottish Scallop Assessment Areas (Marine Scotland, 2011) (Marine Scotland, 2014c)

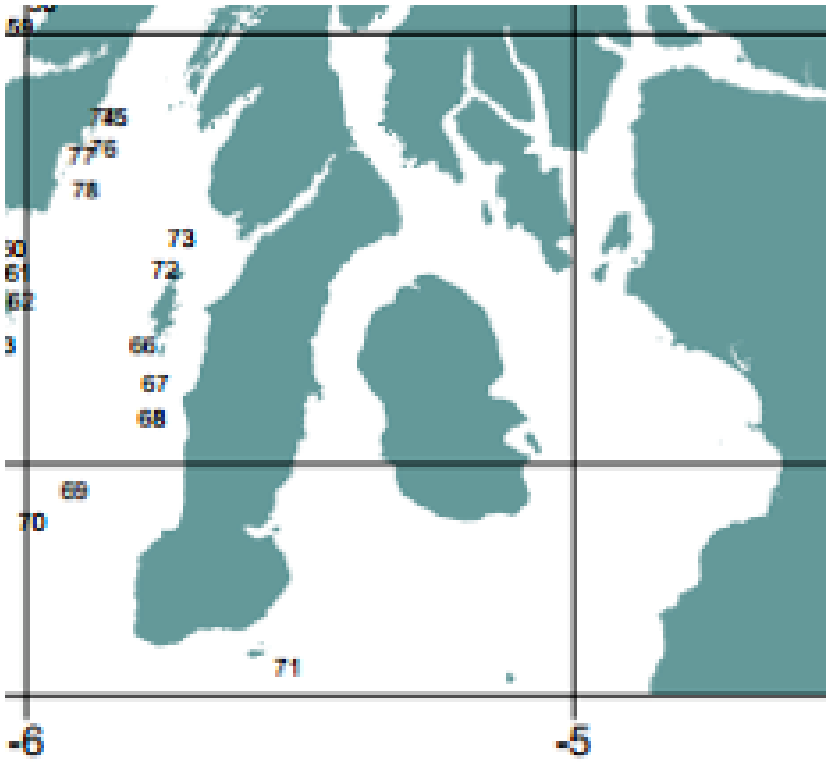


Figure 29 | Scallop survey sites on the West coast of Scotland (Marine Scotland, 2011)

Pelagic

A Clyde herring and sprat survey has been carried out annually by MSS since 2012 by acoustic survey. Figure 30 shows a typical survey pattern. The survey provides a reasonable assessment of the herring and sprat stock.

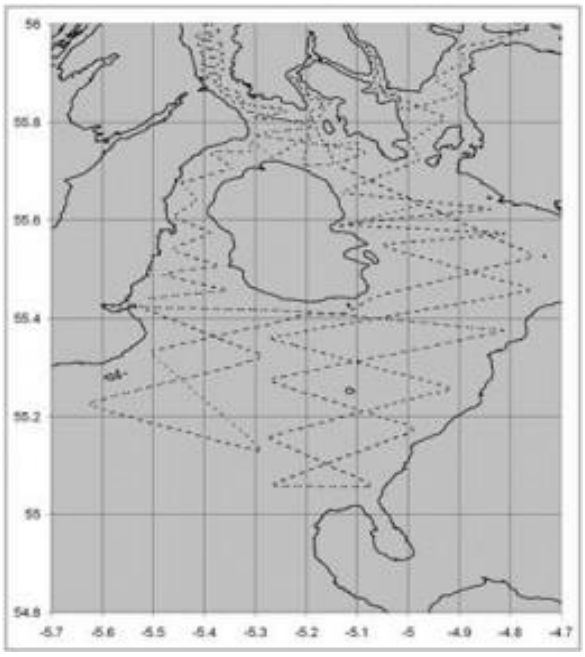


Figure 30| Survey Pattern for the Clyde Herring and Sprat Acoustic Survey, 2012 (Marine Scotland, 2014c).

Finfish

A west of Scotland bottom-trawl survey is carried out annually by MSS as part of the ICES IBTS survey programme (Marine Scotland, 2014). IBTS is a multi-species survey (IBTS) which gathers data on spatial and temporal changes in (a) the distribution and relative abundance of fish and fish assemblages; and (b) the biological parameters of commercial fish species for stock assessment purposes. Each year, only two or three survey sites fall within the Clyde, all of which are at least 1nm from shore. The survey is not comprehensive.

Figure 31| ICES International Bottom Trawl Survey (IBTS) sites in the Clyde and wider west coast area (Marine Scotland, 2014c)

Ecosystem Assessments

Current monitoring of the wider Clyde ecosystem is carried out to fulfil species conservation, site protection and wider marine policies and measures obligations. These obligations are often far-reaching (Chapter 7, Table 1). This section focuses on the current ecosystem monitoring most relevant to this proposal.

- ***EU Water Framework Directive (WFD)***

SEPA fulfils monitoring requirements under the WFD for fish and shellfish in the Clyde. Specimens are identified and counted, with some sampled for contaminants. Transitional fish monitoring is also required under the WFD to determine the ecological status of fish assemblages. The Directive obliges Scottish Government to achieve *Good Ecological Status* [13] by 2027. Current monitoring is comprehensive.

- ***Protected Areas***

SNH fulfil monitoring requirements under a variety of EU Directives for designated habitats and species in the Clyde. The "Site Condition" and "Conservation Status" of important habitats, species and features form the main components of monitoring in various protected areas including SSSIs, SPAs, SACs and Ramsar Sites. Site condition and Conservation Status should be reported every six years.

The Lamlash Bay NTZ is also regularly surveyed.

- ***Marine Protected Areas (MPAs)***

The effectiveness of the MPAs are to be reviewed every five years. SNH, Marine Scotland and SEPA are currently developing monitoring programmes for the newly designated Clyde MPAs.

Section 2: Proposed Monitoring Programme

This section sets out the proposed monitoring programme for the RO. The programme has been designed to deliver the Initial Research Priorities of the CST (Chapter 13, CST) In particular, the programme will deliver stock assessments for the key commercial species, help better identify Clyde ecosystem baselines, and monitor the impact of spatial management proposals under the RO.

Much of the monitoring currently undertaken is sufficiently comprehensive to effectively monitor particular components of the Clyde fisheries. However, in some instances additional data are required. Therefore, the programme is designed to include:

1. **Existing** monitoring (where the current monitoring is comprehensive);
2. **Enhanced** monitoring (where the current monitoring is adequate but could be improved), and;
3. **Additional** monitoring (where new monitoring programmes are proposed).

Priority Monitoring Components

The monitoring programme will have 5 priority components (*Nephrops*, king and queen scallop, finfish, biodiversity), which encompass the species covered by the RO and the wider ecosystem.

[13] Good ecological status is defined in Annex V of the Water Framework in terms of the quality of the biological community, the hydrological characteristics and the chemical characteristics.

Parameters

The proposed monitoring programme will collate data on key parameters; Abundance & Distribution and Size & Age Structure. These provide the essential information required to inform stock management decisions. They are set out below.

Abundance and Distribution

Trends in abundance and distribution data over time will be used to advise the setting of catch and effort regulations and other management measures, and to assess their effectiveness. As a time series of these data builds up it will be possible to apply more formal stock assessment methods such as catch surplus or time series analysis models for the key commercially species.

Size and Age Structure

Size structure data will enable the conversion of abundance data into estimates of spawning stock biomass – which are more meaningful for assessing both stock status and fisheries performance. Information on age structure will provide estimates of recruitment (the number of young fish / shellfish due to enter the fishable stock in future years), catchability, growth rates and exploitation rates (by providing estimates of total mortality). Certain stock assessment models (e.g. the Time Series Analysis currently used by Marine Scotland for scallop stock assessments in areas other than the Clyde) rely on accurate estimates of age structure.

Survey Methods

A range of different survey methods will be employed to fulfil the proposed monitoring programme. Data can be gathered from two sources:

1. **Fisheries Dependent Data**. These data are gathered during the course of normal fishing operations. For example, on-board sampling of *Nephrops* whilst a fishing vessel is at sea can provide size composition data.
2. **Fisheries Independent Data**: These data are gathered independently of fishing operations. For example, underwater towed video could be deployed to survey *Nephrops* stock densities.

A combination of fisheries dependent and fisheries independent data will be collected under this proposal. Five survey methods (one fisheries dependent, four fisheries-independent) are proposed;

1. On-board and/or portside catch sampling (Fisheries Dependent);

MSS observers monitor the amount of each species caught and discarded by commercial fishing vessels, and take measurements of the size composition and, for a selected group of species including cod, haddock and whiting, collect otoliths (ear bones) which are examined to determine the age of the fish. This is carried out regularly throughout the year, both on board and at ports and fish markets. The monitoring programme will enhance this survey method to supplement these datasets.

2. Towed Video (Fisheries Independent);

Towed video surveys consist of a video camera and light mounted on a sledge which is towed over the seabed behind a research vessel. This method can be used for monitoring areas off-limits to towed fishing gear where destructive sampling would be undesirable. MSS undertakes an annual Under Water Towed Video (UWTV) survey to gather information on *Nephrops* densities and stock biomass in the Clyde. Towed video can also be used to provide estimates of commercially important species such

as king and queen scallops. No additional UWTV surveys are proposed under the monitoring programme. However, other towed video surveys will be initiated for the stock assessment of scallops.

3. Dredge Survey (Fisheries Independent);

For scallops, annual dredge surveys are carried out around Scotland by MSS to provide information on changes in abundance, recruitment, age structure, growth rate, and other biological data. MSS only has one sampling station in the outer Clyde. The monitoring programme will replicate this survey method at a range of appropriate sites around the Clyde using chartered commercial fishing vessels.

4. International Bottom Trawl Survey (IBTS) (Fisheries Independent);

MSS undertakes the IBTS survey as outlined above. No additional IBTS surveys are proposed under the monitoring programme.

5. Baited Remote Underwater Video (BRUV) (Fisheries Independent).

BRUV is used to record the diversity, abundance and behaviour of fish assemblages. Using a baited canister, which is lowered to the sea floor, fish are attracted into the field of view of a remotely controlled camera which stores the recording for future analysis. This method is particularly suited to inshore monitoring in areas protected from towed fishing gear. The monitoring programme will initiate BRUV surveys.

The proposed monitoring programme is summarised in Table 57 and set out in detail below:

Nephrops

- Fisheries dependent data will be collected by MSS using on-board and portside catch sampling. Sampling will be conducted throughout the year;
- Fisheries independent data will be collected by MSS using UWTV. This survey will be conducted annually in Q2.

King

- Fisheries dependent data will be collected by MSS and enhanced by the CST using on-board and portside catch sampling. Sampling will be conducted throughout the year;
- Fisheries independent data will be collected by or on behalf of the CST using a chartered scallop fishing vessel towing standard & queen scallop dredges at a selection of key scallop fishing grounds around the Clyde. This survey will be conducted annually in Q2 (preferably June).

Queen Scallop

- Fisheries dependent data will be collected by MSS and enhanced by the CST using on-board and portside catch sampling. Sampling will be conducted throughout the year;
- Fisheries independent data will be collected by or on behalf of the CST using a chartered scallop fishing vessel towing standard & queen scallop dredges at a selection of key scallop fishing grounds around the Clyde. This survey will be conducted annually in Q2 (preferably June).

Finfish

- Fisheries dependent data will be collected by MSS and enhanced by the CST using on-board and/or portside catch sampling. These surveys will be conducted throughout the year;
- Fisheries independent data will be collected by MSS through the IBTS. IBTS survey information will be supplemented by the CST at a selection of key sites using baited remote underwater videos (BRUVs), deployed from a research vessel. This survey will be conducted in Q3 (preferably August).

Biodiversity

- Fisheries Dependent: A limited amount of data on biodiversity (bycatch and discards) will be collected using on-board and portside sampling. These surveys will be conducted throughout the year;
- Fisheries independent data on biodiversity will be collected by the CST at a selection of key sites using a towed video camera system deployed from a research vessel. These surveys will be conducted annually in Q3 (preferably August).

Table 57 |Summary of Proposed Monitoring Programme for the Priority Monitoring Components; Existing Methods (green) Enhanced Methods (yellow) and Additional Methods (red).

Priority Monitoring Component	Fisheries Dependent or Independent	Parameter(s)		
		Abundance & Distribution	Size Structure	Age Structure
Nephrops	Dependent	N/A	On Board and Portside catch sampling[14]	N/A[15]
	Independent	UWTV (MS:S)	UWTV (MS:S)	UWTV (MS:S)
King scallop	Dependent	On board catch sampling	On board catch sampling	On board catch sampling
		Portside catch sampling	Portside catch sampling	Portside catch sampling
	Independent	Towed video	Towed video	Dredge surveys
		Dredge surveys	Dredge surveys	
Queen scallop	Dependent	On board catch sampling	On board catch sampling	On board catch sampling
		Portside catch sampling	Portside catch sampling	Portside catch sampling
	Independent	Towed video	Towed video	Dredge surveys
		Dredge surveys	Dredge surveys	
Finfish	Dependent	On board catch sampling	On board catch sampling	On board catch sampling
		Portside catch sampling		
	Independent	IBTS (MS:S)	IBTS (MS:S)	N/A
		BRUV		
			BRUV	
Biodiversity	Dependent	On board catch sampling	N/A	N/A
		Portside catch sampling		
	Independent	Towed video	N/A	N/A
		Dredge surveys (outwith restoration and CDOs)		

Delivering the Monitoring Programme

The CST will be responsible for overseeing the delivery of the proposed RO monitoring programme. This will necessitate collaboration with MSS and other outside bodies responsible

[14] Unlike scallop and finfish species, *Nephrops* cannot be aged.

for the delivery of the existing monitoring programmes. It is anticipated these existing monitoring programmes will continue during the life of the proposed RO, however it is recommended the CST hold discussions with Scottish Government to agree this.

The monitoring programme will be undertaken or commissioned by the CST.

15 Stakeholder Engagement

Introduction

Stakeholder engagement has played a vital part in the development of this RO application. SIFT believes that the knowledge and experience of the Clyde's local stakeholders is second to none. If the RO is to promote stewardship by local stakeholders, they must play as large a part in the design of the fishery as they do in its subsequent operation.

Stakeholders include any individual or group whose livelihood or amenity is impacted by the proposed RO. Although a RO is intended to be a shellfish fishery management measure, it has a profound impact upon the livelihoods and amenity of stakeholders who are not directly engaged in the shellfish fishery. This is because the methods adopted by shellfishermen can also impinge upon the finfish fishery and the wider ecosystem, so a wide range of relevant stakeholders have a strong interest in the RO proposal. From the outset, SIFT has sought to develop relationships and promote communications with all these stakeholders in order to identify their needs and expectations and hence inform the development of the RO proposals.

The engagement process involved two discrete activities; consultation and information provision.

Consultation process

The consultations undertaken by SIFT were intended to be an informal pre-application consultation process. This process aimed to identify issues of concern to stakeholders, integrate any representations that they made into the development of the RO proposals, and to resolve any objections. Accordingly SIFT has encouraged feedback and commentary as the proposals have developed.

A wide range of, often mutually exclusive, representations have been made to SIFT during this process. As a consequence, it has not been possible to accommodate all stakeholders, and certain representations and objections remain to be resolved. The consultation process has been further complicated by the challenge of fully engaging with all stakeholders. Furthermore, multilateral meetings with members of the fishing industry have also been unachievable owing to the established distrust between these parties.

Nevertheless, the numerous representations which SIFT has received, including from the local mobile sector, have been fundamental to the development of the RO proposals. They have enabled a design based on sound science to be integrated with local knowledge, and combined to develop a proposal which aims to take the interests of all stakeholders equitably into account.

Information provision

In addition to the consultations, SIFT has also endeavoured to ensure that its RO proposals have been fully understood by all stakeholders as they develop. It has been a priority for SIFT to ensure that there is understanding about its proposals, even by those stakeholders who do not wish to make representations.

This has not always been a straightforward process. SIFT acknowledges that it carries responsibility for ensuring understanding about its proposals, However, such efforts have been complicated by inaccuracies regarding its proposals in certain media outlets.

Identification of stakeholders

The initial task that SIFT undertook was the identification of stakeholders. This was achieved by:

- Seeking and obtaining the advice of Marine Scotland;
- Seeking and obtaining the advice of the Crown Estate;
- Using SIFT's own established contacts in the Clyde fishery; and
- Contacting relevant Local Authorities.

SIFT was supplied with various non-comprehensive lists of stakeholders from the above sources. These lists were merged to create a master list.

Categorising the main stakeholder groups

The master list of stakeholders was subsequently analysed so that the main stakeholder groupings could be categorised, to ensure that all sectors of stakeholders were engaged with. The list was categorised as follows;

- Commercial Fishing Industry - individual and representative bodies;
- Amenity and Conservation Groups;
- Recreational stakeholders including Recreational Sea Anglers;
- Scientific community;
- Central Government and Public sector bodies;
- Political stakeholders;
- Local Authorities;
- The local communities including Local Community Councils; and
- Other Statutory consultees including Ministry of Defence and Port Authorities.

Communication methods

To achieve the engagement process's ends with the wide array of stakeholders in the Clyde fishery, SIFT has;

- Held bilateral and multilateral stakeholder meetings;
- Organised public meetings;
- Given presentations;
- Established websites;
- Issued press releases and articles via various media;
- Provided updates via social networking sites; and
- Published documents including briefing notes and a RO Information Pack.

We set out below brief summary details of each of these methods.

Bilateral and multilateral meetings

Bilateral and multilateral meetings with stakeholders formed the core of the engagement process. They have been held at the different stages of the process in order to provide updates on the project, stimulate discussion, receive representations and endeavour to resolve objections. The stages of the process are as follows and are provided in more detail below:

1. Scoping exercise;

2. Developing background knowledge on ROs and the Clyde fisheries;
3. Initial consultation meetings to discuss the concept of a Clyde RO & potential management measures;
4. Consultation on proposed RO management measures;
5. Consultation on revised RO management measures.

1. Scoping exercise

This stage involved initial discussions between SIFT Board members and various external organisations to identify and investigate potential management tools to achieve the overarching aim of *'Restoring the Clyde ecosystem so that it can once again support a healthy mixed fishery.'*

A RO under the relevant legislation - the Sea Fisheries (Shellfish) Act 1967 - was identified as the best available management tool.

2. Developing background knowledge on ROs and the Clyde fisheries

This stage focused on:

1. Research on ROs as a management tool for shellfish fisheries; and
2. A desk study to collate current information on the Clyde fisheries and ecosystem.

Subsequent gap-analysis led to SIFT commissioning the following independent research projects to complement the desk study:

i. Ryan & Bailey (2012) Trawling and Dredging in the Clyde Sea Area: History, Impacts and Prospects for Recovery;
ii. SOI LIMITED (2012) A review of Static Gear Reserves in relation to proposals in the Clyde;
iii. Creel Consultation Exercise Report (2012) – Questionnaires sent to Clyde-based creelers seeking views on general management options, spatial and non-spatial.

A workshop, entitled 'Exploring New Science Strategies for Managing the Clyde Fisheries', was held in September 2013. Invitations were extended to a wide range of academics with relevant expertise, both from Scotland and elsewhere. The workshop encouraged attendees to make a direct contribution to SIFT's scientific strategy and identify research opportunities through a series of short presentations and mediator-led workshops.

3. Initial consultation meetings to discuss the concept of a Clyde RO & potential management measures

Initial consultations were held with statutory and non-statutory consultees, seeking views on the viability of a RO proposal for the Clyde. Stakeholders provided their opinions on the potential management measures that a RO can encompass. Table 58 gives a summary of key representations by stakeholders regarding management proposals under the RO.

Table 58| Summary of representations made by these diverse stakeholders regarding management proposals under the RO

Management Recommendation	Note	
Spatial measures	• Restriction of trawling during season of berried prawns. • The Clyde needs a three mile limit or to be closed completely except for sustainable fishing practices (i.e. creels, rod and line, hand diving) for three years. • No mobiles between Cumbraes to protect finfish. • No trawling above line from Skipness Point to Portencross. • Spatial management would help but concern about the displacement it could cause. • Ban for all gears on weekends may work better than spatial management. • Spatial zones and licences may stop ghost fishing with creels which is a big problem – ghost fishing occurs up north. • Spatial management will not work where creel and trawl-only areas are concerned. • Summer closures for scallops where spat are found is needed. • Close the entire Upper Clyde to mobile gears. • Split around Cumbrae/Largs will not work as Cumbrae is too important for trawlers. Recommends seasonal closures in line with berried female prawns instead of removing weekend ban. • Concerns over Scenario 1 as it would interfere with shipping lanes and MoD area in the Upper Clyde.	
Non-spatial measures	**Creel limits**	• 350 to 400 creels per vessel. • 300 creel limit would improve safety, issues of tiredness, be more fuel efficient and have conservation benefits. • For creelers to make a living would need minimum 300-450 creels. • Suggested using creel tags as they do in Cornwall. • 700 creel limit per vessel. • 600 creel limit per vessel. • Concerns over hobby creel fishermen- something should be done to limit or restrict those without a licence.
	Size/engine power limit	• A speed limit would be a great thing in the Clyde. • Horsepower limit on trawling needed but not creels. • Proposes in Upper Clyde a 230hp limit and one net at a time. • Restrictions on Northern Irish vessels and vessels over 400hp needed.
	Licences	• Creel licence costs should be enforced. • Licences are required.
	Minimum Landing Size for scallops	• Scallop MLS should be increased to 110mm at least.
	Removing the weekend ban	• The current weekend ban reduces conflict up in the Upper Clyde. • The current weekend ban is vital to many of the creelers.

Management Recommendation	Note	
	Other	• Compulsory v-notching and returning of berried females is needed especially for creelers who catch more females. • A ban on catching berried females is needed. Science is needed to prove they would survive after being thrown back. • Environmental health visiting licensees and restaurants to conduct routine checks on fish supply sources is required.
Policing	• Do not support VMS on vessels. • Do not support gear tagging, as tags always fall off with consequent penalizing. • Suggests number of creels that are deployed should be written on a boy and enforcement can request to count them. • At least four ribs are required to effectively police a RO.	

4. Consultation on proposed RO management measures

SIFT developed and released an Information Pack on the proposed Clyde RO on February 20th 2015 laying out a first draft of spatial and non-spatial management measures. The emphasis for the engagement process at this point was on public meetings.

SIFT held a number of bilateral meetings with a variety of stakeholder groups and individuals to discuss these first draft proposals. In March 2015 SIFT hosted a series of public meetings at four locations around the Clyde Arran; Prestwick, Tarbert and Inverary. The overall aim of the public meetings was to provide an opportunity for stakeholders to hear about and give feedback on the management measures laid out in the RO Information Pack.

A total of 61 individuals attended the public meeting. 31 attendees were representatives from the commercial fishing industry. The sector breakdown of those 31 were as follows: Scallop dredgers, 2; *Nephrops* trawlers, 12; *Nephrops* creelers, 13; Scallop divers, 2; and processors, 2.

The remaining 30 attendees comprised of: recreational users, 6; Local Councillors, 2; Community Council representatives, 2; NGOs, 3; members of the public, 13, quango, 2; retired fisherman, 1 and a journalist from a local newspaper.

A summary (non-verbatim) of the key representations from both the bilateral and public meetings are set out in Table 59 below.

Table 59 | A summary of key representations by stakeholders regarding management proposals under the RO during public meetings

Management measures	Note
	• The western area of the Kyles of Bute should be a creel and dive only zone to allow small residential creelers to fish local areas. • A 0.5 nm creel and dive only zone should run along the North Ayrshire coastline. • A spatial split of fishing gears around Bute and Largs will not work. Cumbraes are needed by trawlers and Bute is needed for creelers.

Management measures	Note
Spatial measures	• Area around Lamlash Bay and Holy Isle is needed for *Nephrops* for the Troon fleet and trawlers would suffer from closure. • Area downwards from the Heads of Ayr is important for scallop dredgers during winter months and would suffer from a creel and dive zone designation. • A restoration zone on the Ballantrae banks for trawl and dredge could be considered and justified for the herring stock. • Supports spatial management in Clyde but consideration needs to be given to compensation for those who will experience short term losses. • Splitting the Upper Clyde is not feasible with trawlers greatly suffering. • Scallop fishers fish within 20 fathoms (never going outside 1 nm) due to scallop patterns along Ayrshire coastline. The spatial restrictions will impact scallop fishers' jobs. • Need to consider creel only areas carefully – as some creelers do not move creels- some areas could get large amounts of pressure creating honey pot situations. Need to consider weather conditions where sheltered lochs are needed by certain gear types. • Need to consider the quality of species caught in areas of the Clyde. Buyers will not buy small tails that are predominantly landed by the NI vessels and found in lower regions of Clyde. Upper Clyde is prime fishing ground for *Nephrops.* • The proposed Loch Fyne creel and dive zone and the restoration area south east of Tarbert are two of most heavily fished areas by the Tarbert fleet, particularly in bad weather/ in the winter. In the summer they fish west of Argyll. • Winter runs from the 1st October to end of March each year for fishers so consideration of seasonality for management is very important. • Only areas fished are in proposed replenishment zone in Loch Fyne and west Kyles and stated would go out of business if passed. • Creel only areas are not needed- even with creel limits they are not workable. • Gear conflict is huge issue and needs to be addressed using gear separation zones. • Royal Navy very concerned with Upper Clyde proposals on grounds of safety. • Fishing around the Kyles supports almost the whole Tarbert fishing community. • The substrate mapping by SIFT is incorrect in some areas - all sand/mud. Similarly the substrate off bottom of Kintyre is all sand- NOT the sensitive course mixed that SIFT have on substrate charts. • If you close these areas, Tarbert fishers and the community will be negatively impacted.

Management measures	Note	
	• For Tarbert fleet, fishing almost entirely takes place at the Kyles of Bute in the area SIFT have designated as restoration area. • Noted the upper river area, in the Inner Clyde, currently a replenishment zone could benefit from remaining a replenishment zone as there are fish there. • 1nm creel and dive only zone would be an ideal spatial scenario for creelers. • Suggest rotational areas in line with seasonal fishing patterns. • The split in the Upper Clyde will not work. • Substrate is not suitable here for a split in the Upper Clyde. • Concern over impact of spatial management around the Kyles of Bute for static gears. • More consideration of areas for RSA outside SSACN input is needed. • Want to see more areas closed to fishing – especially in Upper lochs. • Would go out of businesses if spatial plans went through in Upper lochs with the split and restoration zones around Kyles of Bute.	
	Creel limits	• Creel limits needed in creel and dive only zones with a limit of 400-500. • Not all creel limits will suit all fishers as some have larger crews and bigger vessels. • Creel limits needed with limit based on size of vessel (this will have backing from mobiles) i.e. limit of 500 for an 8m boat. • Creel limits should be emplaced in relation to kilo-watt and tonnage of boat. • Creel limits needed and creel caps should also be enforced. • Creel limits needed to control fishing. In some cases c 1,000 creels are fishing in Upper Clyde areas. • Creel limits are not needed.
	Size/ engine power limit	• Does not agree with twin rig ban - twin rig is cleaner and more efficient in terms of fuel and a single net catches more whitefish.
	Licences	• Concerned re availability of licences for divers - was not available in the Shetland RO. • Concerned re price of licence and the need to have two licences.

Management measures	Note	
Non-spatial		• General consensus from trawler fleet in Tarbert that buying two licences is unfair.
	Minimum Landing Size (MLS)	• Supports suggested MLS increases for scallops. • Supports suggested MLS increases for scallops and states MLS should be in line with Poseidon recommendations. • Supports suggested MLS increases for scallops. • Supports all suggested non-spatial measures for scallop fishery by SIFT.
	Removing the weekend ban	• Does not think the weekend ban should be removed. • The weekend ban works fine and continues to alleviate gear conflict.
	Other possible management measures	• A six-month ban on scallop dredging is needed. • Trawls should be allowed to fish four days a week and creel the remaining three days. • Escape panels on creels is needed to let undersized *Nephrops* and crab out. Noted this was in place in Galloway by the Galloway Static Gear Association. • A net size in Upper Clyde to restrict larger vessels is needed.
	Enforcement	• A minimum of six to seven ribs are needed to enforce an RO. • Concern over the amount fishers may have to pay to enforce and regulate an RO. • AIS is needed to reduce gear conflict and help enforcement under the RO.
	RO Management structure: CSMO no notes on CST as such	• MO board of 2 x CFA, 2 x SCAD, 2 x Ayr Statics, 2 x Kintyre Statics & independents. • SIFT should not have a representative on the CSMO board. • The board composition should be an equal spilt for fishing sectors. • Board should be split between creel and trawl, i.e. 3 + 3. • Processors must have representatives on the CSMO Board.

5. Consultation on revised RO management measures

Following the feedback received during stage 5, revisions to the management proposals were made. Further consultations were then undertaken.

Table 60 below presents a summary of stakeholder meetings undertaken during each stage of the RO management planning process.

Table 60 | Summary of stakeholder meetings undertaken during each stage of the RO management planning process

Sector		1. Scoping exercise	2. Developing background knowledge on the RO and Clyde fisheries	3. Initial consultation meetings to discuss the concept of a Clyde RO	4. Consultation on proposed RO management measures	5. Consultation on revised RO management measures	Total
Commercial Fishing Industry	**Individuals**			14	31	7	52f
	Representative bodies		10	8	2	1	21
Amenity and Conservation Groups			2	20	15		37
Recreational stakeholders (including Recreational Sea Anglers)				1	8	1	10
Scientific community			6	12	14	2	34
Central Government and Public sector bodies			3	14	8		25
Political stakeholders				11	1		12
Local authorities				4	3		7
Local communities including Local Community Councils			1		10		11
Other Statutory consultees including Ministry of Defence and Port Authorities			5	8	7		20
Total			27	92	99	11	229

Presentations

SIFT recognises that an important means of engaging with the public is through presentations directly to the public or to their representatives. Accordingly SIFT has given presentations to;

Interest Groups

i) Recreational Sea Anglers

A series of presentations were delivered by SIFT facilitated by the Scottish Sea Anglers Conservation Network (SSACN) to recreational sea anglers in 2014. The first of these outlined the concept of a RO and the measures SIFT were considering and took place in Prestwick on the 1st of October 2014. The event was attended by approximately 20 sea anglers, a creel representative and the CFA Chairman.

SSACN requested this presentation be given at other locations around the Clyde coast, which took place as follows:

- Lochgilphead, 12th of November 2014
- Helensburgh 19th of November 2014
- Prestwick 26th of November 2014

At these three events it was possible to present further information on the spatial and non-spatial management measures being considered for the RO. The 21 attendees were therefore able to provide more detailed feedback on the proposals.

ii) Other community groups

SIFT was invited to present to Troon Rowing Club and the Troon Rotary Club. The presentations took place on the 26th of March and 7th of July 2015 respectively. Both events attracted around 20 attendees.

iii) Community Councils

In February 2015, SIFT contacted Community Councils around the Clyde via email to outline the RO proposals. From the 67 Community Councils contacted, 3 responded leading to the following presentations;

- **Cumbrae Community Council, March 2nd 2015**
  All council members were in attendance and feedback on the RO proposals was noted. The presentation was not open to the public.

- **Kilfinan Community Council, March 10th 2015**
  All council members were in attendance and feedback on the RO proposals was noted. The presentation was open to the public and was attended by interested members of the local community and was facilitated by Argyll and Bute Councillor Bruce Marshall.

- **Kilmun Community Council, June 22nd 2015**
  All council members were in attendance and feedback on the RO proposals was noted. The presentation was open to the public and was attended by interested members of the local

community and was facilitated by Argyll and Bute Councillor Bruce Marshall and attended by Cllr. Michael Breslin (a Trustee of SIFT).

iv) Local Authority

Local Authority presentations provided members with details of the RO process, the management planning process undertaken and the draft management measures being proposed. The presentations were as follows;

- **Argyll and Bute Council, Members' Seminar, 13th April 2015**
  All Argyll and Bute council members were invited to attend. Approximately 20 Argyll and Bute Councillors were in attendance.

- **North Ayrshire Council; Ardrossan and Arran Area Committee, 25th June 2015**
  All Ardrossan and Arran Area Committee members were invited to attend. Approximately 10 committee members were in attendance.

v) Scottish Parliament

SIFT gave two parliamentary presentations at Holyrood in 2014 to MSPs to highlight the benefits of a RO as a fisheries management tool in the Clyde. All MSPs were invited to attend. SIFT also delivered a presentation to Holyrood's Cross Party Group on Recreational Boating and Marine Tourism,

- **MSP Presentation, 9th January 2014**
  Cabinet Secretary Richard Lochhead, MSP attended the presentation.
  Ten other MSPs also attended the presentation; Kenneth Gibson MSP; Rob Gibson MSP; Michael Russell MSP; Stuart McMillan MSP; Alex Fergusson MSP; Alison Johnstone MSP; Jean Urquhart MSP; Margaret McDougall MSP; Patrick Harvie MSP and Claudia Beamish MSP, as well as Douglas Patullo, researcher for Jamie MacGrigor MSP.
  Senior figures from Marine Scotland:Policy were in attendance. In addition the event was attended by the Secretary of the Clyde Fishermens Association (CFA) Mr Archie MacFarlane.

- **MSP Presentation, 6th November 2014**
  Six MSPs attended the presentation; Kenneth Gibson MSP; Rob Gibson MSP; Claudia Beamish MSP; Stuart McMillan MSP; Jamie McGrigor MSP and Hanzala Malik MSP.
  The following Clyde stakeholders from the commercial and recreational fishery sectors were also in attendance; Patrick Stewart; CFA Secretary, Alistair Sinclair; Scottish Creel Fisherman's Federation (SCFF), and Steve Bastiman and Edward Wright; SSACN.

- **MSP Presentation, Cross Party group, 24thJune 2014**
  Stuart McMillan MSP chaired the meeting and it was attended by a wide range of stakeholders.

Website

In order to share information and to act as a portal for those seeking information on both SIFT and the RO project, the website www.sift-uk.org was created in 2012. News updates and project updates were uploaded to the website regularly. The website provided the opportunity for interested individuals to make an enquiry to the SIFT team by providing contact details. From 1st July 2013 to 30th June 2015

there were 4,158 visitors to the SIFT website and 385 visits to the publications page where information and news on the RO is published.

A further website www.revivetheclyde.org was developed in 2014 to support the public campaign to raise awareness of the state of the Clyde and to capture the extent of public support for change. From June 2014 to June 2015, the RTC website was viewed 3,123 times.

Social Networking sites

SIFT set up a Twitter account in May 2013 and regularly updates the account. As of July 2015, the site has 414 followers.

For the RTC campaign, SIFT set up a separate Twitter site and created a Facebook page on the 1st of May 2014. As of July 2015, the sites have 234 and 813 followers respectively. Of the 813 Facebook followers who gave personal information on their location, 82% were based in the Glasgow and West coast region.

Documents

SIFT published the following hard copy documents on the project:

i. Briefing Notes
A briefing note was published prior to both MSP presentations at Holyrood in 2014. The briefing notes were sent to all MSP offices and contained updates on the RO.

ii. Information Pack
On the 20th of February 2015, SIFT released a draft information pack on the proposed RO. The information pack was made available on the SIFT website online, all social media pages and soft copies were emailed to 52 stakeholders. All known individual fishers, associations and processors were provided with a hard copy.

iii. Newsletter
In October 2014, SIFT released a newsletter providing an update on the RO process to date and highlighting the ongoing stakeholder engagement process. The newsletter was placed online on the SIFT website publications page and social media sites.

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Appendices

Appendix A: Physical Characteristics

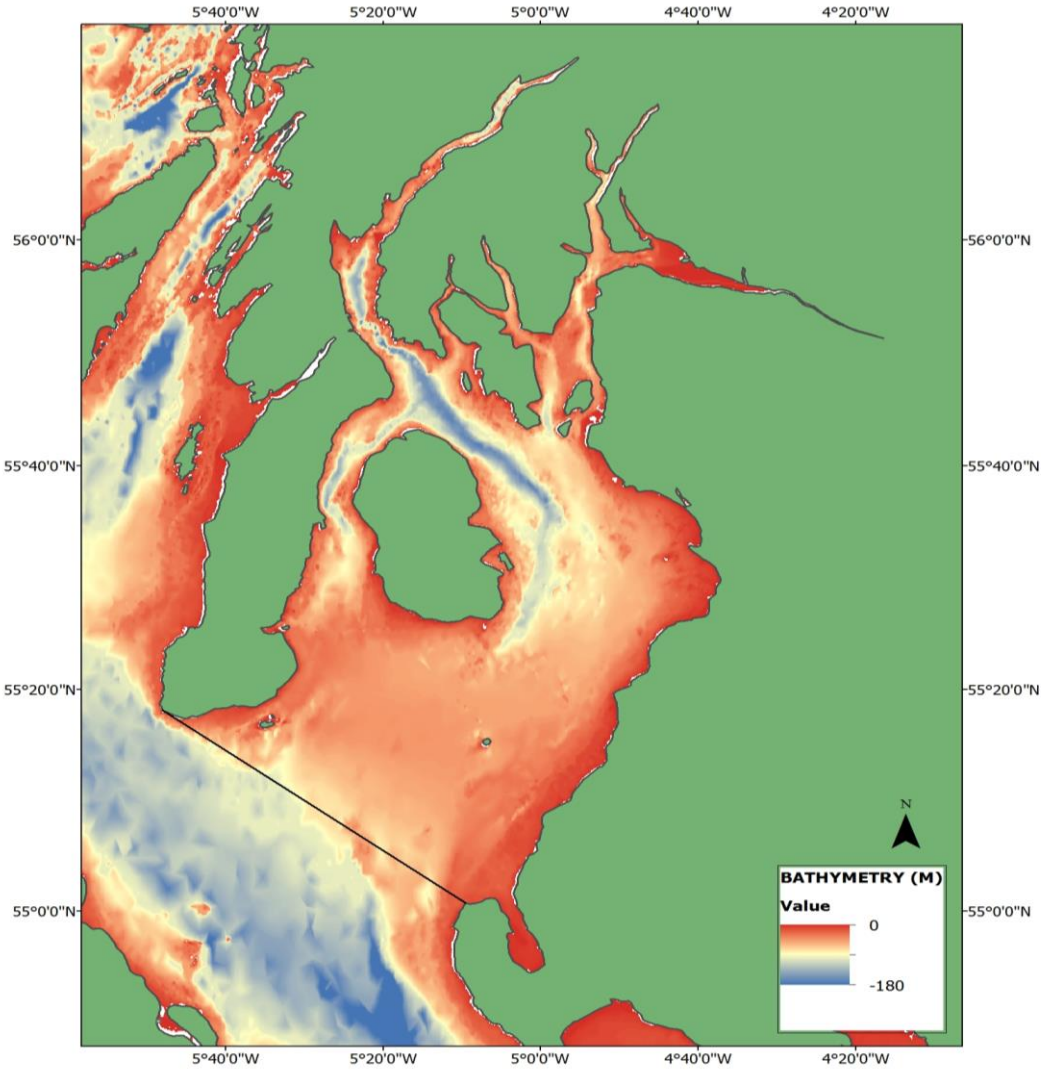


Figure A1 | Firth of Clyde Bathymetry

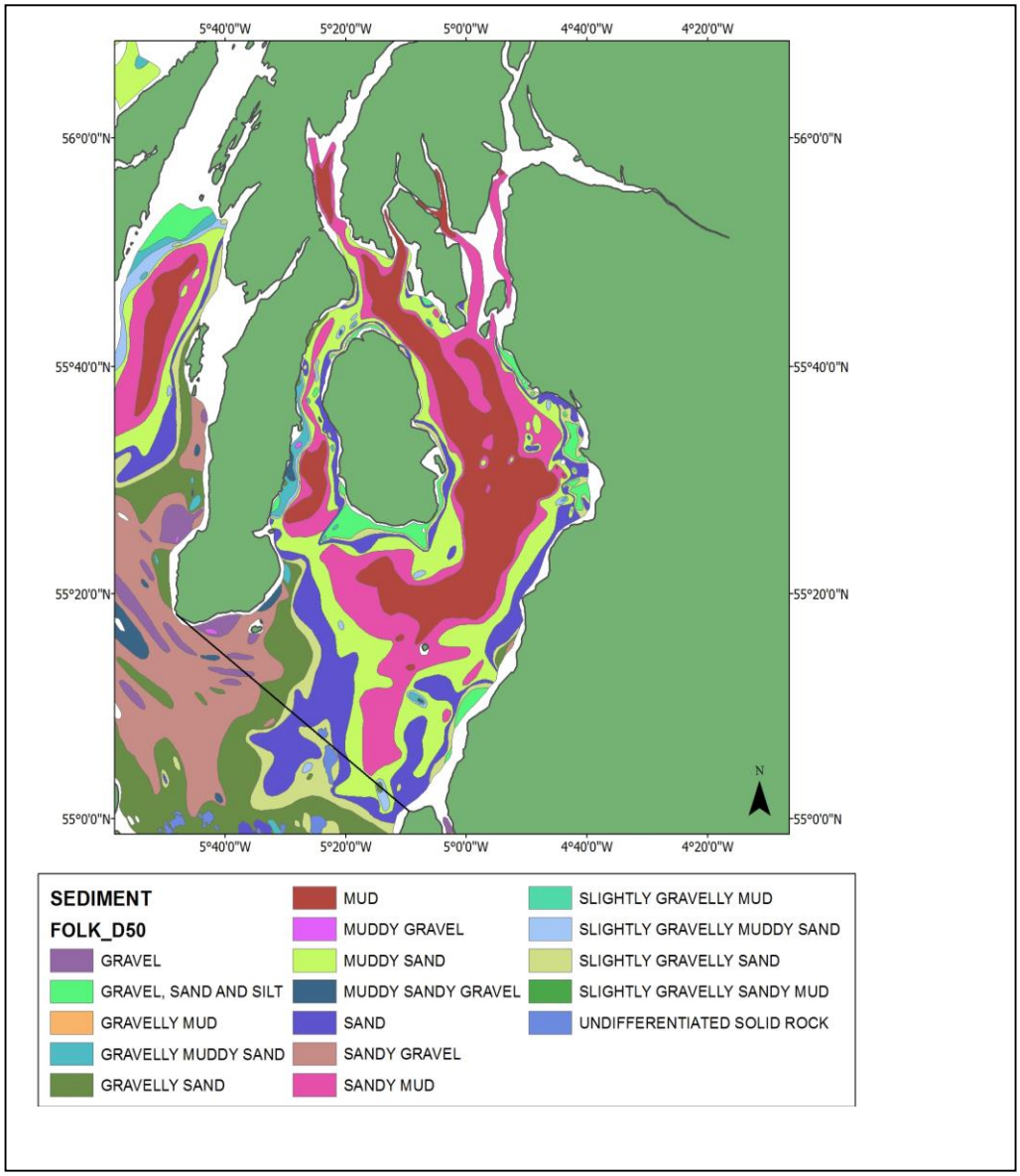


Figure A2| Clyde Substrate

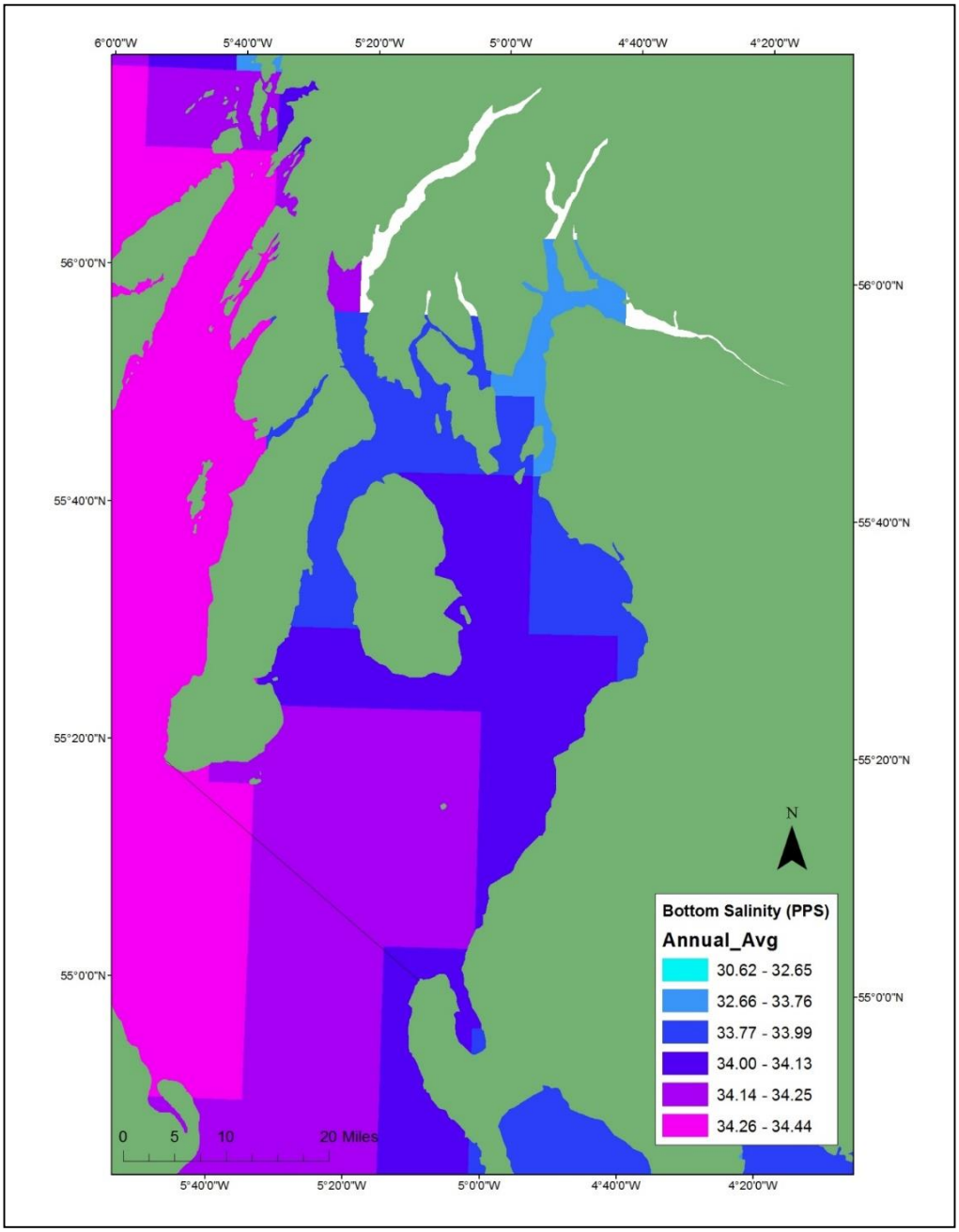


Figure A3| Clyde Sea Bottom Salinity

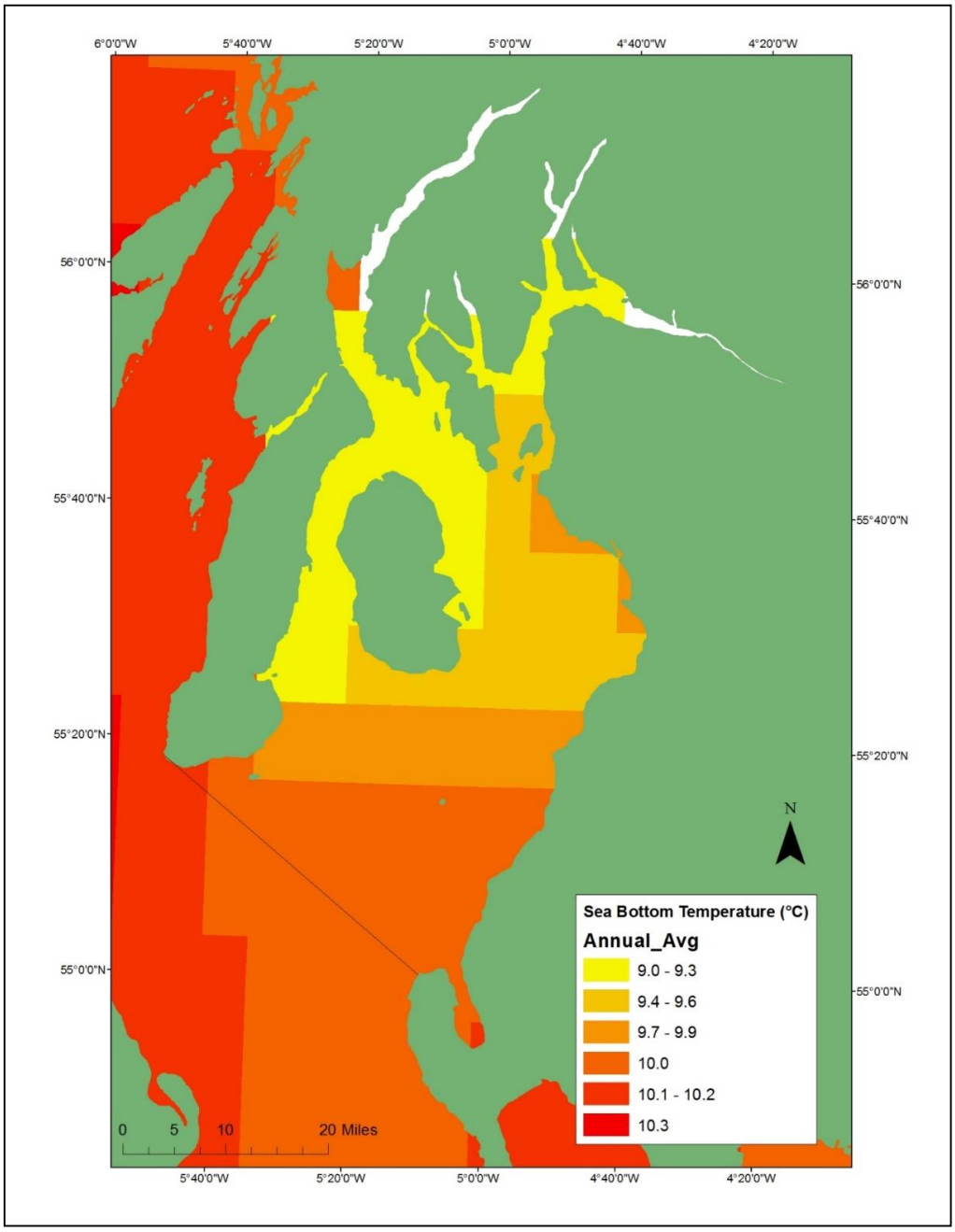


Figure A4| Clyde Sea Bottom Temperature

Appendix B: Spatial Methodology

1. Introduction

This appendix details the methodologies that were used to develop the Spatial Management Measures (SMM) for the proposed Clyde Regulating Order.

It sets out how SIFT developed a Geographical Information System (GIS)- based map of the Clyde combining best available information on fishing vessels activity with data on the physical parameters to obtain a detailed picture of fishing intensity around the Clyde. Wherever possible, the analytical methodology followed procedures used by Marine Scotland.

The appendix contains the following:

- Section 2 provides details of data sources and methodologies;
- Section 3 estimates the potential displacement effects of the SMM; and
- Section 4 analyses the relationship between fishing activity data and physical data, chemical data, species data and existing spatial management measures.

2. Data Sources and Methodologies

2.1 Data Sources

The spatial analysis is based on the best available data from a range of authoritative sources. Table B1 provides a summary of datasets used.

Table B1| Spatial datasets: Sources.

Parameter	Data set	Source	Year Accessed	Data Type
A. Fisheries Data	Vessel Monitoring System (VMS)	Marine Scotland	2014-2015	Comma-separated values (CSV) file
	ScotMap	Marine Scotland	2013	Raster
B. Physical Data	Substrate	British Geological Society (BGS)	2014	Shape file
	Bathymetry	EU SeaMap	2014	Shape file
	Broad-scale Habitat	European Nature Information System (EUNIS) Level 3 habitats	2014	Shape file
C. Chemical Data	Bottom Salinity	National Oceanic and Atmospheric Administration (NOAA), World Ocean Atlas	2014	CSV file
	Sea Bottom Temperature	National Oceanic and Atmospheric Administration (NOAA), World Ocean Atlas	2014	CSV file
	Current Speed	Atlas of UK marine renewable energy resources	2014	Shape file
D. Species Data	Scallop presence points	National Biodiversity Network (NBN) Gateway	2014	CSV file
	Nephrops presence points	National Biodiversity Network (NBN) Gateway	2014	CSV file
	Priority Marine Features (PMF)	The Oslo Paris Convention (OSPAR)	2014	Shape file
E. Current Spatial Management Data	Marine Protected Areas	Scottish Natural Heritage (SNH)	2013	Shape file
	SFF Voluntary closures	Scottish Fishermen's Federation (SFF)	2014	Coordinates
	Marine Conservation Order SPA	Marine Scotland	2014	Coordinates

2.2 Methodologies

This section is laid out as follows;

A. Fisheries Data Analysis

1. Vessel Monitoring Systems Data
2. ScotMap Data

The data was analysed using ArcGIS Desktop 10.2 GIS software. All spatial datasets were projected to a Transverse Mercator projection (WGS84 datum). The use of a Transverse Mercator projection reduced the distortion in the grid and allowed accurate measurements of distance and areas.

A. Fisheries Data Analyses

Two fishing activity data sets were analysed:

1. Vessel Monitoring Systems data (which provides movement data for all registered fishing vessels **exceeding 15 metres in overall registered length**); and
2. ScotMap data (which provides data on the fishing activity of registered vessels of **less than 15 metres in overall registered length**).

1. Vessel Monitoring Systems (VMS)

It is a legal requirement for all fishing vessels which exceed 15m overall length to be fitted with a satellite based VMS. This consists of a Global Positioning System (GPS) receiver that records the speed, latitude and longitude of every vessel by means of an electronic poll every 2 hours.

VMS data provides information on spatial and temporal distribution of fishing activity and is used primarily for fisheries enforcement purposes. In this instance the data was used to inform design of the SMM.

i. Availability of VMS Data

VMS data are commercially sensitive and provision for the disclosure of VMS data is not included within the Freedom of Information (Scotland) Act (2002). This means that individual vessel plots (and the associated vessel details) are not available. Anonymised plots of vessel positions and speeds are publically available and were used in this analysis.

ii. VMS Data Information

Marine Scotland provided data from its VMS database for all fishing vessels in the ICES sub-rectangles that cover the Clyde. The Clyde lies within four rectangles: 39E4, 39E5, 40E4, 40E5 (Figure B1). The data provided;

- Vessel position (latitude, longitude);
- Vessel speed (Knots);

- Vessel gear type (creel, trawl); and
- Target species (scallops, *Nephrops,* cod and haddock).

VMS data for vessels from the UK, Northern Ireland and the Isle of Man were included in the datasets however a determination of individual vessel nationality was not included.

Marine Scotland provided VMS data for years 2010 and 2014. Table B2 provides a summary of the VMS data.

Table B2| Summary of raw VMS data polls for years 2010-2014 (Marine Scotland, 2014d & Marine Scotland 2015)

Species	**Year**					**Total polls**
	2010	**2011**	**2012**	**2013**	**2014**	
Nephrops	36,434	27,492	30,670	24,758	33,229	**94,596**
Scallop	2,890	1,446	2,216	1,676	2,231	**6,552**
Cod (landed via *Nephrops* trawls)	299	167	176	268	687	**642**
Haddock (landed via *Nephrops* trawls)	1140	471	446	367	941	**2,057**

iii. **VMS Data Filtering**

The VMS data was filtered so that only polls located within the Clyde remained. The GIS's *Buffer* function was used to create zones up to 1, 2 and 3 Nautical Miles (NM) from shore to allow for analysis of fishing activity within each zone. This allowed for a comparison between the fishery benefits of a simple 1, 2 or 3NM closure against the more sophisticated SMM.

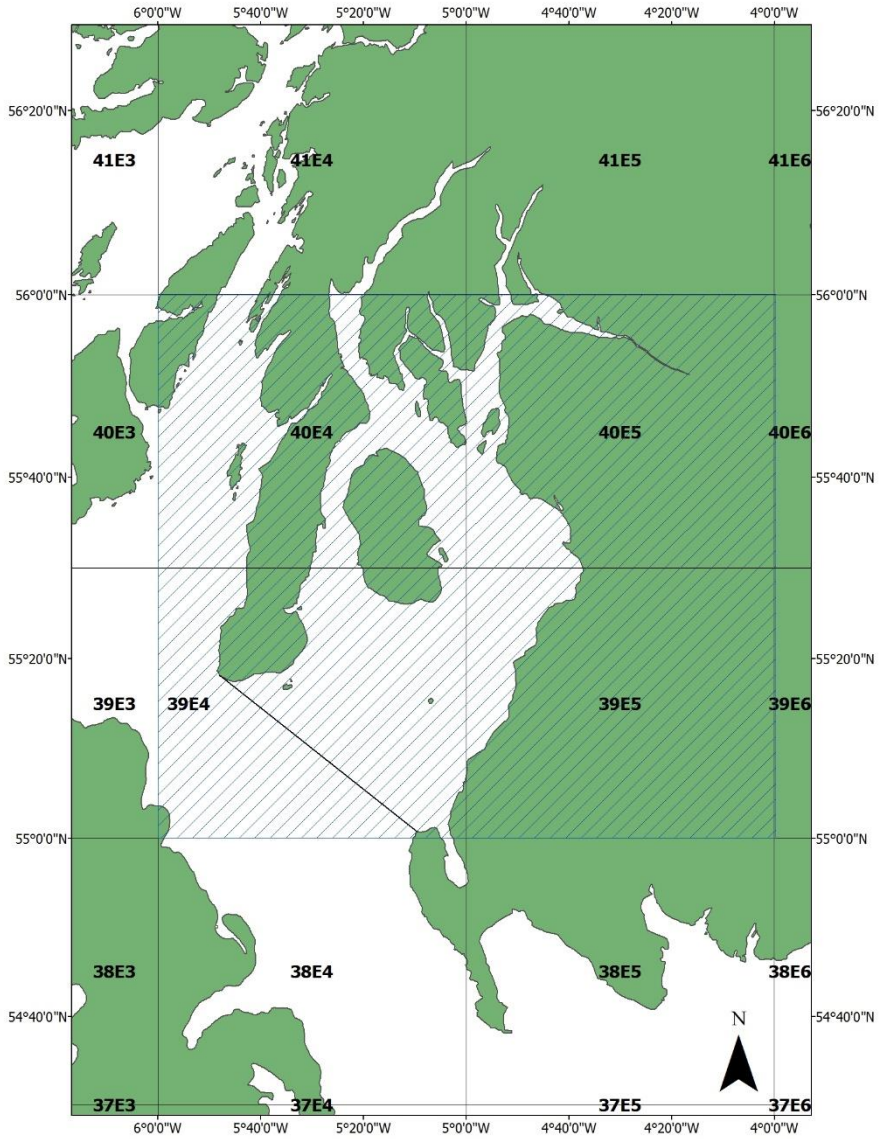


Figure B1| The Clyde in relation to ICES statistical rectangles 39E4, 39E5, 40E4, 40E5 (hatched on chart).

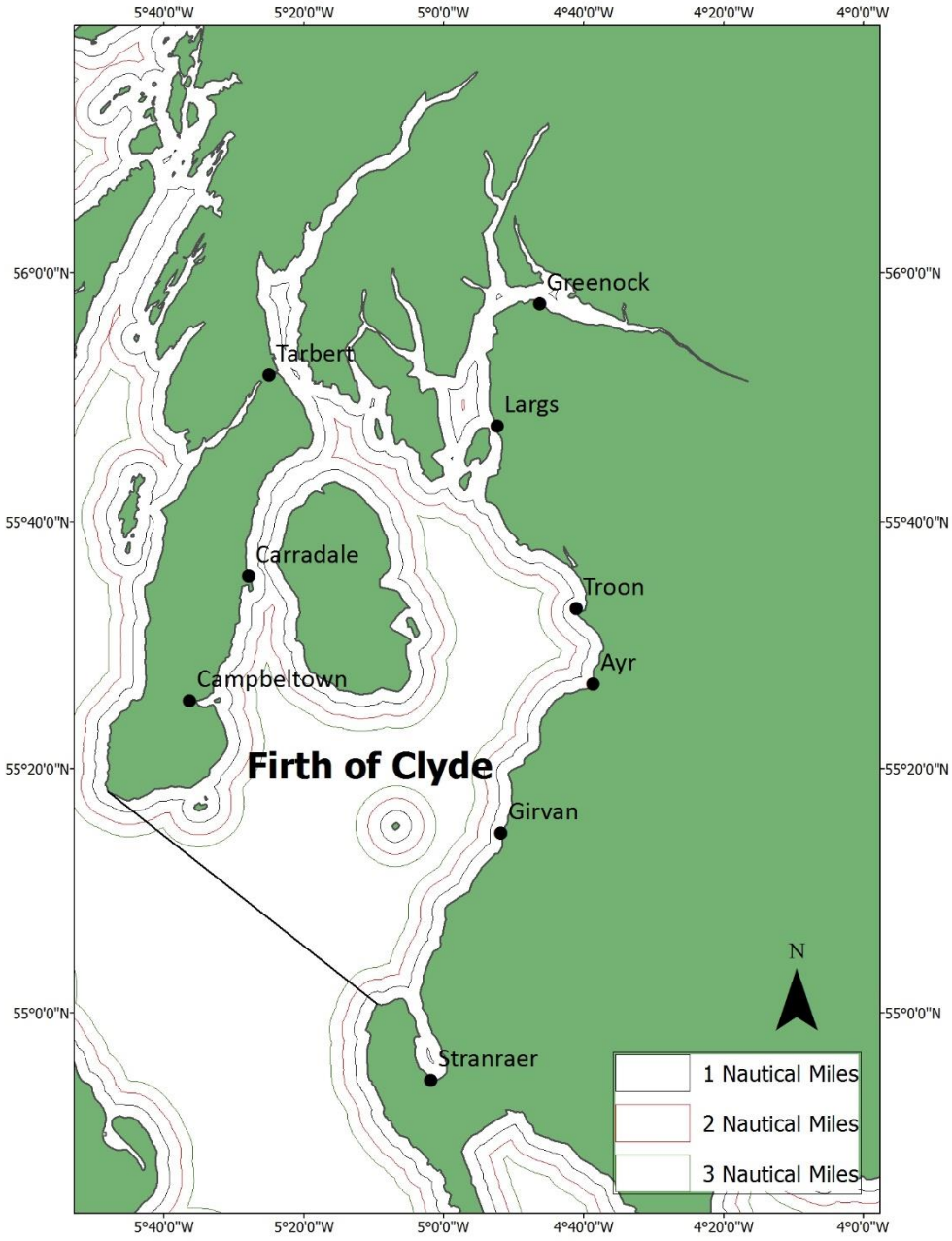


Figure B2| The Clyde showing major ports and the 1, 2 and 3 NM zones.

Filtering: Vessel Speed

It was necessary to determine whether vessels using mobile gears were fishing or merely steaming. It was assumed that vessel speeds between 1 and 4 knots represent a good proxy for fishing activity. This is consistent with Marine Scotland VMS analysis methodologies as in the Clyde Ecosystem Review (McIntyre *et al.,* 2012). Therefore all vessel movements at speeds outwith this range were removed.

Filtering: Port Entry and Exit Movement

VMS data shows an anomaly of fishing activity in the approaches to ports due to the slower speeds at point of entry and exit. To remove this overestimation of fishing activity all polls within 2.5km^2 of ports in the Clyde were filtered from the analysis. This is consistent with Marine Scotland VMS analysis methodologies (Kafas *et al.,* 2013).

Filtering: Geofence (Lamlash Bay, Arran)

Following the implementation of the Lamlash Bay No Take Zone in 2010 a Geofence was placed around the area by Marine Scotland Compliance (Marine Scotland, Mike Faulds, Pers. Comms. 14/03/14). Figure B3 shows the area of the Geofence.

When a vessel enters the Geofence area (between latitudes 55°28.641”N and 55°34.5”N and less than 005 longitude) poll frequency increases from the standard 2-hourly intervals to 10 minute intervals. In order to avoid misrepresentation of fishing activity within the Geofence area, Marine Scotland filtered the 10 minute interval polls from the data prior to its release to SIFT, leaving the standard 2-hourly interval polls.

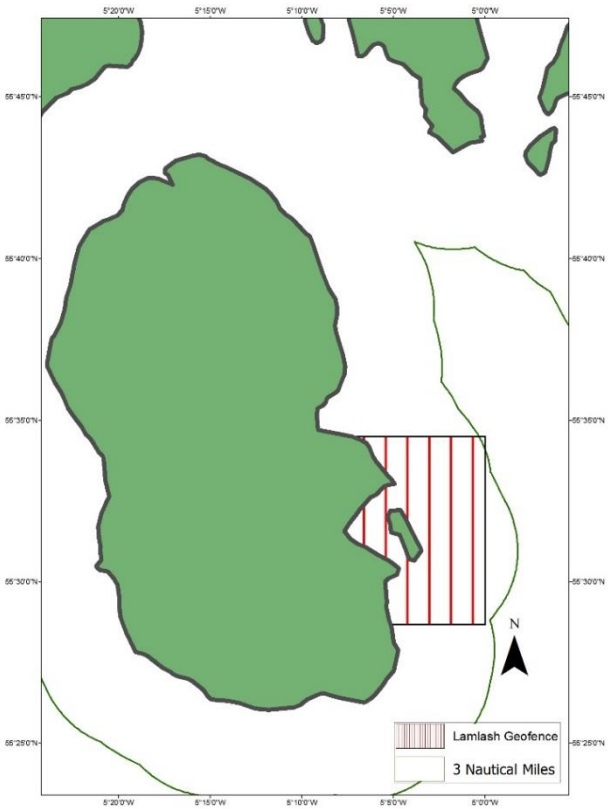


Figure B3| Lamlash Bay (Isle of Arran) Geofence (Shown hatched in Red).

IV. VMS Spatial Analysis

A *Point Density* analysis was undertaken to assess fishing intensity. This function calculates the number of polls in a given unit area (or ‘cell’) and enables fishing activity during the unrecorded 2-hr intervals to be estimated. By analysing and filtering the VMS data as described above, it was possible to

generate a representation of the spatial distribution and intensity of fishing activity for *Nephrops* and king and queen scallops.

The VMS polls from *Nephrops* vessels which also resulted in landings of cod and haddock were not analysed. As cod and haddock were not the target species, the VMS data did not inform where vessels fished for cod and haddock, but only where they caught these species when fishing for *Nephrops*.

The results are shown in Figure B4.

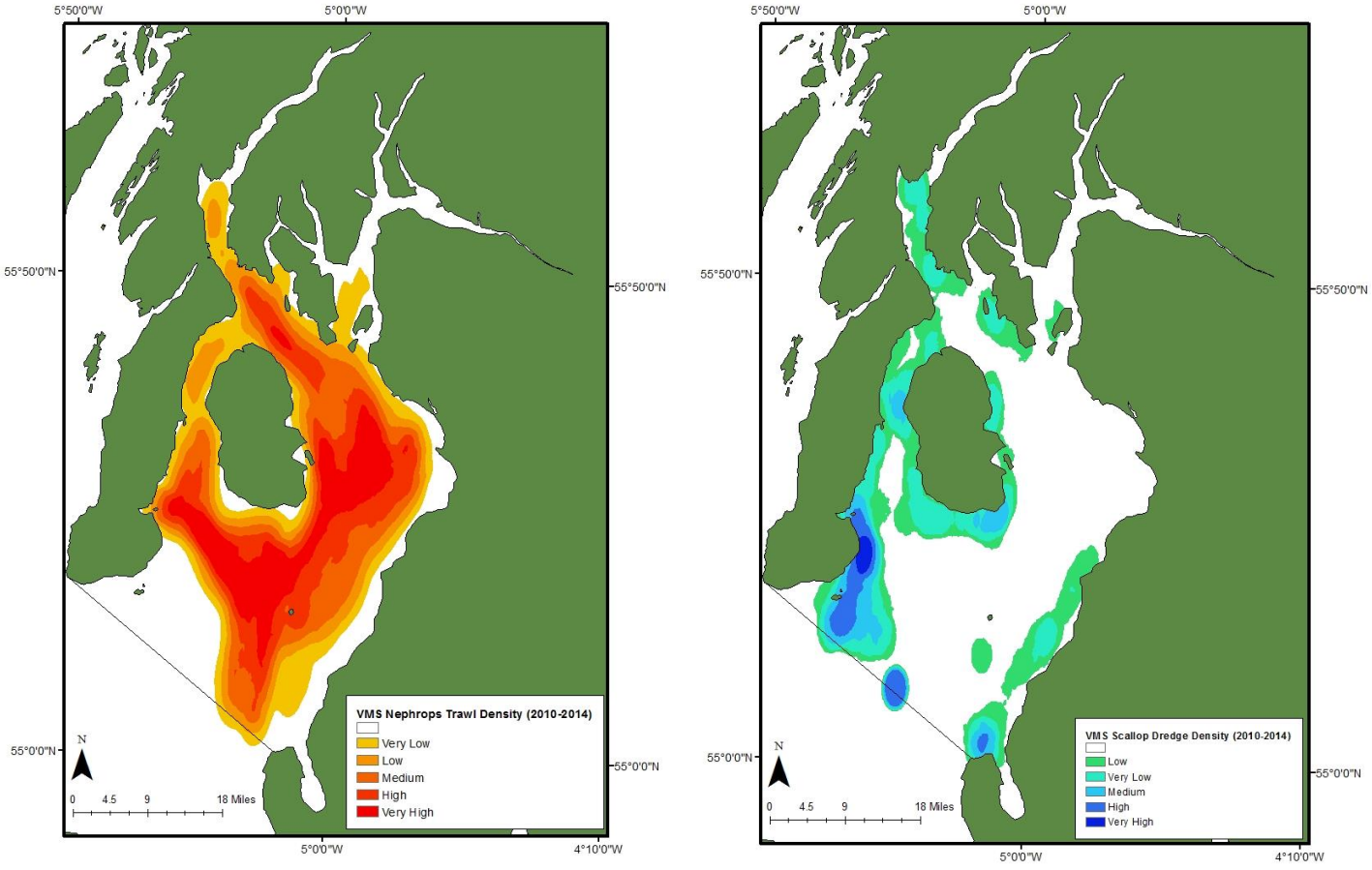


Figure B4| Spatial distribution and intensity of fishing activity for *a) Nephrops trawl* and b) scallop dredge.

2. **ScotMap Data**

The lack of VMS data for fishing vessels under 15 metres overall length is widely recognised as a barrier to comprehensive assessments of fishing activity, particularly in inshore waters where the majority of the under 15 metre sector operates (McLay *et al.,* 2012). Consequently, Marine Scotland initiated a national level project, ScotMap, to gather fishing activity information for this sector. The data relates to fishing activity for the period 2007 to 2011.

The respondents' information about their fishing activities were recorded as polygons on an electronic map. Within each polygon, each respondent identified a primary and secondary target species and

reported the value of landings for each. Fishermen were asked to identify more than one polygon where relevant.

As with the VMS data, the ScotMap information has been anonymised for reasons of commercial confidentiality and compliance with data protection requirements: only the number of vessels that appear in each polygon is known. The amount of time spent in each polygon has not been made available.

Data on monetary value[16] and number of vessels were collated for:

- Crab and lobster pots;
- *Nephrops* trawls;
- Trawling where *Nephrops* is not the target species;
- Potting for *Nephrops*;
- Scallop dredging;
- Scallop diving;
- Lines for mackerel.

[16] To calculate **monetary value**, the value associated with each fishing polygon is calculated from the percentage contribution and gross vessel earnings data.

Table B3| Number of Clyde-based vessel respondents (and associated crew numbers) to the Marine Scotland ScotMap project (Pers. Comms, A.McLay, October 2013).

Fishing gear	Species	Number of vessels	Number of crew
Bottom seine	*Nephrops*	1	2
Hand picking	Razorfish	2	12
Creel	*Nephrops*	18	34
	Crab and Lobster	22	28
	Whelk	2	
Dredge	Scallop	7	16
Trawl	*Nephrops*	25	61
Hand dived	Scallops	3	11
	Razorfish	2	4
Total		**82**	**168**

Given that the Regulating Order is only proposing to manage for *Nephrops* and scallop, only ScotMap data for these species was used to inform the SMM.

ScotMap Data: Methodology

Marine Scotland released the data in a raster format. Using ArcGIS, the raster data was converted into polygons so that a higher resolution of information could be achieved. The results are shown in Figure B5.

Clyde Vessel Coverage[17]

Only 42% of vessels in Ayr and 64% of vessels in Campbeltown responded to the ScotMap interviews. Of the respondents, eighty two vessels recorded fishing activity in the Clyde. Table B3 provides a breakdown of this data.

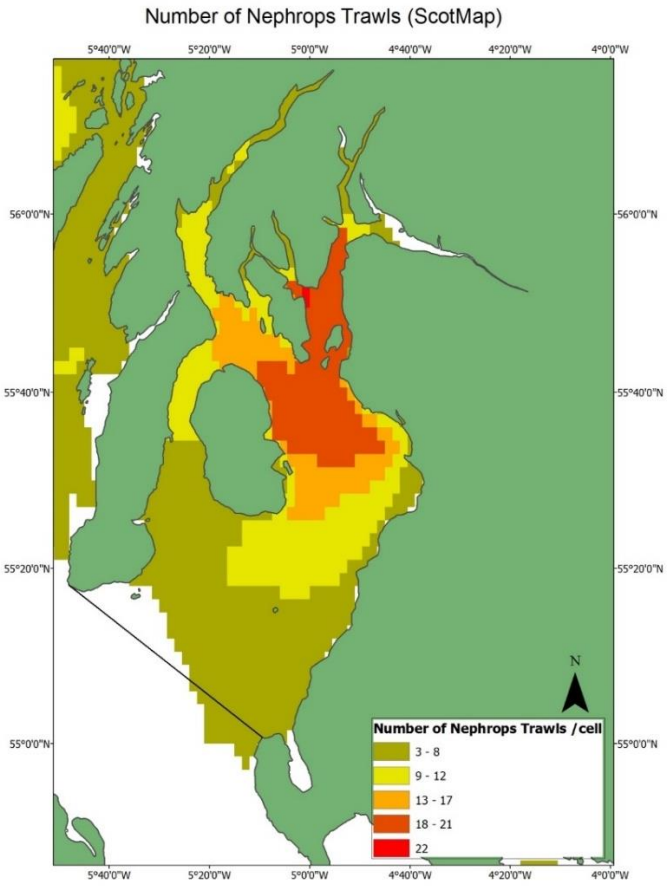
[17] Vessel coverage is the number of vessels interviewed/targeted and the % interviewed.

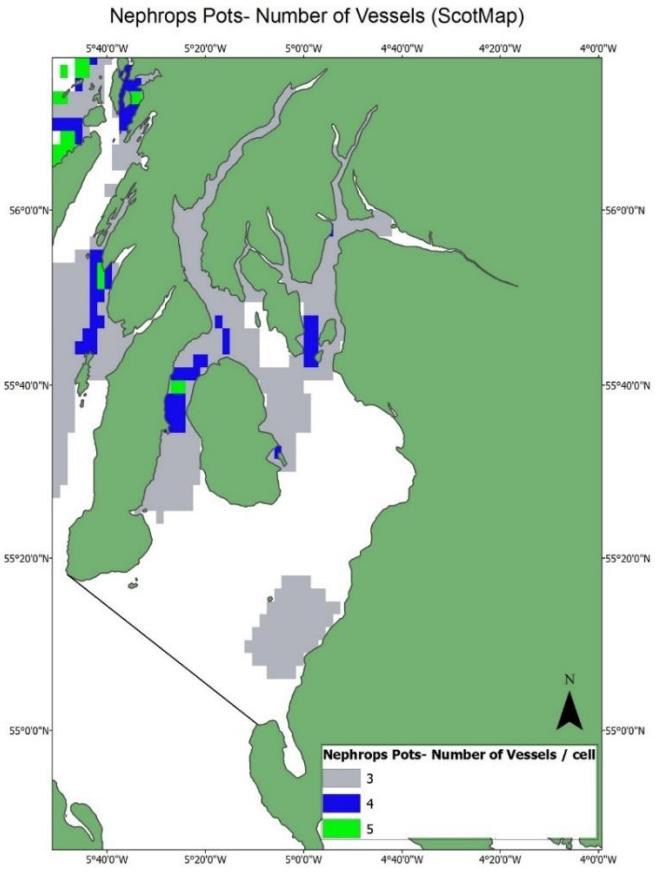
Clyde Average Landings Coverage[18]

Landings data collected by ScotMap in the Clyde were also incomplete. Only 69% of recorded landings (average 2010 and 2011) in Ayr and 61% of recorded landings in Campbeltown were reported to ScotMap.

Consequently the ScotMap data for the Clyde is presumed to under-represent the value of fishing for vessels under 15 metres.

Whilst concerns have been raised about over-reporting of landings, overlapping polygons and overestimation of fishing activity, the ScotMap information provides the best available data for the under 15 metre commercial fishing sector.





[18] Average landings coverage is the value of the landings of vessels interviewed/the total value of landings of all vessels under 15 m in £s millions p.a. as reported and recorded on FIN (average for years 2010 and 2011) and value for interviewed vessels expressed as a % of the total, for each administration port (District).

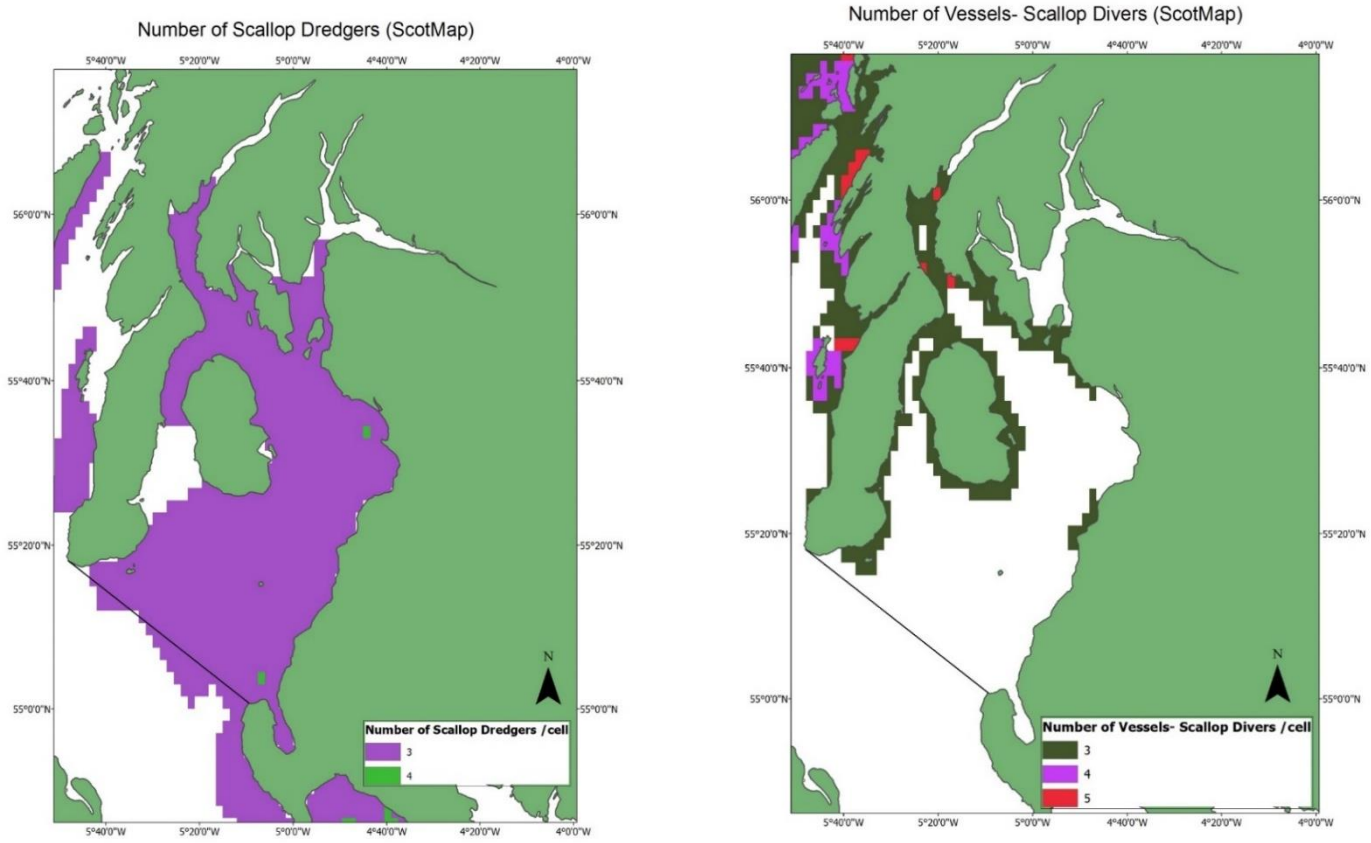


Figure B5| Spatial distribution and intensity of fishing activity for *a) Nephrops trawl,* b) *Nephrops* creel, c) Scallop dredge and d) scallop divers.

3. **Estimating Displacement Effects**

In order to estimate any potential displacement[19] of commercial *Nephrops* and scallop fishing activity arising from the implementation of the proposed SMM, the VMS and ScotMap data were analysed.

i. Over 15m Vessel Displacement Analysis

To estimate the potential displacement for the over 15m fishing fleet, the 2011-2013 VMS dataset was analysed. The number of VMS polls located within each individual SMZ were calculated using the *Intersect* tool in ArcGIS. Each value was converted into a percentage of the total number of polls for all the SMZs for both *Nephrops* trawl and scallop dredge.

ii. Under 15m Vessel Displacement Analysis

The proposed SMM was overlaid with the ScotMap output data and a visual inspection of the under 15m fishing fleet activity was carried out within each individual SMZs. A visual inspection of both vessel coverage and monetary value for the *Nephrops* and scallop fishing fleet was carried out.

The estimates of displacement effects can be seen in Chapter 10.

[19] For the purposes of this study displacement is defined as the changes in fishing behaviour and patterns that could occur in response to the SMM.

4. **Analysis of 'combined' data sets**

The physical, chemical, species and spatial datasets listed in Table B1 were combined with fisheries data to better understand fishing 'hotspot' locations. This information informed the design of the SMM.

a. Fisheries data and Physical data

Physical data (substrate and broad-scale habitat) were analysed alongside fishing activity data, using the ArcGIS *Intersect* tool, for:

1. Individual SMZs for the generation of individual site statistics, and
2. All SMZs combined for the generation of network level statistics.

i. **Substrate**

The distribution of fishing activity was analysed with respect to five benthic substrate types derived from UK SeaMap data. The five types are:

1. Coarse sediment;
2. Mixed sediment;
3. Rock or reef;
4. Sand and muddy sand;
5. Mud and sandy mud.

Using the *Select By Location* tool in GIS, the VMS data was analysed against substrate data to examine the link between the two datasets. The results are shown in Table B4.

Table B4| Distribution of Scallop dredge and *Nephrops* trawl VMS polls by substrate type.

Substrate	**Scallop VMS %age total**	***Nephrops* VMS %age total**
Coarse sediment	20.04	0.48
Mixed sediment	9.28	0.41
Rock or reef	18.73	0.87
Sand and muddy sand	28.7	4.73
Mud and sandy mud	12.02	93.37

The analysis demonstrates that:

a. Scallop dredging in the Clyde occurs over the more complex substrate types. 85.3% of scallop dredger polls were located on the coarse, rock or reef and sand and muddy sand substrates.

b. *Nephrops* trawling in the Clyde occurs largely over the mud and sandy mud substrates. 91.5% of *Nephrops* trawler polls were located on these substrates.

ii. **Broad-scale habitat**

The distribution of fishing activity was analysed with respect to ten broad-scale types derived from EUNIS Level 3 data. The ten habitat types present in the Clyde are shown in Table B5.

Using the *Select By Location* tool in GIS, the VMS data was analysed against habitat data to examine relationship between the two datasets. The results are shown in Table B5.

Table B5| Distribution of Scallop dredge and *Nephrops* trawl VMS polls by habitat type.

Broad-scale habitat	Scallop VMS %age total	*Nephrops* VMS %age total
Atlantic and Mediterranean high energy infralittoral rock	2.12	0.07
Atlantic and Mediterranean moderate energy infralittoral rock	1.6	0.09
Atlantic and Mediterranean low energy infralittoral rock	3.41	0.14
Atlantic and Mediterranean high energy circalittoral rock	1.42	0.1
Atlantic and Mediterranean moderate energy circalittoral rock	1.04	0.08
Atlantic and Mediterranean low energy circalittoral rock	7.54	0.36
Sublittoral coarse sediment	228.65	0.48
Sublittoral sand	27.69	4.67
Sublittoral mud	12.69	93.27
Sublittoral mixed sediments	9.17	0.39
Non-specific habitat designation	6.19	0.35

The analysis demonstrates that:

a. Scallop dredging in the Clyde occurs over predominantly sublittoral coarse sediment and sublittoral sand as 53.38% of polls were located on these habitats.

b. *Nephrops* trawling in the Clyde occurs largely over sublittoral mud as 93.44% of polls were located on this habitat.

c. **Bathymetry**

Using the *Select By Location* tool in GIS, the VMS data was analysed against bathymetric data to examine the relationship between fishing activity and depth. The results are shown in Table B6.

Table B6| Distribution of Scallop dredge and *Nephrops* trawl VMS polls by bathymetry.

Depth zone (m)	**Scallop VMS** **% age total**	***Nephrops* VMS** **%age total**
0-10	5.42	0.26
11- 20	23.45	0.47
21-30	25.71	1.68
31-40	15.08	8.03
41-50	12.54	28.41
51-60	5.25	20.48
61-70	5.9	10.45
71-80	4.19	10.47
81-90	1.56	5.43
91-100	0.52	3.62
<100	1.08	11.72

The analysis demonstrate that;

a. Scallop dredging in the Clyde largely occurs in the shallower, inshore areas: 73.8% of the scallop dredger VMS polls were located at depth of 40 metres or less (Table B6).

b. *Nephrops* trawling in the Clyde largely occurs in deeper waters between 30-80 metres with 73.1% of *Nephrops* trawl VMS polls located within this range (Table B6).

2.1 Fisheries data and chemical data

The available chemical datasets were of low resolution and therefore it was difficult to establish a relationship between fishing activity and chemical data. As a result, it was not possible to take chemical data into account when developing the SMM.

2.2 Fisheries data and species data

A visual inspection of the interaction between fisheries data and species presence data was carried out. Using both VMS data and data provided by the NBN Gateway, it was possible to better understand the distribution of both *Nephrops* and scallops within the Clyde where fishing data was not available.

2.3 Fisheries data and spatial data

Existing spatial parameters such as MPAs, Lamlash Bay NTZ' the Cod Box and the SPAs and their management measures and impacts on fisheries are discussed in Chapter 7.

Appendix C: Clyde Marine Protected Areas (MPAs)

Table C1| Protected features and management measures proposed under the three Clyde MPAs

Marine Protected Area	Legislation	Protected Features	Management Proposal
South Arran	South Arran Nature Conservation Marine Protected Area Order 2014	• Burrowed mud • Kelp and seaweed communities on sublittoral sediment • Maerl beds • Maerl or coarse shell gravel with burrowing sea cucumbers • Ocean quahog aggregations • Seagrass beds • Shallow tide-swept coarse sands with burrowing bivalves	• No suction dredge, mechanical dredge, beam trawl, or demersal trawl (including seine net) is permitted inside the entirety of the South Arran MPA. • Demersal trawl only allowed within Schedule 1 by vessels smaller than 120 gross tonnes. • No static gear permitted in Schedule 2. • No fishing of any kind in Lamlash Bay No Take Zone (area described in Schedules 2 & 3).
Upper Loch Fyne and Loch Goil	Upper Loch Fyne and Loch Goil Nature Conservation Marine Protected Area Order 2014	• Burrowed mud • Flam shell beds • Horse mussel beds • Ocean quahog aggregations • Sublittoral mud and specific mixed sediment communities	• No suction dredge, mechanical dredge, beam trawl, or demersal trawl (including seine net) is permitted inside the management area. • Demersal trawl only allowed within the derogated areas by vessels smaller than 120 gross tonnes. • No static gear permitted in the static gear area.
Clyde Sea Sill	Clyde Sea Sill Nature Conservation Marine Protected Area Order 2014	• Black guillemot • Circalittoral and offshore sand and coarse sediment communities • Fronts • Marine Geomorphology of the Scottish Shelf Seabed- sand and wave fields, sand	• Currently no management measures in place but the following measures have been suggested; - Prohibition on the use of any type of set nets within 2km of Sanda to mitigate the risk of black guillemot being entangled whilst foraging. - Prohibit the use of demersal mobile gear on some of the circalittoral sand and coarse

		ribbon fields, and sand banks	sediment communities. This is the proportion of the habitat with little or no mobile demersal fishing activity and is not driven by a target proportion of habitat. The area to be managed would represent all the component biotopes. - This prohibition would also apply to suction and hydraulic dredging, both boat and diver operated.

Appendix D: Fishing Activity in the Clyde 2010- 2014

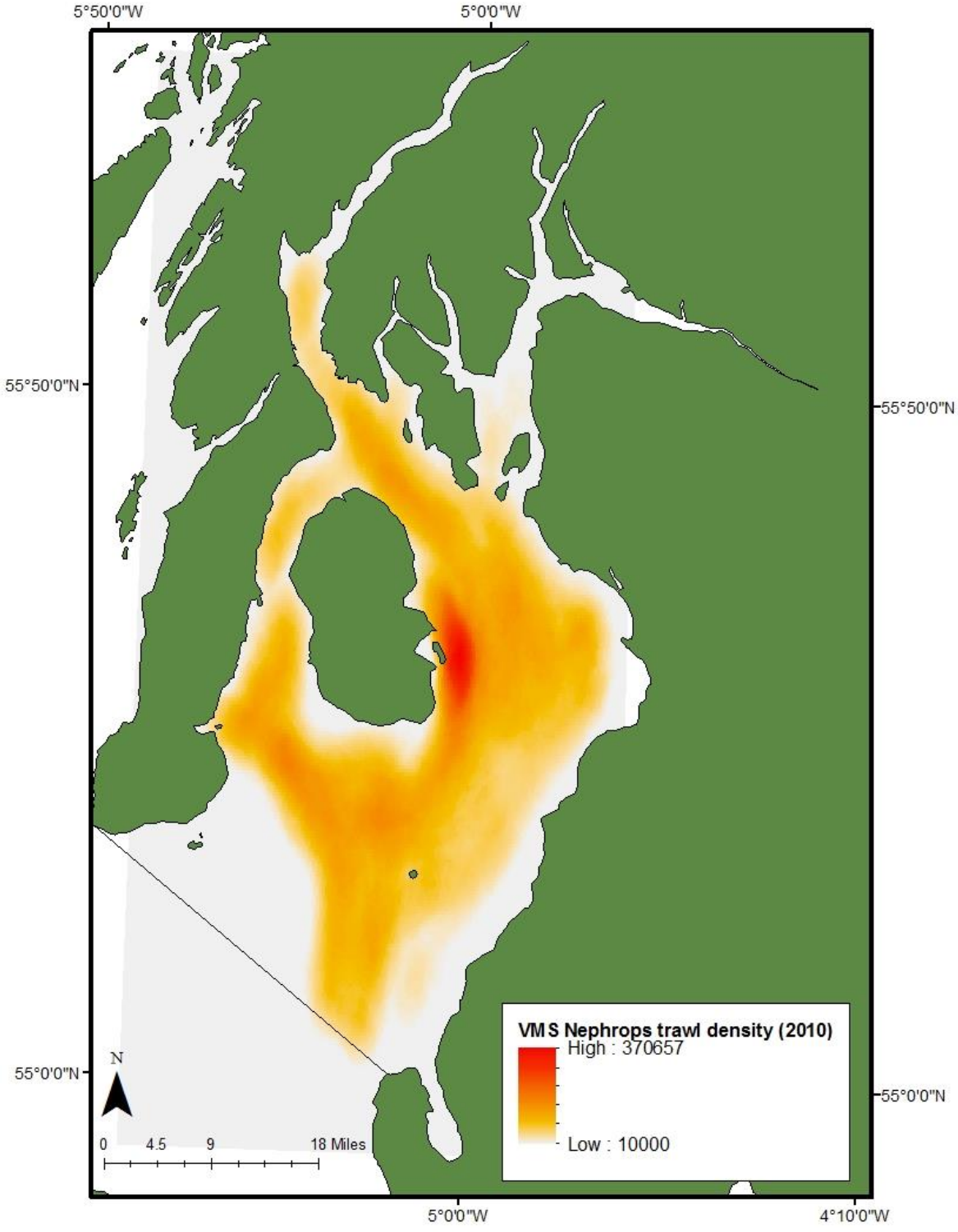


Figure D1| The distribution of fishing activity in the Clyde in 2010 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed *Nephrops*.

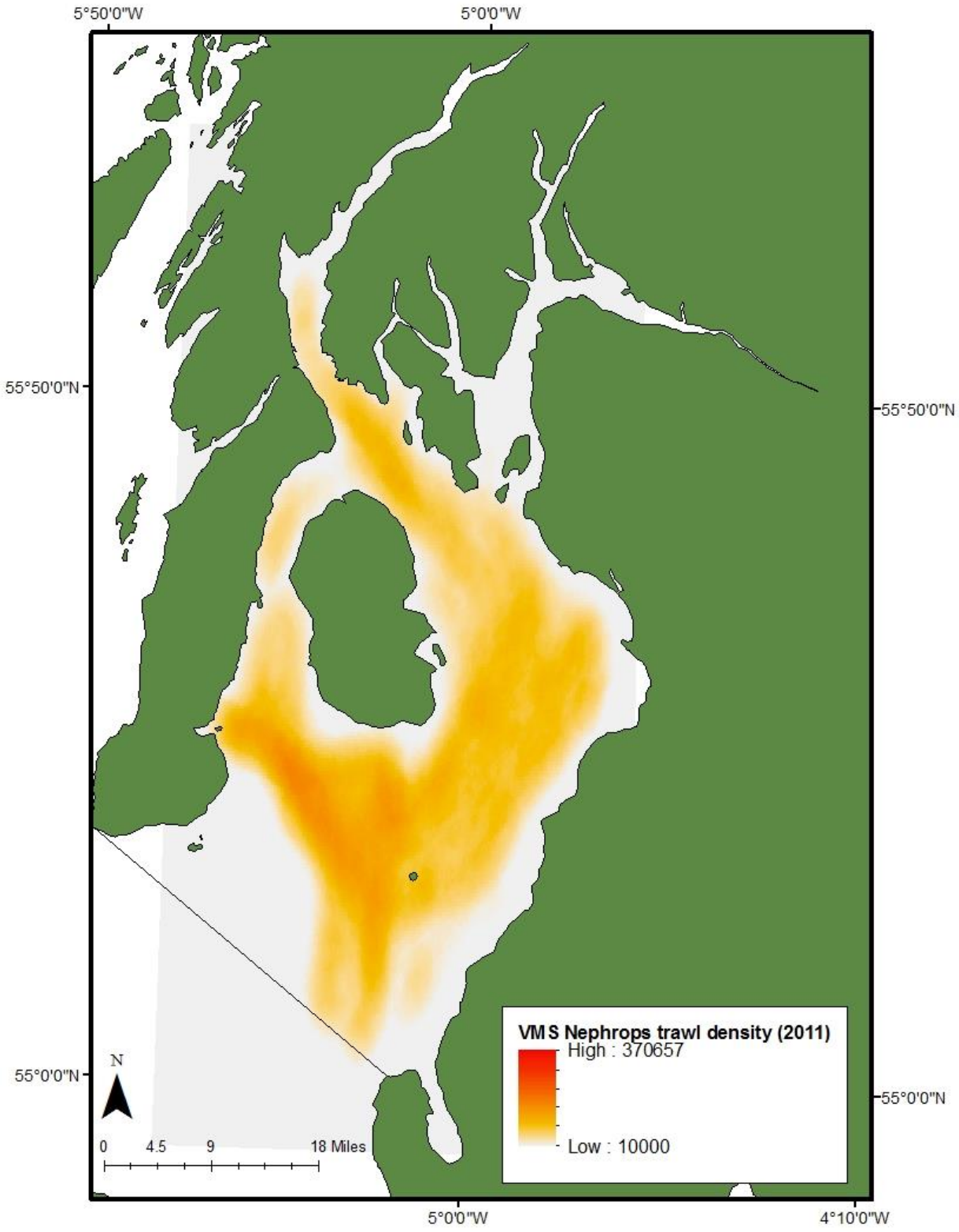


Figure D2| The distribution of fishing activity in the Clyde in 2011 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed *Nephrops*.

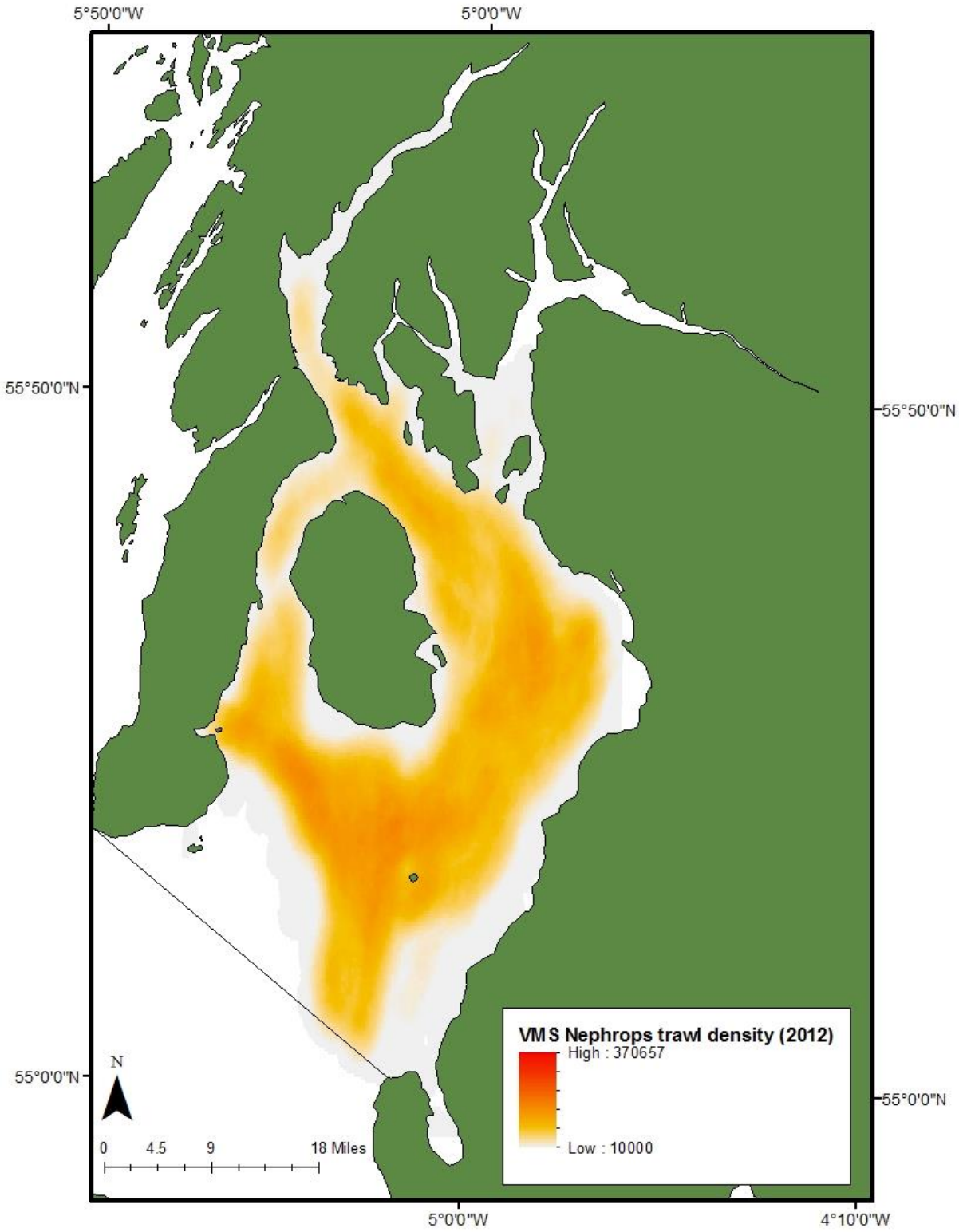


Figure D3| The distribution of fishing activity in the Clyde in 2012 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed *Nephrops*.

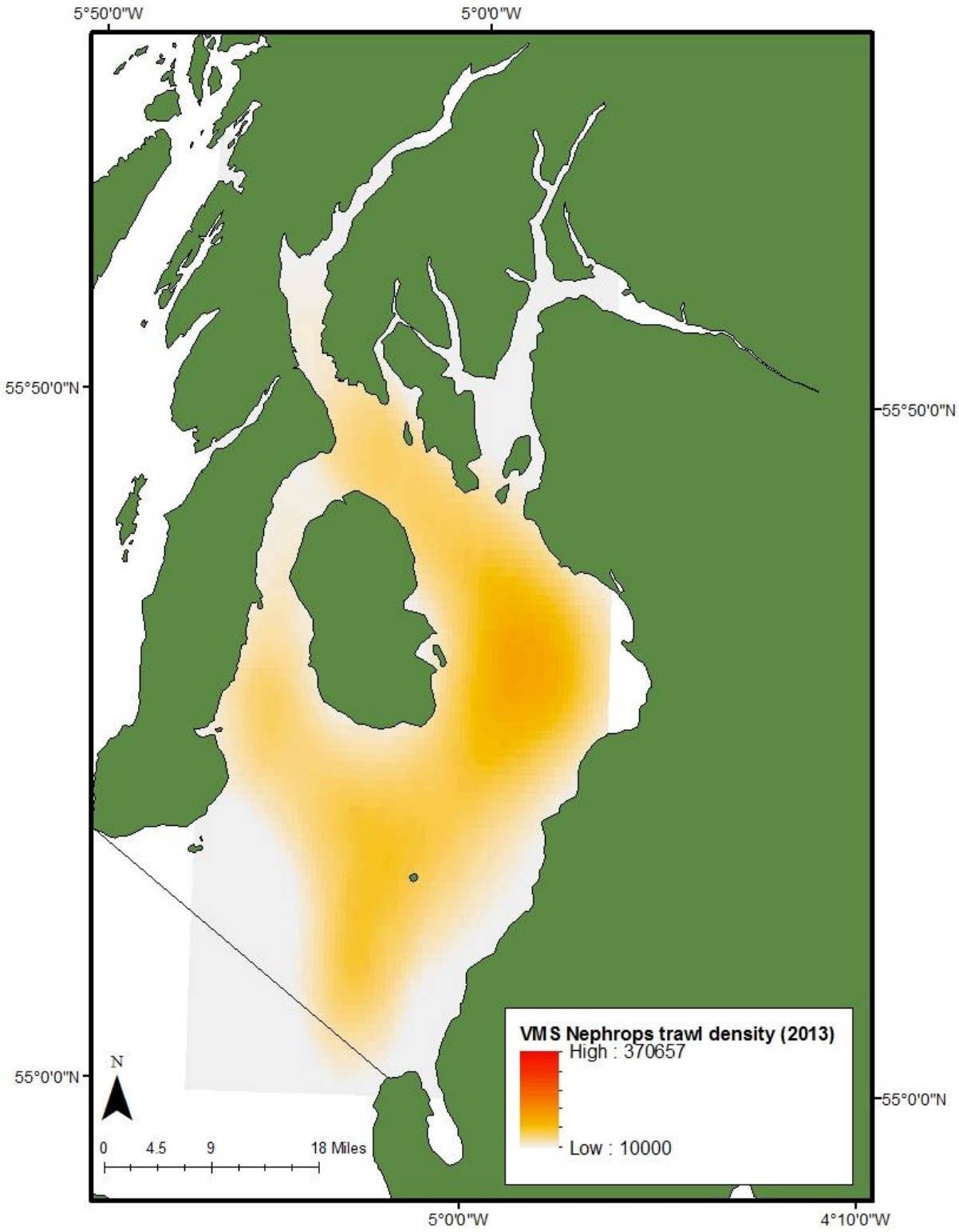


Figure D4| The distribution of fishing activity in the Clyde in 2013 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed *Nephrops*.

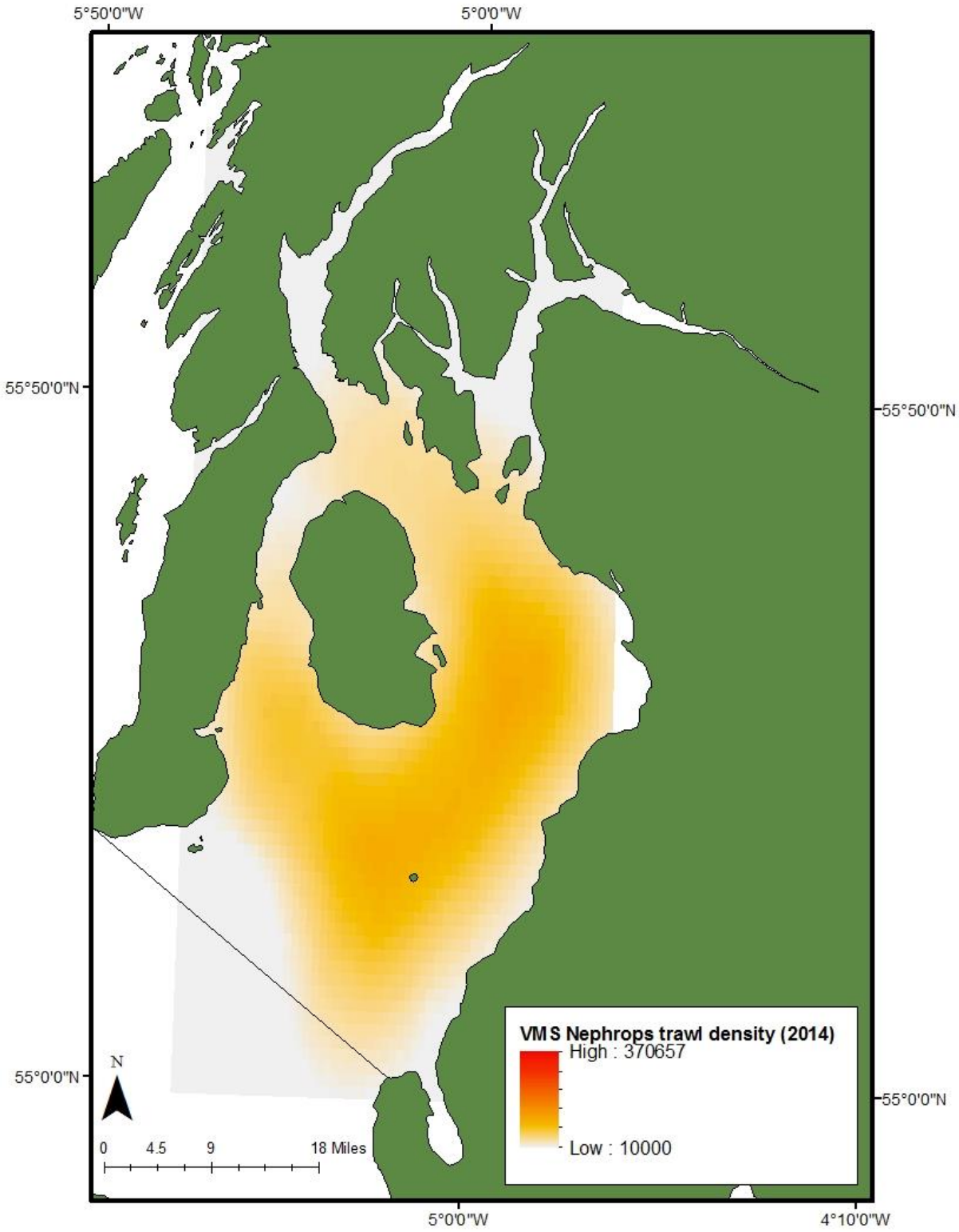


Figure D5| The distribution of fishing activity in the Clyde in 2014 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed *Nephrops*.

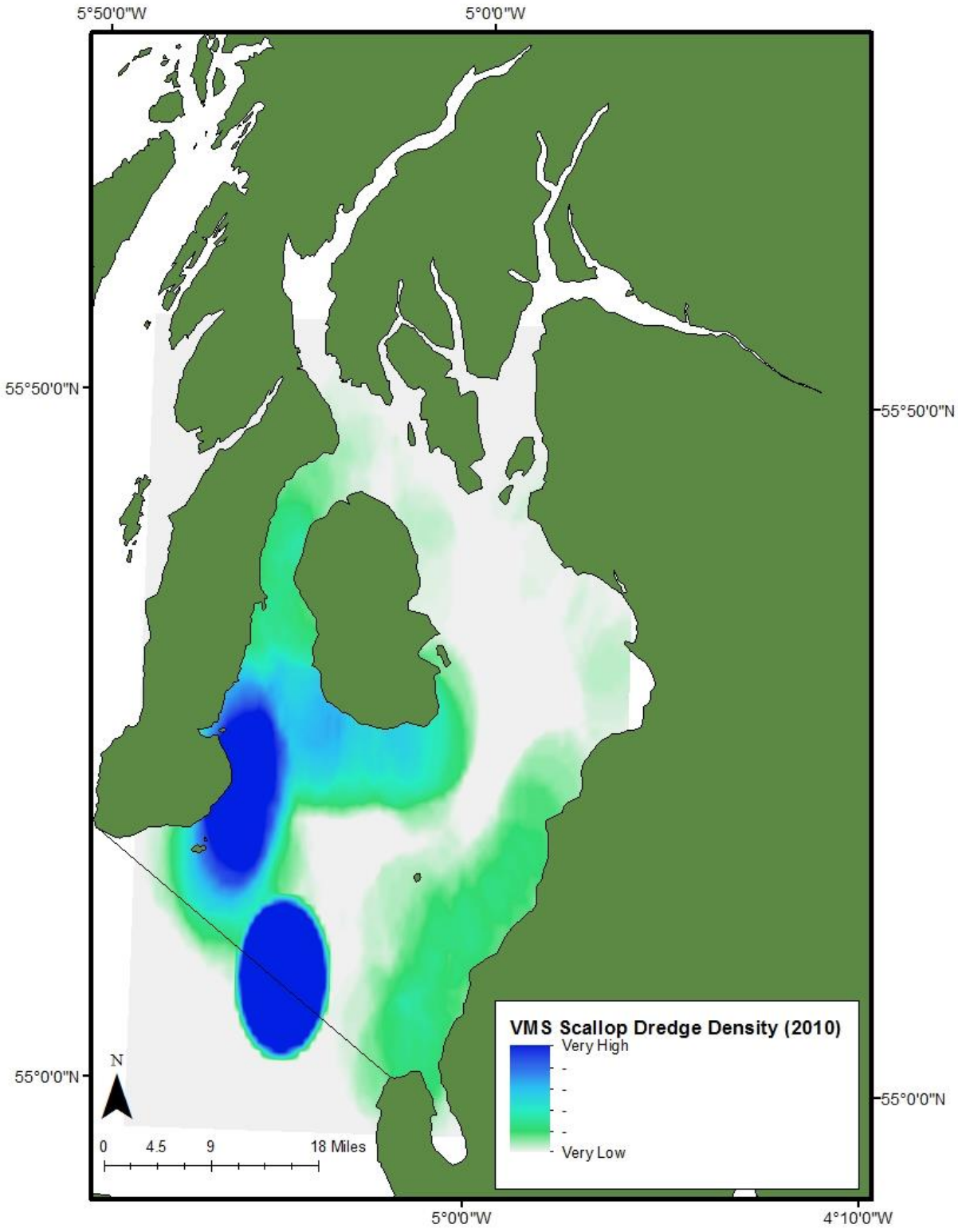


Figure D6| The distribution of fishing activity in the Clyde in 2010 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed scallops.

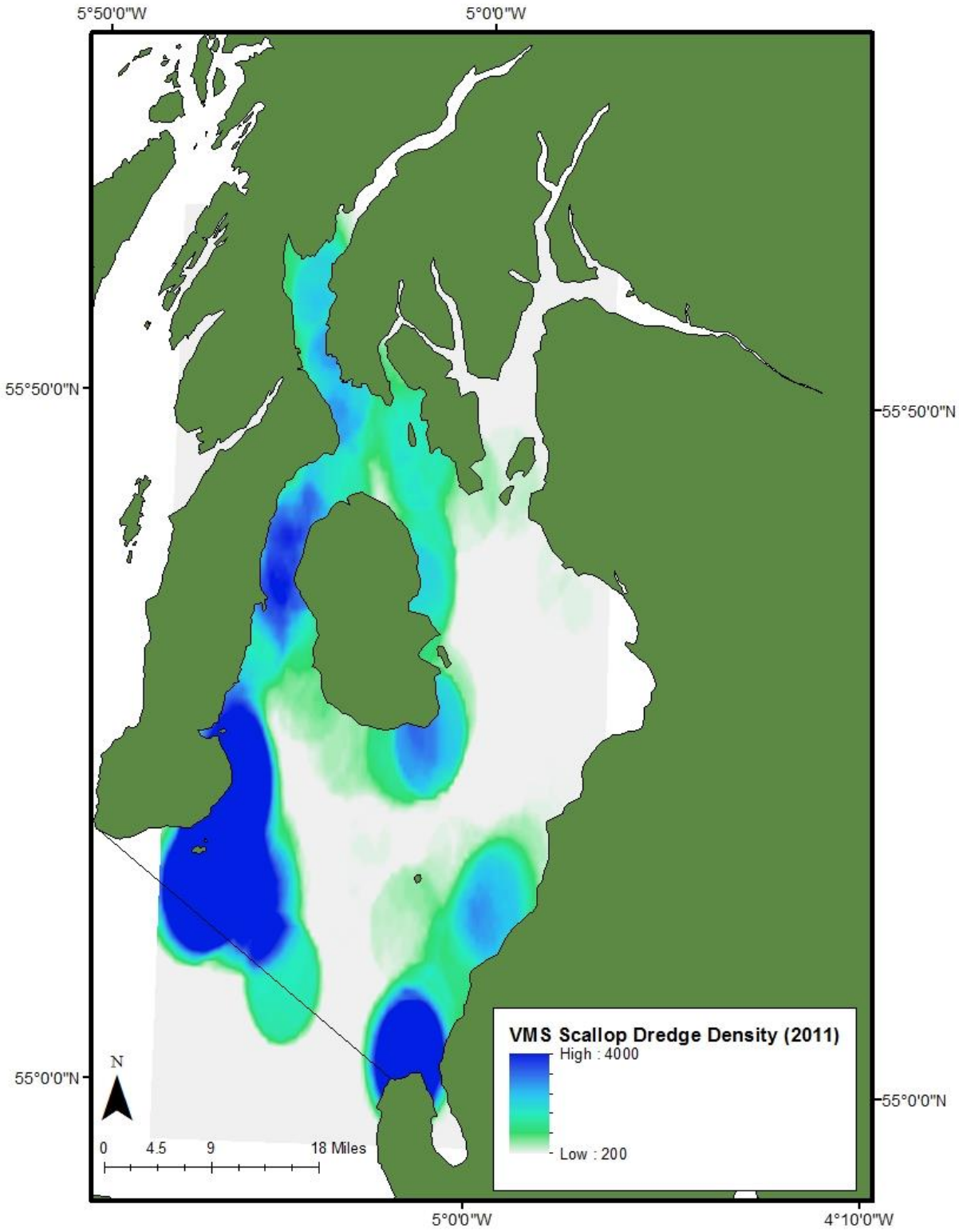


Figure D7| The distribution of fishing activity in the Clyde in 2011 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed scallops.

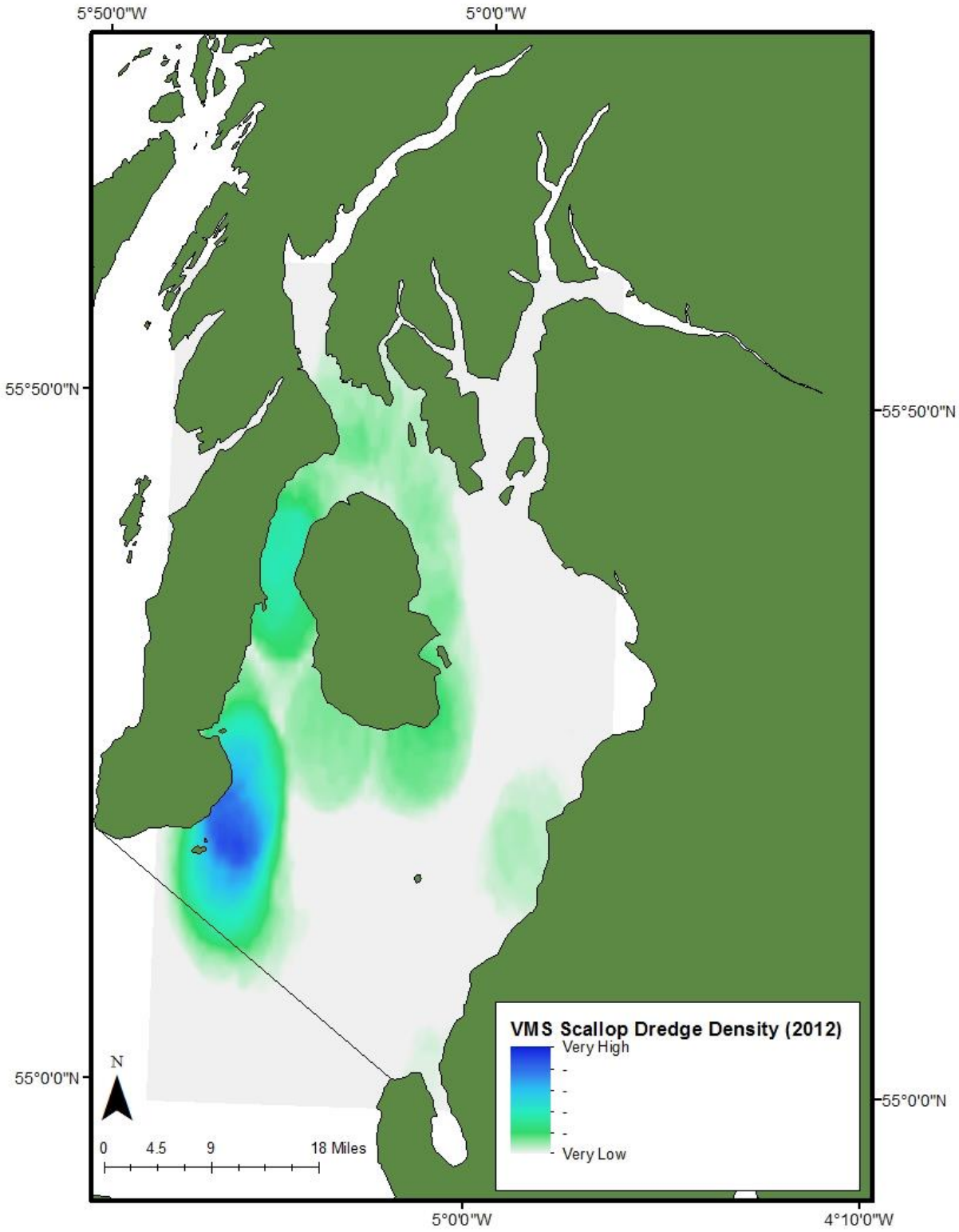


Figure D8| The distribution of fishing activity in the Clyde in 2012 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed scallops.

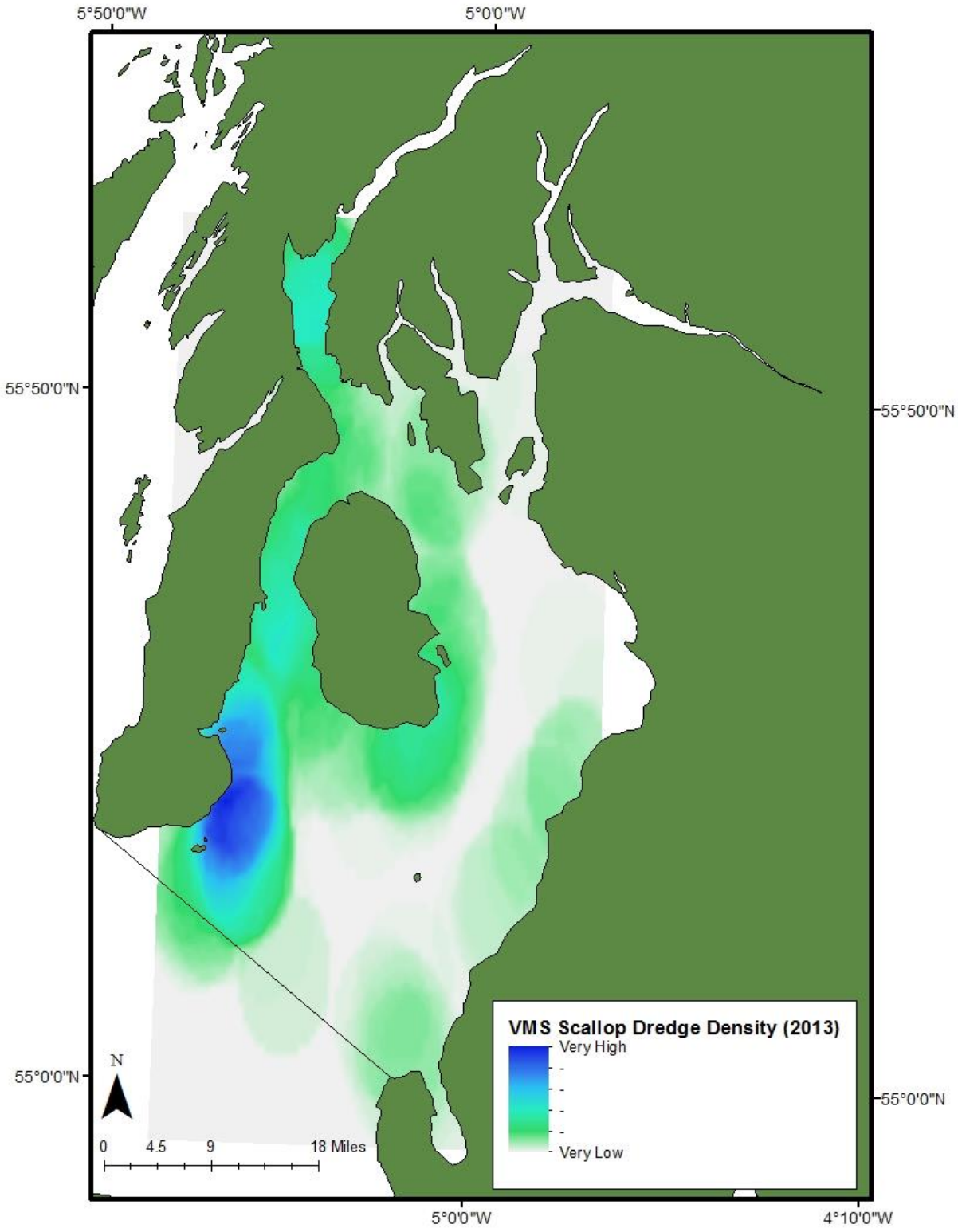


Figure D9| The distribution of fishing activity in the Clyde in 2013 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed scallops.

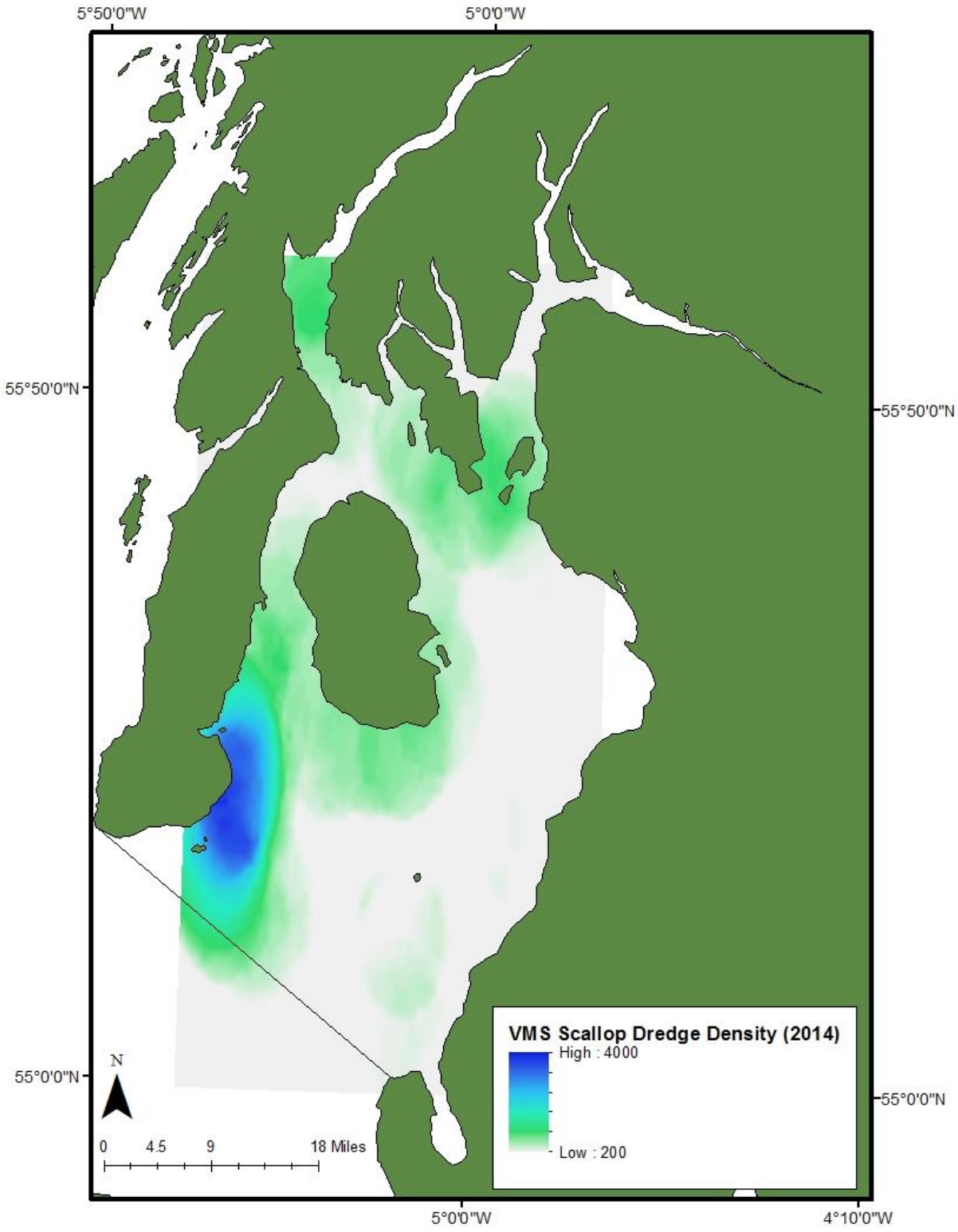


Figure D10| The distribution of fishing activity in the Clyde in 2014 based on VMS pings from vessels believed to be fishing (i.e. speed of vessels between 1 and 4 knots) for vessel trips which landed scallops.

Appendix E: CSMO Business Plan

Clyde Shellfisheries Management Organisation

The Clyde Shellfisheries Management Organisation (CSMO) will be a not for profit company limited by guarantee and would be the 'Grantee' of the Clyde Regulating Order. It. Its proposed purpose is to manage the species designated in the Clyde Regulating Order (RO) and by doing so contribute to the sustainable management of the marine environment in the Clyde sea basin. In seeking to manage shellfish stocks sustainably the CSMO will protect the livelihoods of fishermen while the recovery of the marine environment will provide further socio-economic benefits via tourism and leisure fishing. (Appendix 7 contains a brief overview of Regulating Orders.)

It is anticipated that in due course, following the intended recovery of the fishery, an increasing proportion of the income for the CSMO will come from licences to take shellfish. However, until there is a recovery of the fishery, it will be necessary to support the cost of managing the fishery through philanthropic and public sector funding.

Furthermore, until the Scottish Government has granted the Regulating Order, the company will have no income therefore a source of funding is required to cover start-up costs. Following the granting of the RO licence income may fluctuate due to natural variations in shellfish stocks and it would be prudent to build up reserves to carry the company through periods of reduced licence income.

The CSMO would comprise of a Board made up of local stakeholders with a mix of fishing and non-fishing interests, and an executive team. It is proposed that half of the CSMO Board members will be drawn from the Clyde fishing industry. To reflect the fact that the fishery is a public asset the remaining members will be drawn from other stakeholders with interests in the Clyde fishery.

The CSMO's executive team will be made up of a Fisheries Manager who will report to the Board and is responsible for delivering strategy set by the Board and liaison between the CSMO and the fishing industry. The Fisheries Manager will be supported by an Administrative Officer.

Aims

The CSMO's aims are to implement the Strategic Management Plan and to develop and implement subsequent Annual Management Plans, which will be developed by the CSMO board in conjunction with the advice of external stakeholders. More specifically, the CSMO will:

- sustainably manage the shellfisheries in the Clyde Sea Basin by opening fisheries whenever scientific advice indicates that it is prudent so to do;
- maximise the socio-economic benefits arising from well managed fisheries.

Functions

The CSMO's main functions are to:

- Open and close shellfisheries as indicated by scientific advice;
- set an annual Total Allowable Catch for each species and allocate this to individual licences;
- issue licences and collect levies;
- monitor and manage the fishing effort.

Scientific advice will be a vital element in the management of the fishery. Accordingly the CSMO will work closely with the Clyde Scientific Trust – a newly established charitable organisation which will be tasked with providing CSMO management with sufficient data to enable the Board to take informed decisions regarding the management of the shellfisheries.

Structure

The CSMO will consist of a Board of Directors and an Executive Team.

The Board

The Board will consist of an independent Chairman (who will be paid a retainer in recognition of the fact that the Chair is the management contact for the Fisheries Manager and is expected to undertake operational duties as required). Table D1 sets out the proposed structure of the board, and which stakeholder groups are represented.

Table E1| The proposed structure of the CSMO board.

SECTOR	BOARD REPRESENTATIVES
Independent Chair	1
Mobile gear fishermen	3
Static gear fishermen	3
Local Authority representatives	2
Clyde Scientific Trust representative	1
Environmental NGO representative	1
Marine Scotland (Policy)	1
C2020 Steering Group representative	1

The CSMO Chair

The Chair of the CSMO will be independent of any of the interests represented on the Board. The Chair will be an external appointment and elected by the Board. It will have a casting vote. This vote would be able to maintain the status quo unless scientific advice indicates that change is necessary. The Chair is free to choose how to vote.

Board Composition

The CSMO board will be composed of multiple stakeholder representatives. There will be 12 directors in addition to the independent Chair.

Fishing industry representation

Half of the Board members will be drawn from within the fishing industry. It is vital that industry provides the largest single group within the Board; as these representatives will be able to offer expert advice on the practical implications of fishery management decisions. Of these six directors, three will represent the mobile gear sector of the fishery and three will

represent the static gear sector. This balance between the two sectors reflects the equal rights that the two types of fishery have to operate in the Clyde's waters.

Other stakeholder representation

The remainder of the Board members will be drawn from the public sector and non-governmental organisations. This balance reflects the fact that the fishery is a public asset which must be managed in the interests of the public. The following organisations will be invited:

Local Authorities

In order to ensure that the interests of local communities are taken into account and to collaborate effectively with local integrated coastal management policies around the Clyde, it is proposed that two Board members be drawn from local authorities. It is recognised that local authorities have responsibility for economic development within their areas and that they are able to provide input to the Board in this regard. It is anticipated that these members will be officers with responsibility for coastal and marine matters, rather than elected members of the local authorities. Whilst the Clyde is bounded by five local authorities, it is held that two officers could effectively represent this sector.

Clyde Scientific Trust

It is proposed that the Chairman of the Clyde Scientific Trust (CST) is a Board member. This will ensure that there continues to be an emphasis placed upon sound science when setting fishery policy for the Firth. Whilst it is anticipated that the CSMO and CST will collaborate operationally, it is felt to be important that there is also Board level interaction between the two organisations.

Marine Scotland (Policy)

It is proposed that a representative of Marine Scotland (Policy) is a Board member. This will ensure effective collaboration between the CSMO and Marine Scotland and facilitate effective communication in both directions on matters related to the management of the Clyde, including lessons learned by the CSMO and implications for the Clyde of changes to national fisheries policy. Marine Scotland (Policy) will also have a role in enforcement of the fishery.

Environmental Non-Governmental Organisation

It is proposed that a representative of an environmental Non-Governmental Organisation (NGO) sector is a Board member. This will ensure that the important issue of environmental sustainability is considered in management decisions. The precise identity of the NGO is not predetermined, however it is the qualifications of the individual rather than the organisation which will be the critical factor.

Clyde 2020 Steering Group member

It is proposed that a representative of Clyde 2020 Steering Group is a Board member. In the first instance it is felt that this should be a member from the Sustainable Inshore Fisheries Trust (SIFT). This will ensure that there is effective coordination between SIFT which drafted

the original RO proposal and the CSMO which is the Grantee of the RO. As primary initiator of the RO, and co-ordinator of the Strategic Management Plan for the Clyde, SIFT will bring a wealth of knowledge about the proposal. It will also ensure that the underlying principles of the RO are not overlooked in the development of subsequent Annual Management Plans.

It is anticipated that once management powers have been transitioned to the CSMO and it is established as an effective body, that the Board place held by SIFT may be offered to another body on the Clyde 2020 Steering Group which remains the appropriate body to fill this gap given its anticipated role as the relevant Marine Regional Planning Authority.

Timing

Invitations to join the Board of Directors will be issued to organisations shortly after the RO application has been submitted. Recruitment of the Chair will commence at the same time. In this way there will be a management structure in place to guide the application process, to put in place the organisational structures and to develop the necessary management plans. (An organisational chart for management and committees is included at Appendix 1.)

Executive Staff

The staff of the CSMO will consist of a Fisheries Manager, supported by an Administrative Officer.

Fisheries Manager

The Fisheries Manager will be responsible for implementing Board decisions, liaison (both internal and external) and day to day management of the fishery.

Administrative Officer

The Administrative Officer will provide secretariat support to the Board, administrative support to the Fisheries Manager and administration associated with the issuing of licences. This post will be part time for nine months of the year with the option of full time working during the licensing period.

Recruitment

Recruitment of the Fisheries Manager will be undertaken by a professional recruitment consultant using criteria drawn together during the development of the Regulating Order application. Further recruitment will be undertaken by the Fisheries Manager. The timing for recruitment will be guided by the application process for the Regulating Order. (An organisational chart for staff is included at Appendix 2.)

Funding

The CSMO is intended to be a not for profit organisation. It is anticipated that it will not be able to sustain itself financially during its initial years of operation. Minimal expenditure is anticipated during the RO application process. However once the RO has been approved, the costs will increase until the organisation becomes fully operational and commences the management of the fishery. As the RO's Grantee, the CSMO will be responsible for devising fishery management measures and ensuring their implementation.

There are risks associated with being operational at the point the RO is granted however there are also risks associated with not being in a position to open fisheries immediately should the scientific advice indicate that it is prudent to do so.

Initial Capital Costs

Table E2| An estimate of the initial capital cost:

Description	**Estimated Costs £**
Office equipment	3,500
Telephones	1,000
PCs and laptops	5,000
Personal protective equipment	2,000
Risk assessments/ health & safety audits	2,000
Management information software	5,000
Vessel monitoring system	96,000
Creel marking	45,000
Total	**159,500**

Vessel Monitoring Systems

A central feature of the proposed enforcement regime within the RO will be the use of Vessel Monitoring Systems to provide real time precise locational information of licenced fishing vessels. Recently enacted European Union (EU) legislation carries a requirement to install VMS on all vessels with a length overall in excess of 12m. However, in order for the CSMO to have access to the data and hence be able to monitor the location of licensed vessels in the Clyde, it will be necessary for CSMO to install its own system of VMS. SIFT estimates that the initial cost of equipping the CSMO to be operational will be £159,500.

The estimated costs of installation[20] are:

- Cost of basic unit per vessel: £850
- Fitting Unit: £200

Creel marking costs

An additional component of the fishery management regime will be the marking of static fishing gear. It will be a requirement of licensed fishing vessels operating under the RO that all static gear must have a tagging number and that every marker dan-bouy for lines of creels must have a GPS locator. On the assumption that there will be a limit of 800 creels per static gear vessel, run on 8 lines, and there will be 25 static gear vessels operating in the RO area, there will be an initial cost of £45,000:

- Additional cost per creel vessel (to monitor creel numbers): £200
- Creel tagging @ 800 creels per vessel: £1,600

Operating costs

The operating costs of the CSMO will comprise of staff and operating costs. The total cost of these activities is set out in Table D3.

Table E3| Proposed operating costs of the CSMO

	2016/17	2017/18	2018/19	Total
Staffing	88,047	88,047	88,047	264,141
Overheads	34,740	34,740	34,740	103,500
Total	**122,787**	**122,787**	**122,787**	**367,641**

The operating costs will be those incurred by the employment of staff and the operating of the CSMO's office premises. Employed staff will be responsible for ensuring the functioning of the CSMO Board and the delivery of its policy recommendations regarding the opening and closing of the fishing grounds.

Office overheads required to ensure the running of the CSMO and the delivery of the Board's fishery management policy are estimated at a cost of £34,740 per annum.

Enforcement Costs

Marine Scotland will undertake the majority of enforcement duties for the fishery in consultation and collaboration with the Fisheries Manager. Therefore, enforcement costs will

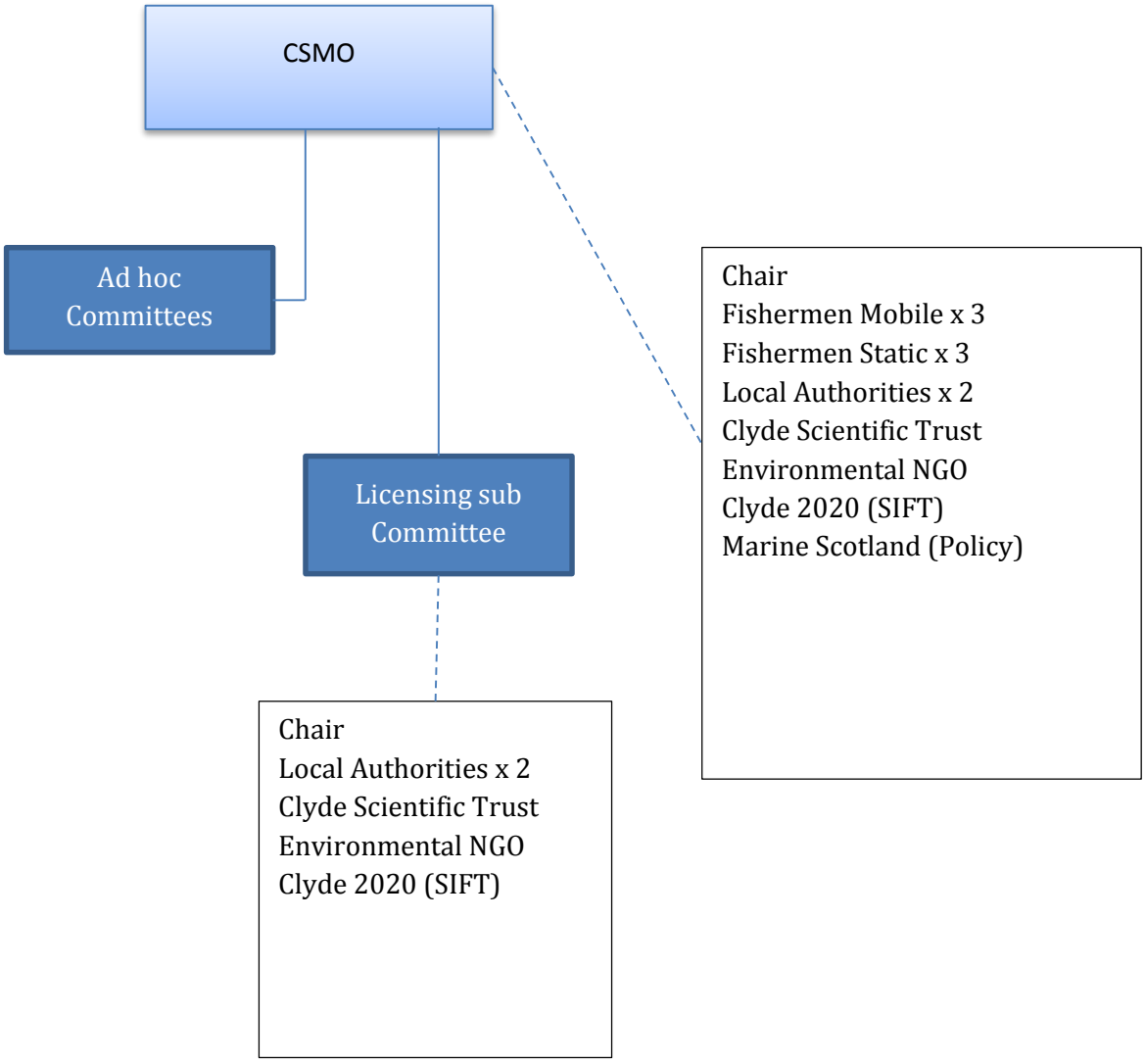
[20] The annual costs per vessel for operating VMS is in the order of £120. It is proposed that this cost is borne by the vessel owners.

be minimal and, as part of the Fisheries Manager's duties, the proportion of the Fisheries Manager's time spent on enforcement is difficult to estimate before the fishery is operational.

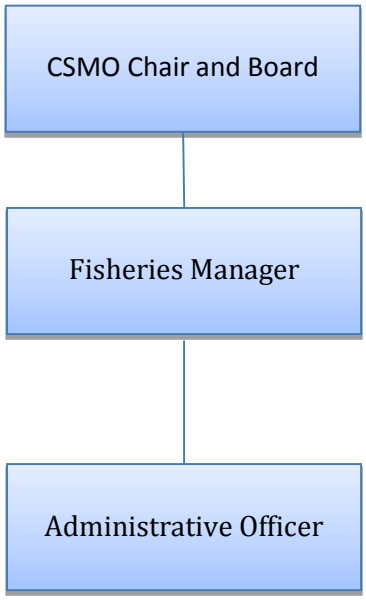
Income

The majority of funding for the operation of the CSMO will be sourced from EU and philanthropic grants. It is anticipated that an income of approximately £20,000 per annum will be generated from licences issued to fishermen permitting them to take an allocated catch. Fishing licences will be priced at approximately £250 per vessel with an annual average fleet of 80 vessels. However, this income is not guaranteed. It is possible that the fishery will not be able to open, for example, scientific advice might indicate that stock levels are too low to allow any catch allocation. Thus it is important that the CSMO builds up sufficient reserves to cover closed seasons. Due to the number of species covered by the Regulating Order there is less risk that there would be a total closure however it would still be prudent to build up reserves of one year's operating costs and this will be an aim. Expenditure will be reviewed during any such closure and cost saving measures put into place as appropriate.

Appendix 1: Organisational chart (Board and committees)



Appendix 2: Organisational chart (Staff)



Appendix 3: Legal certificates, insurances

The CSMO will carry all relevant insurances including:

- Motor Insurance
- Employers' Liability Cover
- Professional Indemnity Insurance

Appendix 4: Policies and Procedures

Policies and procedures will be drafted and adopted by the Board before the CSMO becomes operational. However, in the absence of the procedures it should be noted that the CSMO will:

- Adopt public procurement rules;
- Be an equal opportunities employer;
- Be an environmentally responsible business; and
- Ensure that, as far as possible, our policies and processes are socially inclusive.

Planned policies and procedures

Organisational

- Health and Safety Policies and Procedures
- Equal Opportunities Policy
- Data Protection Policy
- Media Handling Policy
- Online Communications Strategy
- Procurement Procedures
- Financial Policies and Procedures
- Complaints Procedure (for Board, licensees, public)
- Training Policy (staff, Board members)
- Carbon Plan

Staff

- Disciplinary Procedure
- Grievance Procedure
- Appraisal Procedure
- Sick Leave Policy and Procedure
- Leave policy and Procedure
- Time off in Lieu Policy and Procedure
- Public Duties Procedure
- Recruitment Procedure

Governance

- AGM procedures
- Board (and sub-committee) Terms of Reference and standing orders

Appendix 5: Detailed financial projections

Start up costs

	Estimated Costs £	Comments
Office equipment	3,500	Desks, chairs, filing cabinets etc.
Telephones	1,000	Hotel style phone system allowing direct dials to Fishery Officers and numbers set up for specific issues.
PCs and laptops	5000	For all members of staff.
Personal protective equipment	2,000	For Fishery Officer including waterproofs, boots, flotation suits etc.
Risk assessments / health & safety audits	2,000	Due to the specialised nature of this role a specialist will be required to undertake the risk assessment.
Management information software	5,000	Customer Relationship Management (CRM) type system to manage licensees and monitor catches etc.
Vessel monitoring system	96,000	Includes monitoring system at the CSMO base along with mobile units on all licensed vessels.
Creel marking	45,000	
Total	**159,500**	

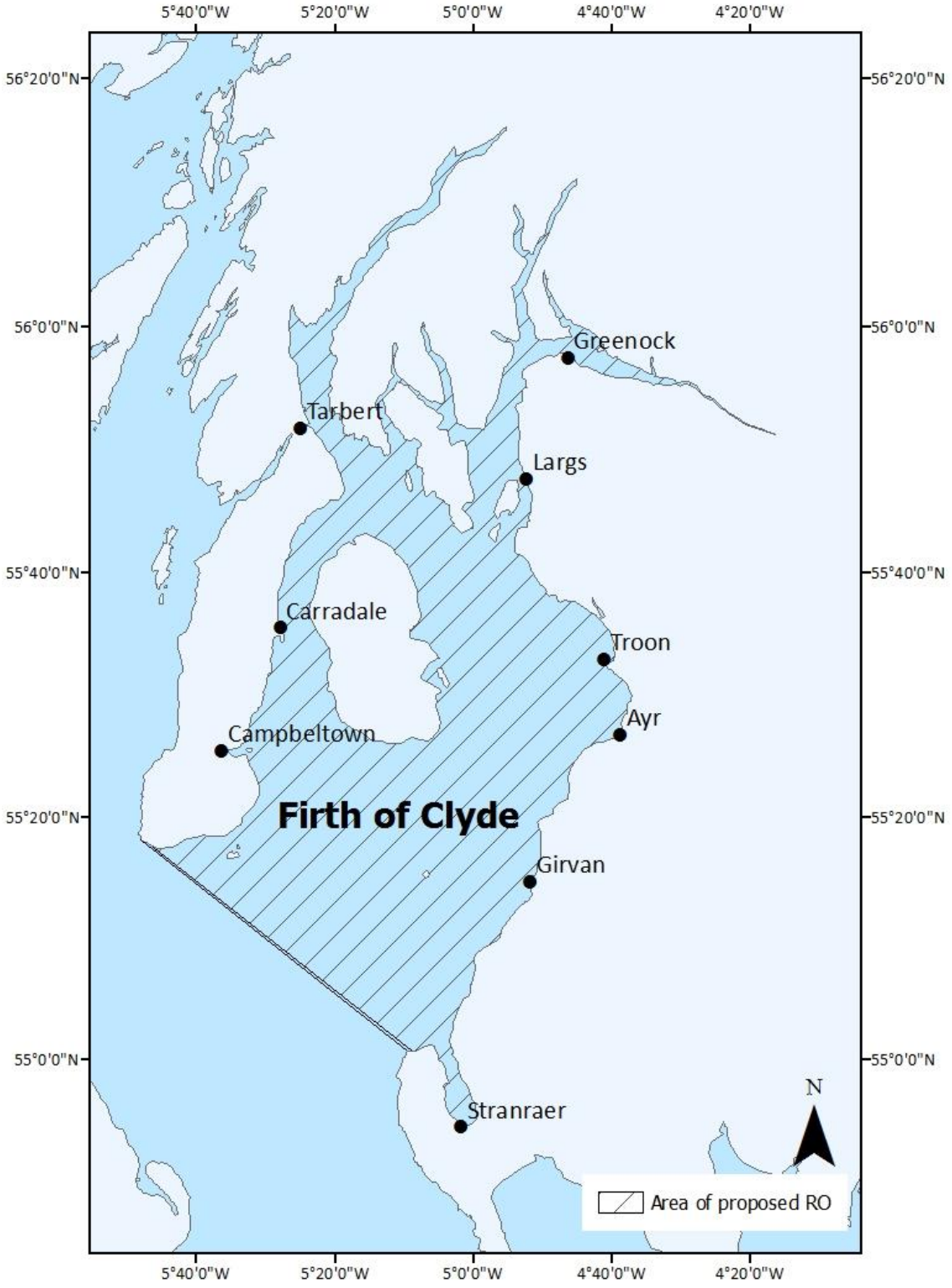
Staffing costs 2016/17

	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Total
Chair (contractor)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Fisheries Manager	4,740	4,740	4,740	4,740	4,740	4,740	4,740	4,740	4,740	4,740	4,740	4,740	56,880
Administration Officer	1,354	1,354	1,354	1,354	2,327	2,327	2,327	1,354	1,354	1,354	1,354	1,354	19,167
Total staffing	**7,094**	**7,094**	**7,094**	**7,094**	**8,067**	**8,067**	**8,067**	**7,094**	**7,094**	**7,094**	**7,094**	**7,094**	**88,047**

Overheads 2016/17

	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Total £
Travel	350	350	350	350	350	350	350	350	350	350	350	350	**4,200**
Rent	500	500	500	500	500	500	500	500	500	500	500	500	**6,000**
Rates	200	200	200	200	200	200	200	200	200	200	200	200	**2,400**
Services	300	300	300	300	300	300	300	300	300	300	300	300	**3,600**
Phones	150	150	150	150	150	150	150	150	150	150	150	150	**1,800**
Cleaning	100	100	100	100	100	100	100	100	100	100	100	100	**1,200**
Printing, copying etc.	75	75	75	75	75	75	75	75	75	75	75	75	**900**
Stationery /postage	100	100	100	100	100	100	100	100	100	100	100	100	**1,200**
IT Equip/support	250	250	250	250	250	250	250	250	250	250	250	250	**3,000**
Training & Courses				250						250			**500**
Events			500			500			500			500	**2,000**
Accountancy etc.												1,500	**1,500**
Insurance	5,000												**5,000**
Bank charges	20	20	20	20	20	20	20	20	20	20	20	20	**240**
Miscellaneous	100	100	100	100	100	100	100	100	100	100	100	100	**1,200**
Total overheads	**7,145**	**2,145**	**2,645**	**2,395**	**2,145**	**2,645**	**2,145**	**2,145**	**2,645**	**2,395**	**2,145**	**4,145**	**34,740**

Appendix 6: Area of Proposed Regulating Order



Appendix 7: Regulating Orders (RO)

A Regulating Order (Order) is a piece of legislation granted by Scottish Ministers under the terms of the Sea Fisheries (Shellfish) Act 1967. It is intended to improve the management of natural shellfisheries by granting fishing rights to the applicant covering one or more named species in a designated area of the sea or tidal waters. Since the granting of an Order will restrict the public right to fish in the designated area there is a formal procedure to be followed when applying for an Order. This process is intended to protect the rights of anyone who has an interest in the area and/or species that would be covered by the proposed Order.

Since an Order allows the Grantee to vary when the fishery is open and how much stock may be removed from the fishery it enables Grantees to act quickly when needed; for example when a storm impacts on shellfish stocks or when mild spring weather causes species to spat earlier than anticipated.

An Order provides regulatory certainty for the species covered by removing unmanaged harvesting of resources and replacing it with controlled harvesting using a management plan that considers all aspects of the management of a species. Unmanaged harvesting of stocks can result in overfishing during good years that results in lean fishing in future seasons.

An Order allows the Grantee to restrict and regulate the taking of shellfish covered in a specific area. The restrictions and regulations may include the right to:

- issue licences;
- levy tolls;
- impose quotas;
- specify fishing methods to be used;
- restrict times and dates for fishing; or
- close the fishery.

A Regulating Order is sought for the following species:

- Prawns (*Nephrops* norvegicus);
- King scallop (Pecten maximus);
- Queen scallop (Aequipecten opercularis).

Appendix F Monitoring

Table F1| Summary of survey methods carried out to monitor changes in an ecosystem

Area	**Survey methods**
Lyme Bay MPA (Stevens *et al*., 2014)	Selected sites for monitoring based on patterns of historical fishing effort, benthic substrate and biotope distribution. **Towed video**- abundance of large, epibenthic taxa, colonial or cover-forming epibenthos, and indicator species. **Baited Remote Underwater Video (BRUV) -** abundance of reef-associated nekton (fishes and mobile invertebrates).
Lamlash NTZ (Howarth, 2014)	**Diver surveys** (50m x 3m transects) - recording all organisms and collecting data from all scallops encountered. **Photoquadrates**- identity and count all organisms. **Baited underwater video cameras**- surveying fish populations. **Crustacean surveys**- data collected from lobsters and crabs found in the reserve
Isle of Man, Ramsey Bay Fisheries Management Zone (FMZ) (Dignan *et al*., 2014)	**Size frequency distribution** inside and outside of the protected areas. **Age frequency distribution** inside and outside of the protected areas. **Catch depletion rate** to monitor if Catch Per Unit Effort (CPUE) decreased as the fishery progressed. **Energy return on investment (EROI)** worked out to as a quantification of fisheries energy efficiency. **Video Sled Survey** to conduct a Before After Control Impact (BACI) experiment to establish baseline conditions.
Isle of Man, scallop surveys	**Biannual queen scallop surveys** at up to 50 stations around the island. Results feed into stock assessments for both king and queen scallops. **Visual surveys** for queen scallop within closed area and habitats around the Isle of Man. **Port Erin grid squares**- the grid squares are 5 × 5 nautical miles and are used by fishers in their logbooks to designate fishing location. **Red Bag Scheme**
Baie ny Carrickey Closed Area, Isle of Man (Bloor *et al*., 2014)	**(Proposed monitoring measures)** **Towed video array with static photographs-** spatially explicit habitat data will be quantified from the static photos and a map of benthic habitats will be created. **Spatially specific environment data-** salinity, water temperature and depth will also be recorded. **Logbook sheets for data collection-** monthly data to be collected across 11 scientific data sites. **Tag-mark-recapture study-** undertaken to assess the movement and habitat use of crustaceans. **Baited Remote Underwater Video (BRUV) -** non-destructive technique commonly used to sample fish populations. **Surveys for juvenile shellfish**

Table F2| Summary of key current international and national monitoring obligations

Directive or treaty	Date	Legislation	Legal Objectives	Timescales	Relevant Species	Criteria
Common Fisheries Policy	1983	EU No 1380/2013	Ecosystem based management, multi-species and multi-year management plans	Achieved by 2020	Predominantly concerned with main commercial species- reference to others via MSFD	MSY of commercial species
Habitats Directive: Conservation of natural habitats and of wild fauna and flora	1992	Council Directive 92/43/EEC	Favourable Conservation Status, Favourable Site Condition	In operation	Species listed under Annex VI of the Directive and “typical species” of marine SACs	Population sizes and distribution for species listed individually or as typical species of habitats Reporting every 6 years
The Convention for the Protection of the marine Environment of the North-East Atlantic (OSPAR)	1992		Establish a network of marine protected areas which is both ecologically coherent and well-managed	Achieved by 2016	Any	Effectiveness of marine management schemes to be reviewed every 5 years
Convention on Biological Diversity	1992		Biodiversity duty, on all public bodies in Scotland. Creation of Scottish Biodiversity Strategy	Achieved by 2020	Any	Coherent network of MPAs, CFP stocks to MSY, biodiversity to be taken into account in inshore fisheries, improve monitoring
Water Framework Directive	2000	2000/60/EC	Good Ecological Status	Achieved by 2027	Any within territorial waters (3 nautical miles of baselines)	Transitional Fish Classification Tool Reporting every 6 years
Marine Strategy Framework Directive	2008	2008/56/EC	Good Environmental Status (GES)	Achieved by 2020	Any	MSY of commercial species, positive trends in other species

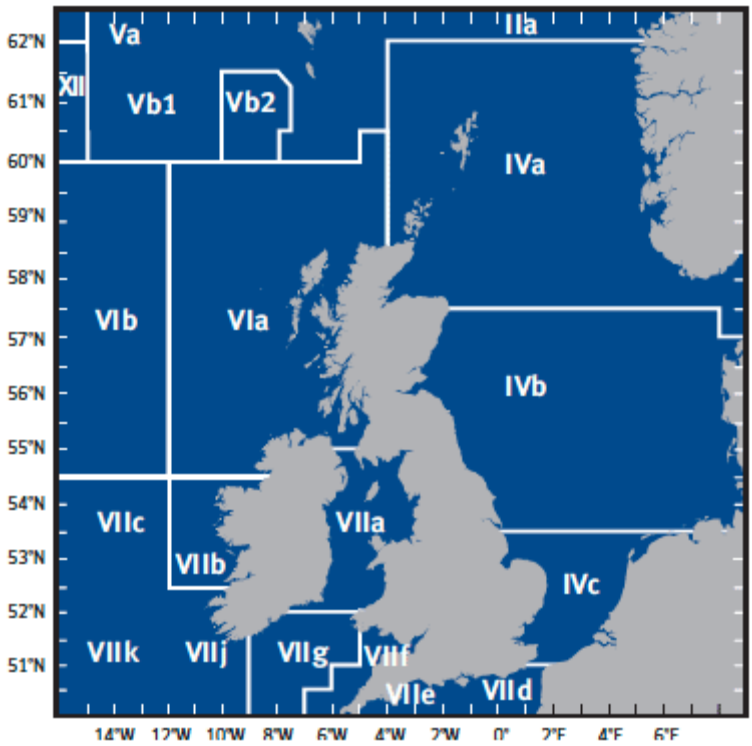


Figure F1| Detailed boundaries of the ICES subdivisions IV, V, VI, VII and VIII (Marine Scotland, 2012)