Co-existence of capture fisheries and marine aquaculture

Review of measures for improved co-existence with recommendations for adoption in Scotland

Report

May 2022

POSEIDON
AQUATIC RESOURCE MANAGEMENT

Report Information

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Abbreviations and acronyms

ABM	Area Based Management
CES	Crown Estate Scotland
CFA	Clyde Fishermen's Association
CIFA	Community Inshore Fisheries Alliance
EIA	Environmental Impact Assessment
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group
FMMS	Fisheries Management and Mitigation Strategy
GVA	Gross Value Added
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries and Conservation Authority
IFGs	Inshore Fisheries Groups
INTOG	Innovation and Targeted Oil and Gas
i-VMS	Inshore Vessel Monitoring Systems
MPA	Marine Protected Area
MS-LOT	Marine Scotland Licencing Operations Team
NM	nautical mile
NMPi	National Marine Plan interactive
RIFG	Regional Inshore Fisheries Groups
SFF	Scottish Fishermen’s Federation
SSMO	Shetland Shellfish Management Organisation
SWOT	Strengths, Weaknesses, Opportunities And Threats
UK	United Kingdom
VMS	Vessel monitoring system

1. Introduction, objectives and approach

1.1 Introduction

Poseidon Aquatic Resource Management Limited, was commissioned by the **Crown Estate Scotland (CES)** to undertake a:

> *Review of measures for improved co-existence of capture fisheries and marine aquaculture developments with recommendations for adoption in Scotland.*

1.2 Objectives

The project objectives were as follows:

a. Based on a comprehensive review of national and international experiences, identify measures by which co-existence between capture fisheries and marine aquaculture may be achieved.
b. Review the relative success of the identified measures, highlighting those factors that have contributed to their success or failure.
c. Consult with aquaculture industry, inshore commercial fisheries representatives and governing authorities to understand nature of existing interactions and potential co-existence solutions.
d. On the basis of the above, recommend measures that may be applicable in Scottish waters and identify any associated enabling actions.
e. Engage with stakeholders to discuss and agree recommended measures and approaches to piloting them.

1.3 Methodology

1.3.1 Phase 1: Desk based research and review

In delivering objectives a. and b. above, phase 1 of the project involved desk-based research to review a range of global case study examples of co-existence between capture fisheries and aquaculture, as well as other appropriate marine co-existence examples, including the offshore wind sector. The review focused on aquaculture and fisheries interactions, conflicts, mutual benefits and co-existence solutions, including representative case studies.

The project primarily focused on shellfish and seaweed aquaculture and static gear commercial fisheries sectors (e.g., creeling), and therefore focused on co-existence within the 0-6 NM zone. Useful learning from (and for) marine finfish aquaculture, and other marine development sectors, were also drawn out where appropriate. The comprehensive review and case study analysis are provided in the Appendix Report.

1.3.2 Phase 2: Stakeholder consultation

Following the desk-based research, phase 2 of the project involved engagement with representative stakeholders from the UK aquaculture sector, inshore Scottish commercial fisheries representatives and UK governing authorities. Engagement aimed to further understand the nature of interactions from a Scottish and wider UK context, sought feedback on recommended co-existence measures and explored the willingness for these measures to be trialled.

A pro-forma questionnaire was developed to steer these discussions, which were undertaken on a one-to-one basis, or in small groups, through Microsoft Teams or telephone. Further details are provided in Section 3.

1.3.3 Phase 3: Analysis and recommendations

Phase 3 analysed the findings of the consultation phase to develop a set of recommendations for co-existence measures. Each measure was assessed for strengths, weaknesses, opportunities and threats (SWOT analysis) for delivering co-existence in a Scottish context.

Due to the benefits of virtual meetings, a workshop was held during the analysis phase. This brought together key industry consultees to further discuss potential implementation and trialling of co-existence measures.

1.3.4 Outputs and reporting

This project has delivered the following main outputs:

1. **Desk based global review of co-existence** – presented in an Appendix Report which acts as an evidence base to inform phases 2 and 3 of the project.
2. **Final report (this report)** – which provides an overview of the methodology, results of the consultation process, analysis of co-existence measures in a Scottish context and recommendations for piloting these measures in Scotland.
3. **Final slide-deck** – summarising the findings from the main report.

2. Project Context

2.1 Aquaculture and commercial fisheries sectors

The vision for Scotland's blue economy growth means that co-existence is increasingly crucial if marine sustainability is to be delivered across all of the environmental, social and economic pillars. Scotland's marine waters are increasingly busy spaces, with a wide range of commercial and non-commercial users, including well established seafood production businesses.

Both capture fisheries and marine aquaculture are significant contributors to Scotland's blue economy and play an important role in supporting many coastal and remote communities. A recent Scottish Government report indicates that fishing accounts for 7% of the Scottish marine economy GVA (gross value added) and contributes 7% to marine economy employment. Aquaculture accounts for 6% of the Scottish marine economy GVA and contributes 3% to marine economy employment (Scottish Government, 2020) (Figure 2.1). Scotland's National Marine Plan (Marine Scotland, 2015) acknowledges the importance of both sectors and supports their sustainable development.

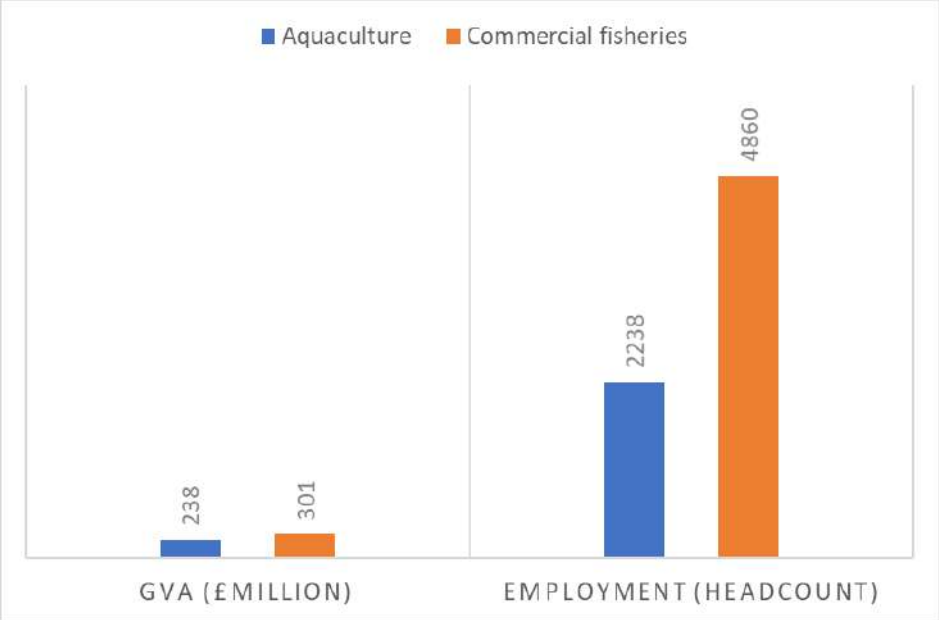

Figure 2.1 Aquaculture and fisheries GVA and employment numbers in 2018 (Scottish Government, 2020).

To create a more sustainable UK seafood supply chain, and reflecting the natural assets of the Scottish coastline that could support further aquaculture development, there is a recognised potential for growth of the aquaculture sector in Scotland. The Crown Estate Scotland (CES) have identified the particular potential for development of larger scale shellfish and seaweed farms on parts of Scotland's coast in the 0-6 NM zone. Any future growth in this sector will need to co-exist with inshore commercial fishing interests operating in the same marine space in order to avoid negative physical interactions, minimise displacement of fisheries activity, and maximise any potential benefits of co-existence.

The characteristics of shellfish and seaweed cultivation suggest that the greatest potential for conflict with inshore fisheries exists off the western and northern coastlines of Scotland (Table 2.1 overleaf). The east coast of Scotland has a presumption against finfish farming for the precautionary purpose of minimising effect on wild salmonid populations. Seaweed and shellfish aquaculture does not have the same presumption and therefore potential opportunity remains for future developments along the east coast. It is also noted that the recent ABPmer (2021) report undertaken for the CES suggests East coast sites for restorative aquaculture.

Table 2.1 Characteristics of shellfish and seaweed aquaculture and inshore fisheries in Scottish waters.

Shellfish and seaweed aquaculture	Inshore fisheries
•Potential focused in the north and west (Shetland, Western Isles, Highlands and Strathclyde) •Shellfish species - mussels, scallops and oysters - grown on lines, in lanterns, in bags, on trestles •Non-fed, natural stocking, mixed cultivation possible •Often located in sea lochs and voes	•Inshore fleet, generally Scottish vessels ≤12m length •Generally not nomadic, landing to home ports •Variety of gears used; predominantly pots and traps targeting shellfish, but also fixed and drift nets and mobile gear depending upon location •Dynamic; various fishing grounds may be targeted seasonally

2.2 Aquaculture and fisheries interactions

The Appendix report details the potential for interaction between shellfish and seaweed aquaculture and static commercial fisheries, including conflict descriptions and potential mutual benefits, summarised as follows:

Conflict descriptions:

- Exclusion, access and displacement: temporary or long-term exclusion from or reduction in access to fishing grounds due to the physical presence of aquaculture infrastructure, and associated displacement of vessels into adjacent areas.
- Snagging and infrastructure damage: including entanglement of pot strings with aquaculture ropes / mooring systems, and gear trawled through or at the edge of aquaculture sites.
- Changes to the local environment: affecting nearby fishery resources such as, attraction or displacement of adults; recruitment reductions (through consumption of eggs /larvae); and food web effects.
- Other conflicts:
    - Pressure on land-based resources including harbour facilities.
    - Lack of involvement of fishing sector in site selection for aquaculture developments, specifically where environmental impact assessment (EIA) is not a requirement.
    - Potential for indirect competition between market products and by-products.

Potential mutual benefits:

- Multi-use of marine space: where the aquaculture infrastructure is designed to allow access to commercial fishing vessels within the order limits.
- Shared facilities: there may also be opportunities to rationalise the facilities for shore access and minimise the environmental footprint of shore based developments by sharing infrastructure.
- Improved access: aquaculture developments may require improvements to land based access points (such as transport network, roads etc), which would also benefit the local community including fishermen.
- Employment: potential for fishermen to provide vessel services or act as liaison officers.
- Knowledge transfer and common market development.

3. Consultation

3.1 Consultees

Poseidon consulted with the organisations listed in Table 3.1 via Teams video meetings or telephone calls during February to April 2022.

Table 3.1: List of consultee organisations

Type	Organisation / company / authority
Inshore fisheries organisations, associations, federations and research	Scottish Fishermen's Federation
	Orkney Fisheries Association
	Clyde Fishermen's Association and Community Inshore Fisheries Alliance (CIFA)
	West Coast Regional Inshore Fisheries Group (RIFG) and Aquaculture sub-group
	Western Isles Fishermen's Association
	Scottish Creel Fishermen's Federation
	Shetland Shellfish Management Organisation
	University of Highlands and Islands Shetland
Shellfish / seaweed aquaculture developer	Inverlussa
	Fowey Shellfish
	Kelp Crofting
Governing authorities	Marine Scotland, Inshore Fisheries
	Marine Scotland, Aquaculture
	Shetland Islands Council
	Cornwall Inshore Fisheries and Conservation Authority (IFCA)

An identified weakness of the consultation process is the representation received from the aquaculture industry. Of the twelve aquaculture consultees contacted, only three agreed to participate: one based in England, one Scottish mussel farmer and one Scottish seaweed developer.

3.2 Interview pro-forma

A stakeholder interview pro-forma was developed to assist the consultation process and is shown in Figure 3.1 overleaf.

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1. Introduction

- **Study purpose:** Review of measures for improved co-existence of capture fisheries and marine aquaculture developments with recommendations for adoption in Scotland.
- **Scope:** focus on shellfish/seaweed aquaculture and static gear fishing (e.g. pots & set nets).
- **Who:** study being undertaken by *Poseidon* for *Crown Estate Scotland*.

2. Respondent information

Name and contact details	
Affiliations and stakeholder type	
Fishery (gear) / Aquaculture system details	
Geographical operating area (scale & coastal zone)	

3. Potential for interactions between capture fishers and aquaculture

Nature of possible interactions	
Seasonal / spatial characteristics	
Causes / drivers	
Impacts	
Any further examples of interactions you have experienced?	

4. Potential mitigation approaches to addressing these interactions

Communication and coordination solutions	
Technical solutions	
Spatial / temporal solutions	
Policy approaches	
For each of the above, what are the factors that lead to success or failure	
Have you had direct experience of any mitigation approaches?	

5. Potential for increasing synergies between capture fishers and aquaculture

Polyvalency e.g. working across both sectors	
Joint cooperation in mitigating impacts from non-seafood maritime development e.g. wind farms	
Joint cooperation in marine environmental conservation	
Other?	

6. Next steps

Would you be interested in joining an online workshop in March to further discuss practicality of trialling specific mitigation approaches in Scotland?	Yes / No. Other comments

Figure 3.1: Stakeholder interview pro-forma

3.3 Consultation findings - interactions

The sub-sections below describe the potential for interactions between capture fishers and aquaculture based on consultation with the stakeholders listed in Section 3.1.

3.3.1 Exclusion from fishing grounds

The principal potential conflict between commercial fisheries and aquaculture development is the temporary or long-term exclusion from or reduction in access to fishing grounds due to the physical presence of aquaculture infrastructure.

Through the consultation phase of this work it is apparent that historically fisheries and aquaculture sectors have worked well together, particularly for finfish farming given its well-developed status. It has generally been considered that there was enough marine space for operation by both sectors with minimal conflict. However, with the acceleration of offshore renewables developments across wide areas and expansion of the Marine Protected Area (MPA) network and associated management within them, the concept of 'marine squeeze' is a significant concern to the fishing industry with increasingly limited space and the incremental loss of grounds within which to operate.

It can be perceived that many marine sectors, except fishermen, can apply to use a specific area of the sea – for aquaculture, renewables, oil and gas – which can lead to a situation where a fishing business that has fished an area over generations, can no longer do so due to a new development.

The fishing industry are feeling increasingly constrained by multiple developments across aquaculture, renewables and other marine sectors (e.g., the Innovation and Targeted Oil and Gas (INTOG) leasing round, additional ScotWind leasing area). These recent developments have brought about a change in the position, with many fisheries interests now having a strong desire for a moratorium on further aquaculture expansion.

The type of aquaculture development influences the level of reduced access and displacement due to the footprint of the farms. In terms of space, salmon farming is considered more localised, although expansion of existing sites may cause concern where infringement on fishing grounds occurs. In comparison, the advancement of shellfish and seaweed aquaculture is a growing concern due to the extensive site areas required for commercial scale seaweed production.

The distance from shore also affects the level of impact. Inshore fisheries associations consider that the closer to shore the aquaculture development, the higher the impact to static gear vessels. For example, a 1 sq. mile aquaculture site may remove all the ground targeted by one vessel; or remove 10% of grounds for all inshore vessels (depending on target species and seasonality). This 10% could have an impact on the viability of all these affected inshore fishing businesses. This is particularly pertinent in rural and island communities where loss of livelihood has significant knock-on consequences e.g., someone put out of business may move away, which can mean a loss of local skills, potential for school closures, and other societal consequences.

The inshore creeling sector consider that displacement experienced by the inshore static fleet is proportionately higher than for the mobile sector that typically works further offshore. Fishing varies in its ability to handle displacement, with the mobile sector able to access a wider area compared with smaller, inshore static vessels with a more limited operational radius. Additionally, all fisheries are limited by the availability of target species, which is dictated by the seabed environment; for example, muddy habitats for nephrops, gravel/ sand for scallops, hard substrates for crab and lobster.

Creel fishermen will target different fishing grounds for different seasonal fisheries e.g., brown crab in spring and lobster in winter. Therefore a development may only be removing a specific targeted fishery, but this could be a significant portion of annual income that is even more significant over certain weeks of the year. This is also true for specific sheltered grounds that

fishermen know can be targeted during inclement weather, especially during winter months. The importance of such locations may not be evidenced by fisheries data which tends to be more aggregated temporally and spatially but becomes evident through industry consultation at a local scale e.g., local Fishermen's Associations, individual fishermen (if non-affiliated), as well as regional Inshore Fisheries Groups (IFGs).

In certain circumstances, the seasonality of fishing grounds presents an opportunity to allow fishermen to enter sites seasonally, e.g., if the harvesting period coincides with the seasonal fishery (assuming aquaculture equipment is not retained on the site). An example of this is scallop diving, when divers enter an aquaculture site when fallowed. It is however unlikely that lines and mooring systems within seaweed or mussel farms would be removed completely, until the decommissioning phase of the site.

Loss of fishing grounds is most significant when an aquaculture development has been inappropriately sited, without due regard to the current fishing activities in operation. The process of communication, consultation and development of sites with regard to fishing interests is considered by some fisheries consultees to be lacking. In comparison to the renewable energy and oil and gas sectors, where the onus is on the developer to mitigate prior to consent, and ensure fishing interests sign off on that mitigation, similar processes are not well-established for the aquaculture industry. The outcome from mitigation processes for these sectors can bring a range of project-level adaptions e.g., avoiding construction in certain areas to allow fishing within array sites; micro-siting export cable routes based on fishers knowledge; designing the timeline of construction to avoid key spawning periods and ensuring effective methods of communication between the developer and fishing industry.

3.3.2 Consultation between aquaculture and commercial fishing industries

A consistent finding across the fisheries stakeholders is that fishers feel they are not given adequate opportunity to input to the consultation processes or lease decisions for aquaculture developments. Some specific examples provided by fishing industry representatives were:

- Imminent construction of a finfish farm on the West coast with no prior notification of the development.
- Approval of an extensive seaweed farm in the Lochalsh area with no consultation with the fishing community.
- A seaweed farm on the East coast of Scotland, near St Andrews, located directly over a prime potting ground, with minimal consideration of fishing interests.

In these examples the fishing industry consider they were not provided the opportunity to input to the EIA, marine licence or planning process. In one case, the aquaculture operator presented at a virtual meeting, stating consultation had taken place and that the fishermen approved of the development. This was not an accurate representation of either the level of consultation undertaken or the position of the fishing interests in the area.

The east coast development was cited by a number of consultees (across fishing industry and governing authorities) as being a poor example of site selection, located on highly productive shellfish grounds and therefore not a logical location to site aquaculture development. Commercial fisheries data is available at different scales, from landing statistics at ICES rectangle scale, to (limited) mapping of inshore fishing grounds, however it may not be immediately apparent from available data that a specific area is a key fishing ground. This highlights the importance of consultation focused on corroboration with a range of stakeholders (Fishermen's Associations, regional IFG, Marine Scotland Compliance and fishery officers) to provide consensus on key fishing grounds.

An exception to this experience is Shetland, where the Marine Planning Partnership and Shetland Islands Marine Spatial Plan considers fisheries interests more intrinsically. This is enabled by clear communication channels between sectors and governing authorities and good baseline data on key fishing grounds.

The perceived effectiveness of informal pre-application consultation is mixed; some consultees feel the pre-application process works for early engagement and successful micro-siting of aquaculture infrastructure, while others consider there to be limited direct engagement by aquaculture developers with fisheries organisations early in the planning pre-application process, despite it being the recommended approach. There appears to be a tendency for developers to avoid early engagement to avoid interest from other developers and creating the potential for objections to a proposal; in such instances applications are submitted without prior discussion with the fishing industry.

In addition to a lack of consultation, when it does take place, the methods of engagement can be ineffective with consultation opportunities easily missed or considered out-dated. The fishing community are responding to several pressures from various marine developments. The roles of association representatives that were previously focused on assisting members in their daily fisheries operations have had to adapt to responding to multiple developments and formal EIA representations. Fisheries representatives can fall into a 'fire-fighting' position for responding to and engaging with multiple developers across multiple sectors, which takes resources away from prioritising initiatives that benefit their fishermen. The onus falls on the fishermen to engage to safeguard their fishing grounds.

In terms of the form of communication, a single email from a developer can be easily missed, and there is no co-ordinated strategic approach for disseminating information on all potential aquaculture developments, as there is for offshore renewables for example. Other forms of announcements are through newspaper adverts, including non-local newspapers (e.g. 'Edinburgh Gazette' (an official journal of public record) for a site located in the northwest of Scotland), which are unlikely to be picked up.

In addition, the multiple consenting and lease requirements, and formal / informal consultation requirements for each of these can be confusing to stakeholders. There is no clarity over responsibility or accountability, with a general consensus that fishing interests are not given adequate consideration, e.g., a fisheries stakeholder may think they have responded to an aquaculture application, but this is not accounted for in other consenting / lease decisions. The consultation process is considered by fishers to not be managed effectively, and is unnecessarily complex, leading to frustration and a lack of transparency or explanation on how inputs from the fishing sectors have or have not been used in the decision making processes. It is, however, also possible that consultation processes are not seen as effective because the consulted stakeholder does not get the outcome they had hoped for.

There are examples of effective consultation, where engagement and due diligence by the aquaculture developer has been thorough. In one instance reported by an aquaculture developer, the local fishing industry informed the site selection process which allowed the site to be carefully designed to avoid key commercial fishing operations e.g., crab and nephrops.

There is some opportunity for sectors to interact locally – at site level, and via regional forums such as IFGs. A Scotland-wide IFG Aquaculture Work Group was recently set up to encourage more productive communication between the fisheries and aquaculture sectors on topical issues (e.g., chemical use, safety). This group was established in 2020 and have developed a Position Statement.

3.3.3 Gear snagging, entanglement and navigational safety

Snagging and entanglement

Concerns have been raised around snagging aquaculture infrastructure due to:

- Inappropriate lighting;
- Site infrastructure not being within the exact licensed coordinates; and
- Potting gear movement during soak period.

This can lead to the propeller of a fishing vessel or potting gear entangling around mooring / aquaculture lines.

Safe navigation is a requirement for consent, but this is focused on surface navigation, not underwater navigation, which is paramount to seabed safety.

Issues were also cited in relation to incomplete decommissioning, partial clearance of infrastructure (with subsea infrastructure left *in situ*) and aquaculture related marine litter. Fishing vessels can catch the discarded aquaculture gear and vessels and/or fishing gear can sustain damage. Depending on the nature of the snagged equipment (feed pipe, mooring ropes, anchors), this can be dangerous, especially for single-handed vessels.

> *Currently, there is no requirement to mark aquaculture gear with owner or site and this makes attributing responsibility difficult.*
>
> (pers. comm., Marine Scotland, 2022)

Communication lines are in place for reporting of issues and non-compliances – e.g., Scottish Fishermen's Federation (SFF) have a form to report entanglement (Scottish Fishermen's Federation, 2021) and non-compliances can be reported to Marine Scotland Licencing Operations Team (MS-LOT) using online contacts. But there is confusion surrounding accountability and understanding whose responsibility it is to ensure the aquaculture site matches a licences coordinates and that this is enforced, particularly from a navigational safety perspective, which is covered by the Northern Lighthouse Board, MS-LOT and Local Planning Authority.

Loss of equipment

In cases of gear snagging and entanglement with active aquaculture sites, the aquaculture owner experiences loss of equipment and damage to crops. Examples from England note that mobile gear is often towed very close to farm boundaries and have caught ropes. Currently measures to avoid entanglement occurrences include a buffer exclusion zone around production areas of c. 20m.

3.3.4 Environmental impacts

Long-held concerns remain around the chemical usage within finfish farms and the potential effects on commercially targeted species, including crustaceans, and nephrops in particular that inhabit muddy sediments as well as on larval stages of crab that potentially affect population levels. It is understood that some work has been undertaken to explore this issue and gain an understanding of dispersal of chemicals, however, it is considered to be specific to local hydrological conditions and sediment type. For example, the Clyde and it's loch systems are more contained, and the fishing industry are calling for monitoring of chemical dispersal and sediment quality to demonstrate effects – until this is undertaken, the fishing industry are asking for a moratorium on further development.

While the concern over chemical usage is focused on finfish, treatment of mussel lines with lime was also cited as an area of unknown potential impact. Non-chemical treatments were also cited as concern including freshwater discharge and heat treatments, as was the dumping of 'morts' (dead fish), with fishermen reportedly bringing up morts in their nets (again, this is specific to finfish farming).

Applicable to all aquaculture developments is the potential for ecological changes in the immediate vicinity of the site – a very localised impact, but concern was raised in relation to potential loss of spawning and / or nursery grounds. In particular the large-scale development of seaweed farming – which tends to maximise surface area to allow light access to the crop – has a shading effect and can led to the excessive removal of inorganic nutrients so that it affects primary productivity (Campbell *et al*, 2018). There is also the potential for introducing non-native species that may be growing on seaweed seed plants (e.g. epiphytes and epifauna).

Perhaps the most pertinent environmental impact in relation to considering co-existence of static fisheries within shellfish farms is the change in species composition within the site and in the surrounding area. Specifically due to starfish that are attracted to and predate upon mussels. The higher levels of starfish experienced in these locations are considered to damage the ecology of site, with infestation of any potting gear set nearby. This is reported for pots targeting brown crab, velvet crab and whelks; the starfish are attracted to the bait in the pots, enter the pots, smothering any target species and ceasing the catch-ability of the gear. The scale of this issue is demonstrated in figures shown in Annex 1. This is clearly a significant issue that affects co-existence between static fishing vessel creeling and mussel farms.

3.3.5 Summary

A summary of interactions between commercial fisheries and aquaculture suggested during the consultation process is depicted in Figure 3.2.

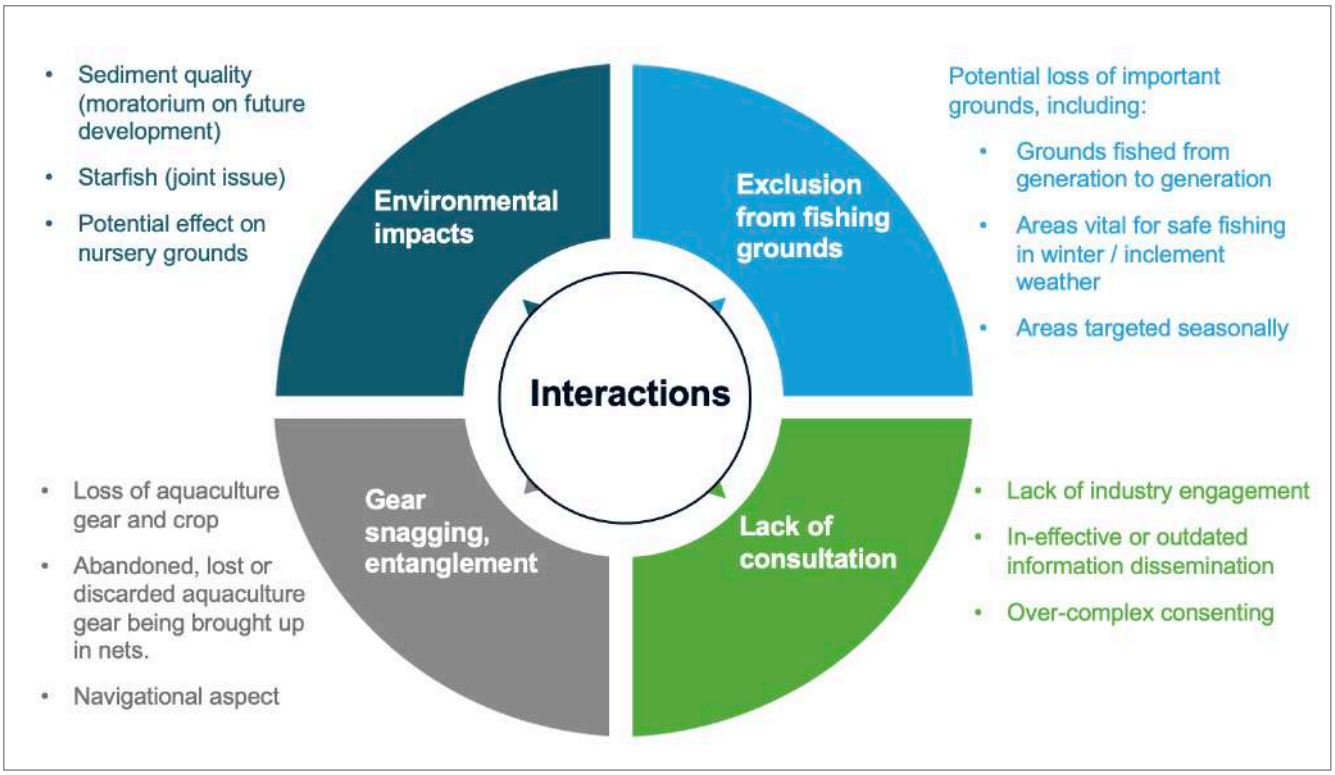

Figure 3.2: Summary of interactions between commercial fisheries and aquaculture

3.4 Consultation findings - mitigation

The sub-sections below describe the potential mitigation approaches and ideas for promoting co-existence between capture fishers and aquaculture informed by consultation with the stakeholders listed in Section 3.1.

3.4.1 Improved communication and consultation

Communication and consultation between commercial fishing and aquaculture sectors is vital. The following quote from the Scottish Fishermen's Federation (SFF) is particularly relevant:

> *"Communication is needed in order to foster collaboration, which leads to co-existence."*
>
> (pers. comm., SFF, 2022)

Consultees across the fishing industry, governing authorities and aquaculture developers agreed that improved communication and consultation prior to site selection, would allow fishing grounds to be more adequately considered within the siting process. Such early engagement could be secured through a formal pre-application process. When this has occurred in practise, it typically leads to examples of good collaboration, siting appropriate to fishing interests and good relations between the sectors going forward.

Advice could be provided to all aquaculture developers on a formal pre-application process and key stakeholders to engage, including fisheries – with potential initial engagement to be via the IFG Aquaculture Work Group. Alternatively, this could be a process undertaken by planning authorities (e.g., the Highland Council undertake a formal pre-application process for a fee). Either way, a sensible lead-in time is recommended to ensure effective engagement with fisheries representatives.

There is opportunity for improving strategic level consultation and information dissemination, allowing the industry to understand the scale and number of developments being considered in the near future. This would ensure a clear message of potential developments and facilitate timely input of key commercial fisheries knowledge. There are existing forums that bring the aquaculture and fisheries sectors together and/or consider both interests – e.g., advisory groups for Regional Marine Plans, and at national level there are also forums such as the Seaweed Review Steering Group, as well as the IFG Aquaculture Work Group.

Maritime safety

When the aquaculture site is constructed, accurate communication of the site / infrastructure coordinates and buffer zones is important for both safeguarding aquaculture equipment and stock, as well as vital marine safety warnings to minimise the risk of gear snagging and entanglement. This is particularly important when new aquaculture equipment is deployed, either as a new site, or extension/update of existing site.

Guidance

There is scope for developing guidance on communication between the sectors, similar to that developed in other marine developments e.g., the Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW) guidance sets a standard for both fisheries and offshore wind sectors (FLOWW 2014).

3.4.2 Polyvalent working

Polyvalent working with one individual or business working across both commercial fishing and aquaculture sectors was considered a possibility, depending on the resource requirements of the shellfish/seaweed farm and timing of inputs. Two interesting examples were cited during consultation:

- An individual or business owns/operates both a seaweed farm and a commercial fishing vessel, alternating between the two periodically, depending on the seasonality of target species, and harvesting cycle of seaweed.
- Fishermen and fishing vessels are hired to harvest seaweed during the seaweed farm production period.

Currently seaweed farms are not at commercial scale, operating in pilot-sized sites to test growth and feasibility. The production process requires intense infrastructure to harvest seaweed at the end of the growing season. There is opportunity for the inshore fishing fleet to be contracted to provide this vessel and man-power resource as a specific service. This would lower the need for investment in aquaculture vessels, while also supporting the inshore fishing fleet through seasonal contracts. It is not known if this is a feasible undertaking for an inshore fishing vessel, or what (if any) specific equipment would be required; but during consultation this suggestion was made by both the fishing industry and seaweed aquaculture company.

3.4.3 Policy and plans

The existing National Marine Plan and policies, whilst useful, are not considered to be clear about priorities and can potentially be interpreted to mean all things to all marine users.

Regional Marine Plans are in development, although it is noted that appropriate and sufficient resources are required to develop, approve and implement plans in an acceptable time period. The significant effort required to develop these plans was a frustration for stakeholders, especially when they do not progress to implementation and, in the process, become outdated.

The potential scope for sectoral plans for aquaculture and fisheries was noted (e.g. as per offshore wind sectoral plan). The ScotWind sectoral plan was helpful in that initial sites included key fishing grounds and were subsequently refined to better avoid these. Although fisheries concerns remain in relation to ScotWind, the sectoral plan process has helped to highlight these and mitigate site selection to some extent.

At a local scale, identification of priorities in marine space or identification of areas for different uses at a detailed scale would be useful and it is not clear to what extent regional marine plans could achieve this. There is potential to improve consideration of fisheries interactions via better inclusion within stakeholder engagement practices, as part of area-based management (ABM) approach.

The use of a Fisheries Management and Mitigation Strategy (FMMS) to implement all committed measures, including conditions of consent, has become best practice within the Scottish offshore wind application process. Similar requirements are becoming more prominent in the aquaculture process, although an opportunity remains to formalise this into best practice.

One aspect of policy that needs consideration is the scale of development. For instance there is increasing interest in the use of seaweed farming as a carbon offset scheme, rather than as a commercial crop. These schemes tend to be financed by larger investors and planned at considerable scales, with varying interest in both enhancing local benefits (e.g. employment) or mitigating impacts (e.g. visual impact, loss of access to inshore sea space etc). Although schemes need to be considered on their individual benefit, this aspect does need consideration at policy level.

Economic reparation

Similar to the development of FMMS, the process for economic reparation to commercial fisheries vessel owners subject to disruption from offshore wind farm construction activities is well established. However, while economic reparation may take place for specific sites based on individual confidential agreements, the process is generally not applied between the aquaculture and fisheries sectors. This is likely to be based on the short-term construction period and localised impact of aquaculture sites (in comparison to offshore wind), together

with the potential for it to be economically unviable for small shellfish and seaweed aquaculture companies to consider this as feasible mitigation.

3.4.4 Improved transparent decision-making processes

There is opportunity to improve transparency in the decisions made by demonstrating how information from the fishing industry has been utilised and how fishing interests have been assessed. Guidance could be provided on a clear and trusted evidence based format e.g., combining landing statistics, VMS data and iVMS data (if available), corroborated through industry consultation. Further clarification on the criteria by which an aquaculture development is assessed and how this accounts for the fishing industry could be better demonstrated.

For seaweed farms, one consultee raised the point that business viability should be considered when granting licences, for example, provision of a well-designed business plan, including evidence of how seaweed will be marketed and processed. Otherwise, there is a risk of over-development, over-production of seaweed at the expense of marine space, and potential discarding of the final product (if there is no secured market, or if grown purely for sequestration purposes). From a socio-economic perspective, the business should demonstrate personnel are available, given the potential for foreign investment without local staff or assets.

Consultees raised concern over the different approach to impact assessments depending on the farm type; they are generally required for finfish, not consistently applied for shellfish, and not required for seaweed. From a commercial fisheries perspective, all types of aquaculture may exclude or reduce access to fishing grounds and therefore a more consistent approach to impact assessment could be applied to inform decision-making processes. It was also noted that cumulative effects are increasingly important to fully assess the marine squeeze effect, and that in most circumstances cumulative effects are only considered when an EIA is undertaken.

3.4.5 Improved inshore fisheries data

It is recognised that spatial data for inshore fishing activity is usually lacking, and while inshore vessel monitoring systems (iVMS) are currently being implemented, the extent to which amalgamated data sets will be available to inform fisheries mapping is unknown.

An example of developing a clear understanding of inshore activity is being delivered through a Western Isles pilot study whereby 40 vessels have trackers on board to monitor fishing locations and fishing intensity. The first year review of this project is expected imminently (Q1/2 2022) and initial indications are that a low cost tracking device can be effective in providing spatial data with high accuracy.

It is anticipated that in the medium term, each regional IFG will be in a position to provide an accurate spatial representation of the most important fishing grounds, noting there are distinct habitats that support fisheries (e.g. scallop grounds, muddy ground for Nephrops, hard ground for shellfish), as well as seasonality and sheltered areas targeted in inclement weather.

There is potential for the identification of Fishing Protected Areas – related to key fishing grounds, which should be avoided by other marine developers.

A challenge is that significant resource is required to accurately develop this level of fisheries knowledge on a spatial scale, and furthermore, fisheries are dynamic, changing with natural fluctuations, together with emerging new fisheries.

3.4.6 Fishing within an aquaculture site

A range of views were provided for the potential of fishing within an aquaculture site. There is a clear trade-off between an intense farm with minimised footprint, versus a larger area that allows operating between farm lines.

Many consultees considered it unfeasible due to the risk of entanglement and would prefer that the footprint and spatial squeeze be minimised; while others considered that theoretically

it could be possible, depending on the size of the site and with good infrastructure design (e.g., strong anchors so that mooring lines and production ropes do not shift). Overall, it would be considered very site specific and involve design of the farm to provide access channels to fisheries. Communication would also be vital between the farm owner and fishing industry.

In cases where the fishing industry oppose further aquaculture development, it is difficult to champion trialling co-existence as it could be viewed as conceding to that further development. A clear message is needed on co-development policy, to initiate and support co-operation between the sectors.

Notwithstanding the above, there is the potential for a future pilot project. From a logistical and practical point of view, Shetland is a very good location to undertake such a trial, with its Marine Planning Partnership in place, good datasets and awareness of fishing grounds, good connectivity and collaboration around research, and current exploration into seaweed (based on confidential applications).

3.4.7 Gear marking

Consultees raised a range of potential solutions for fishing gear snagging on abandoned, lost or discarded aquaculture gear and entanglement of fishing gear on in-situ farm infrastructure:

- Gear marking on all aquaculture infrastructure, to allow the owner and site to be identified.
- Cameras on site to detect incidents and record interactions.
- Licence conditions in relation to lost/damaged farm equipment and its retrieval.
- Clear decommissioning requirements attached to licence conditions and enforcement of those conditions.
- Licence requirements associated maintenance of lighting and marking of farms.

3.4.8 Multi-use of marine space

Trialling co-existence between other marine users was recommended as a means of alleviating marine squeeze on the fishing industry. Specifically, co-locating seaweed farms within floating offshore wind farms was cited (with a suggestion to explore this at Kincardine Offshore Wind Farm), as fishing within a floating offshore wind farm is expected to be more challenging.

In addition, co-location of species within the same aquaculture site is seen as having potential as opposed to requiring new sites. An example of this is in St Austell Bay, Cornwall, where potential is being explored for cultivation of seaweed within mussel farm (Westcountry Mussels (2020) and potential for lobster on-growing within farms also being explored (Lobster Grower, (2019).

3.4.9 Joint collection of science

Opportunity to explore joint scientific projects across both sectors was highlighted. Of specific interest may be the issue of starfish predation on mussel farms, and subsequent infestation of creels in nearby fishing grounds. Suggested approaches included:

- Regular clearance of starfish from the seabed immediately below the mussel farm, and surrounding area (e.g., through use of a dredge);
- Scientific study to better understand the cause and effect of starfish attraction and mitigation measures;
- Investigation of potential markets for starfish consumption or use in supplements (van der Heide *et al.*, 2018; Jacobsen, 2021) or animal feed (Vestjyllands Andel, 2019; Jacobsen, 2021).

Also noted was the vast survey work undertaken to inform offshore wind farm developments and the potential to amalgamate this into an accessible database to inform Crown Estate Scotland and Marine Scotland for planning purposes, as well as wider marine stakeholders.

3.4.10 Infrastructure

Consultation has indicated that the presence of both aquaculture and fisheries industries can catalyse pier and/or harbour improvements and development; the Toft Pier in Shetland was highlighted as an example. Significant opportunity remains for further exploration of joint infrastructure including:

- Processing sites;
- Depuration on shore with shared vivier facilities;
- Communal storage facilities; and
- Ice production facilities.

3.4.11 Summary

A summary of mitigation solutions suggested during the consultation process is depicted in Figure 3.3.

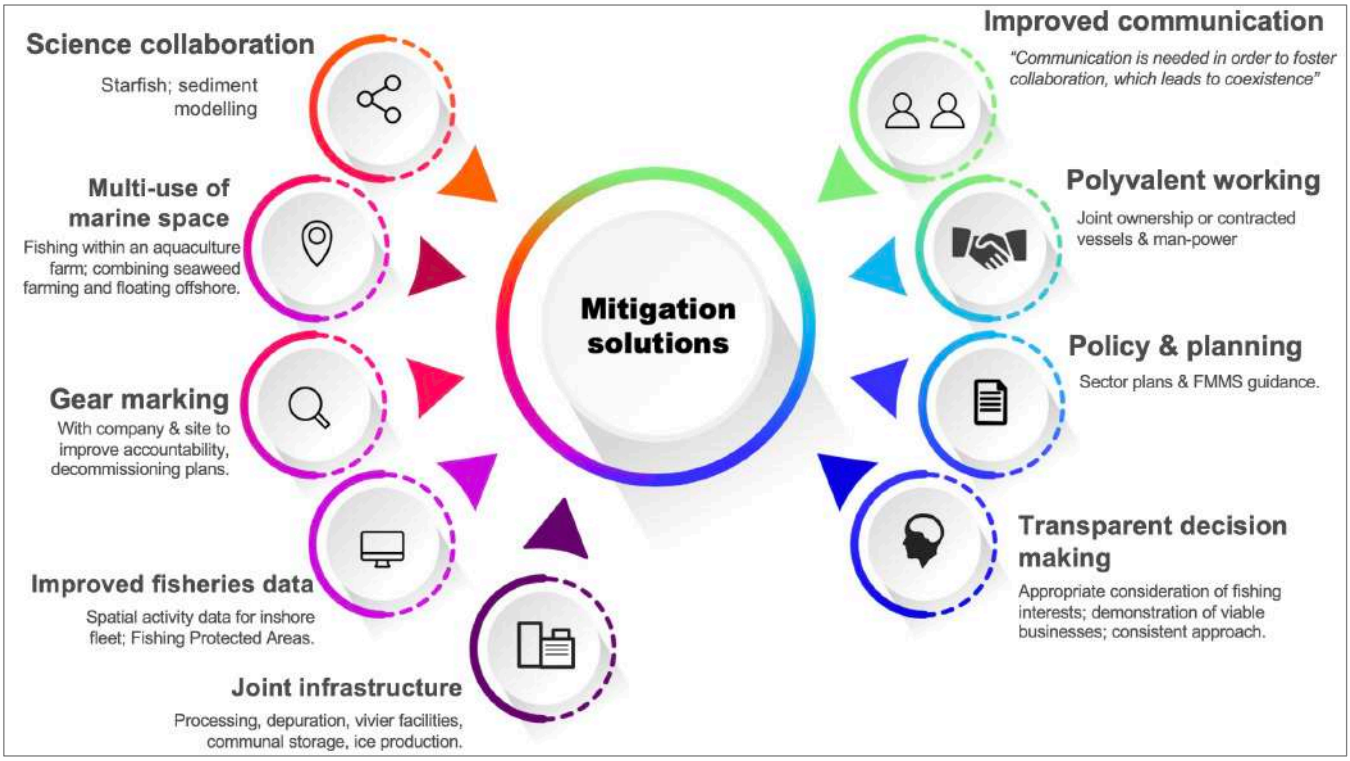

Figure 3.3: Summary of mitigation solutions

4. Co-existence solutions

4.1 Overview of potential co-existence solutions

Based on the co-existence solutions identified within the Appendix Report, together with the consultation undertaken as part of this project, the suite of potential co-existence solutions is summarised in Table 4.1 under the headings of:

- Policy, planning and licencing
- Guidance and collaborative working
- Technical solutions

Table 4.1: Potential co-existence solutions identified through consultation and informed by desk-based review

Policy, planning and licencing	Guidance and collaborative working	Technical solutions
○ Formal pre-application process. ○ Transparency in decision making. ○ Regional / local marine planning ○ Improve inshore fisheries data. ○ Fishing Protected Areas. ○ Allocated zones for aquaculture. ○ Single determining aquaculture licensing authority.	○ Regional and/or local fisheries and aquaculture collaboration working group. ○ Recruit a position for an Interactions manager / engagement coordinator to support collaboration and consultation between the sectors. ○ Polyvalent working – inshore vessels harvesting seaweed during production. ○ Joint infrastructure – processing, depuration, ice supply, storage. ○ Guidance for establishing FMMS including co-existence measures. ○ Guidance regarding site selection with respect to fishing interests.	○ Aquaculture gear marking to identify site and company. ○ Consolidate approach to navigational marking. ○ Aquaculture access - design / layout of site to allow fishing access. ○ Starfish research – improve mussel production and support creel fishing in surrounding area. ○ Multi-use of marine space (shellfish & seaweed and floating wind & seaweed).

4.2 Assessment of co-existence solutions

A SWOT analysis is presented in Table 4.2 for each of the potential solutions identified.

Further to the SWOT analysis, Table 4.3 presents an assessment of the potential for the co-existence solutions to be tested within a Scottish pilot, based on the scale, feasibility at a pilot level, resource requirements, timespan and likelihood of industry support.

The recommended pilot projects are presented in Section 5.

Table 4.2: SWOT analysis of co-existence solutions

Co-existence solution	Strengths	Weaknesses	Opportunities	Threats
Policy, planning and licencing				
Formal pre-application process.	• Provides commitment to consult with fisheries stakeholders pre site selection, allowing fishing interests to be considered at an early stage.	• Additional cost in resources for both aquaculture developer and governing authority	• Will allow fisheries knowledge that is not readily available from existing datasets to be included in site selection process, including sheltered areas relied upon in inclement weather and seasonally important grounds. • Provides opportunity to set good consultation and collaborative thinking from onset, which will encourage co-existence and good relations moving forward	• Aquaculture developers risk confidential information being available to competitors earlier in the planning process
Transparency in decision making.	• Identifies how fishing interests have been accounted for within licence decisions. • Improve confidence in consenting process. • Increase likelihood of fishing interests inputting to the process.	• Requires additional resources. • May result in increased number of objections.	• Improved transparency and local buy-in to developments.	• An effective consultation process gives better opportunity to object.
Regional / local marine planning	• Supports developments appropriate to local environment. • Will provide area-specific priorities. • Will aid site selection process.	• Significant resources required to develop. • Requires significant levels of data in order to be meaningful.	• Provide clear direction for developments. • Encourage local buy-in. • Improve communication and collaboration.	• Can take time to implement and quickly become out-of-date.
Improve inshore fisheries data.	• Provides evidence of fishing activity for the inshore fleet. • Safeguard fishing areas. • Inform decision making processes.	• Significant resources required to develop data. • Uncertainty in usage of amalgamated iVMS data.	• Current implementation of iVMS on all vessels under 12m (during 2022) provides significant potential and opportunity to accurately determine inshore fishing activity spatially for the first time.	• Confidentiality issues related to identifying specific grounds targeted by individuals.

Co-existence solution	Strengths	Weaknesses	Opportunities	Threats
Establish Fishing Protected Areas.	• Proactive approach to safeguard important fishing grounds, identifying them as Fishing Protected Areas, where fishing should carry precedent over all other forms of marine-infrastructure development.	• Difficult to move from all areas are important, to identifying key grounds.	• Based on local fishing industry knowledge to understand key grounds for sheltered fishing in inclement weather (specifically important in winter months) and seasonality - that may not be evident in other forms of data. Opportunity to combine with iVMS, when this data becomes available. • A ranking approach could be taken to protect the most valuable grounds while look for technical solutions to co-existence in less valuable grounds.	• Fishing patterns change and new areas or new fisheries can emerge in the future.
Establish Allocated Zones for Aquaculture.	• Proactive approach to drive aquaculture development and growth.	• Significant resource required. Has been attempted in the past and difficult to define based on varying aquaculture requirements and subject to change as technology and the industry develops e.g., move further offshore as technology allows, development of semi-enclosed systems etc.	• Opportunity to utilise fishing industry knowledge to inform suitable sites e.g. provide criteria for aquaculture development (seabed type, exposure, size of area, depth requirements) and the fishing industry can provide their local knowledge on ground and conditions to identify potential sites.	• Can be mis-communicated and cause undue concern for local community and fishing industry.
Single determining aquaculture licensing authority.	• Provides one clear point of contact and clarity in roles and responsibilities.	• Potential to be resource heavy to establish new processes for consent. Additional work required to transfer existing licences.	• Improved co-ordinated consultation process.	• Potential loss of highly experienced staff across local authorities. • Loss of local knowledge and understanding of local marine planning.
Guidance and collaborative working				

Co-existence solution	Strengths	Weaknesses	Opportunities	Threats
Regional and/or local fisheries and aquaculture collaborative working group.	• Improved consultation, will allow collaboration to regularly discussed and maximise potential for co-existence.	• Potential for consultation fatigue. • Requires engagement by all parties.	• Opportunity to combine into existing groups, e.g., IFG Aquaculture Work Group.	• Lack of consensus prevents any development.
Interactions manager / engagement coordinator to support collaboration and consultation between the sectors.	• Pro-active engagement enabled between sectors. • Provides neutral basis for encouraging co-operation and collaboration.	• Requires resource and recruiting strategy.	• Can be a project officer for managing, delivering or contributing to other pilot studies e.g., ○ polyvalent working ○ formal pre-application consultation ○ gaining fisheries knowledge and progression towards Fishing Protected Areas.	• Success will be dependent on securing a good candidate for the role.
Polyvalent working – inshore vessels harvesting seaweed during production.	• Maximises use of available infrastructure, while minimising investment requirements. • Supplement inshore fishing vessel income.	• Not yet understood if fishing vessels can undertake the harvesting process, from an equipment perspective.	• Boost income and security of inshore fleet. Boost opportunity for seaweed development which may otherwise be constrained by infrastructure costs.	• Dependant on seasonality of seaweed production, to ensure key fishing seasons are not missed.
Joint infrastructure – processing, depuration, ice supply, storage.	• Share cost and responsibility of key infrastructure. • Enable development and growth, where previously unfeasible.	• Require resources and joint-thinking to identify potential opportunities for shared infrastructure.	• May strengthen prospects for investment or funding, if dual purpose infrastructure. • Will require collaboration and cooperation between the industry sectors	• Will require clear understanding between owners for operation and maintenance requirements.
Guidance for establishing FMMS including co-existence measures.	• Securing FMMS as standard practise within aquaculture consenting process.	• In practise, may not be implemented or enforced effectively.	• Align with relevant areas developed between the fisheries and offshore wind sectors.	• Can be seen as paying lip service without adequately mitigating impacts to the fishing industry.
Guidance regarding site selection with respect to fishing interests.	• Will demonstrate that the fishing industry has been appropriately considered within site selection.	• Dependent upon fisheries data (see 'improved fisheries data' and 'Fishing Protected Areas' above)	• Will inform aquaculture developers of key commercial fisheries aspects to consider.	• Could be delivered through other means, such as collaborative working group.
Technical solutions				

Co-existence solution	Strengths	Weaknesses	Opportunities	Threats
Aquaculture gear marking to identify site and company.	• Attribute responsibility of lost or discarded aquaculture gear. • Encourage responsible and complete decommissioning practises.	• Resource requirements for marking current gear in the water. • Enforcement and compliance.	• To have this as standard best practise. • Reduce marine litter.	• Significant increase in level of claims.
Consolidate approach to navigational marking.	• Imperative for effective lighting and marking, ensuring navigational safety.	• May already be established, duplication of effort should be avoided, and effort placed on effective communication of responsibilities.	• Likely to be covered within move to 'Single determining aquaculture licensing authority'.	• Potential for delay in progress if await for 'single licensing authority' approach to be adopted.
Aquaculture access - design / layout of site to allow fishing access.	• Promotes co-existence within an aquaculture site.	• Requires larger footprint of site, to allow for access channels. • Requires buy-in from both aquaculture developer and fishing industry.	• Opportunity to test feasibility of approach / design at pilot stage prior to commercial scale seaweed farm growth.	• May not be feasible for mussel farm dependant on level of starfish predation.
Starfish research – improve mussel production and support creel fishing in surrounding area.	• A number of research possibilities (routine removal of starfish; market for starfish). • A win-win for aquaculture and fishing industry (improved mussel yield and improved viability of surrounding fishing grounds) • Is applicable to existing sites.	• Requires resource for scientific studies and/or dredge removal practice.	• Opportunity to provide raw material to potential markets e.g., omega-3 fatty acid supplements, direct consumption in niche markets (may be alignment with whelk market), production of starfish meal for poultry feed.	• Reasonable disposal of starfish may be required.
Multi-use of marine space (shellfish & seaweed and floating wind & seaweed).	• Method to manage marine squeeze effect. • Utilise areas that are already inaccessible to fishing industry.	• Dependant on willing offshore wind farm developer and aquaculture developers. • Will require separate planning / licences processes, and may be considered too high a risk.	• Maximising generation from defined marine space.	• Safety of harvesting process within a floating wind farm (if considered not safe for fishing vessel, is it feasible for seaweed harvesting vessel?).

Table 4.3: Assessing potential for the co-existence solutions to be piloted in Scotland

Co-existence solution		Scale	Pilot feasibility	Resource requirements	Timespan	Likelihood of industry support	Initial recommendation for pilot study
Policy, planning and licencing	Formal pre-application process.	Regional or national	Feasible	Medium	Short	Mixed support	Possibly
	Transparency in decision making.	Regional or national	Feasible	Low-medium	Short	Mixed support	Possibly
	Regional / local marine planning	Local or regional	Feasible	Very high	Medium - long	Good support	Yes
	Improve inshore fisheries data.	Local / regional / national	Feasible	Medium-high	Medium	Good support	Yes, combined
	Establish Fishing Protected Areas.	Local / regional / national	Feasible	Medium-high	Short-medium	Good support	
	Establish Allocated Zones for Aquaculture.	Local / regional / national	Feasible	High	Medium	Unknown	No
	Single determining aquaculture licensing authority.	National	Unfeasible	High	Medium - long	Good support	No
Guidance and collaborative working	Regional and/or local fisheries and aquaculture collaborative working group.	Local or regional	Feasible	Low-medium	Short	Good support	Yes
	Interactions manager / engagement coordinator.	Regional or national	Feasible	Medium	Medium	Good support	Yes
	Polyvalent working – inshore vessels harvesting seaweed during production.	Local	Feasible	Low	Short - medium	Good support	Yes
	Joint infrastructure – processing, depuration, ice supply, storage.	Local	Less feasible	High	Medium	Good support	No
	Guidance for establishing FMMS including co-existence measures.	National	Feasible	Low-medium	Short	Mixed support	Yes, combined
	Guidance regarding site selection with respect to fishing interests.	National	Feasible	Medium	Medium	Mixed support	
Technical solutions	Aquaculture gear marking to identify site and company.	National	Feasible	Low	Short	Good support	Yes
	Consolidate approach to navigational marking.	National	Less feasible	Medium	Short - long	Good support	No
	Aquaculture access - design / layout of site to allow fishing access.	Local	Feasible	Low-medium	Medium	Mixed support	Yes
	Starfish research – improve mussel production and support creel fishing in surrounding area.	Local	Feasible	Low-medium	Short-medium	Good support	Yes
	Multi-use of marine space (shellfish & seaweed and floating wind & seaweed).	Local	Feasible	High	Medium - long	Mixed support	Possibly

5. Recommendations for Scottish co-existence pilot studies

5.1 Potential pilot studies

Section 4 presented a SWOT analysis (Table 4.2) and suitability appraisal (Table 4.3) of the long list of potential pilot projects. Based on these assessments, a shorter list of nine potential pilot studies have been identified for further discussion; these are presented in Table 5.1 and Figure 5.1.

The short-list of potential pilot studies was presented to key stakeholders for discussion during two separate workshop sessions. The findings of these workshops are provided in this Section.

Table 5.1: Short-list for potential pilot studies

	Title of pilot study	Scale	Potential location
1	**Polyvalent working** – inshore vessels harvesting seaweed during production.	Local	Skye / Loch Alsh
2	**Co-existence within a seaweed farm** - farm design / layout of site to allow fishing access.	Local	Shetland
3	**Starfish research** – investigating starfish control to improve mussel production and support creel fishing in surrounding area.	Local	Shetland
4	**Fishing Protected Areas** - improve inshore fisheries data to inform key fishing areas and establish Fishing Protected Areas.	Local	Western Isles
5	**Regional or local Marine Spatial Plan** - incorporate improved fisheries knowledge into marine spatial plan to inform potential aquaculture siting.	Local or regional	TBC
6	**Collaborative Working Group** – establish a fisheries and aquaculture collaborative working group.	Local, regional or national	Scottish wide or West Coast
7	**Interactions manager** / engagement coordinator to support collaboration and consultation between the sectors.	National	Scottish wide
8	**Guidance** on site selection and Fisheries Monitoring and Mitigation Strategy (FMMS) - Develop guidance for site selection with respect to fishing interests and FMMS.	National	Scottish wide
9	**Aquaculture gear marking** to identify site and company.	Local, regional, national.	TBC

Figure 5.1: Potential pilot studies

5.2 Workshop findings

5.2.1 Workshop attendees

Two virtual workshops were held on 28th April 2022, with representation from commercial fishing sectors and aquaculture developers around Scotland, as well as governing authorities. The list of workshop attendees is provided in Annex 2.

5.2.2 Interactive voting

During the workshop attendees were asked to respond to the following questions via a Mentimeter poll:

- Rank the potential pilot projects in order of preference (results presented in Figure 5.2);
- Select one top pilot project (Figure 5.3); and
- For this top pilot project, indicate where it could be delivered in Scotland (Figure 5.4).

The results from both workshops have been combined in the figures overleaf. The number of respondents varies between questions, reflecting those that chose to vote. The results of this interactive voting are not intended to define which pilot projects should be implemented but were used as a discussion tool during the workshop. Results presented in this section should be viewed as initial findings, with more discussion and collaboration required to prioritise which pilot projects should be implemented.

The ranking process (Figure 5.2) found the establishment of a collaborative working group to be the top pilot project, followed by development of local or regional Marine Spatial Plan(s) and exploring co-existence within a seaweed farm. An interactions manager was fourth and guidance and polyvalent working were joint fifth.

A different order of preference was evident when respondents were asked to select only one choice for their top pilot project (Figure 5.3), with co-existence within a seaweed farm being selected most frequently (by 4 respondents), followed by aquaculture gear marking (by 3 respondents). Four pilot projects received 2 votes each and three received one vote each. This demonstrates that the workshop attendees did not overwhelmingly choose one specific project but showed interest across the range of pilots presented.

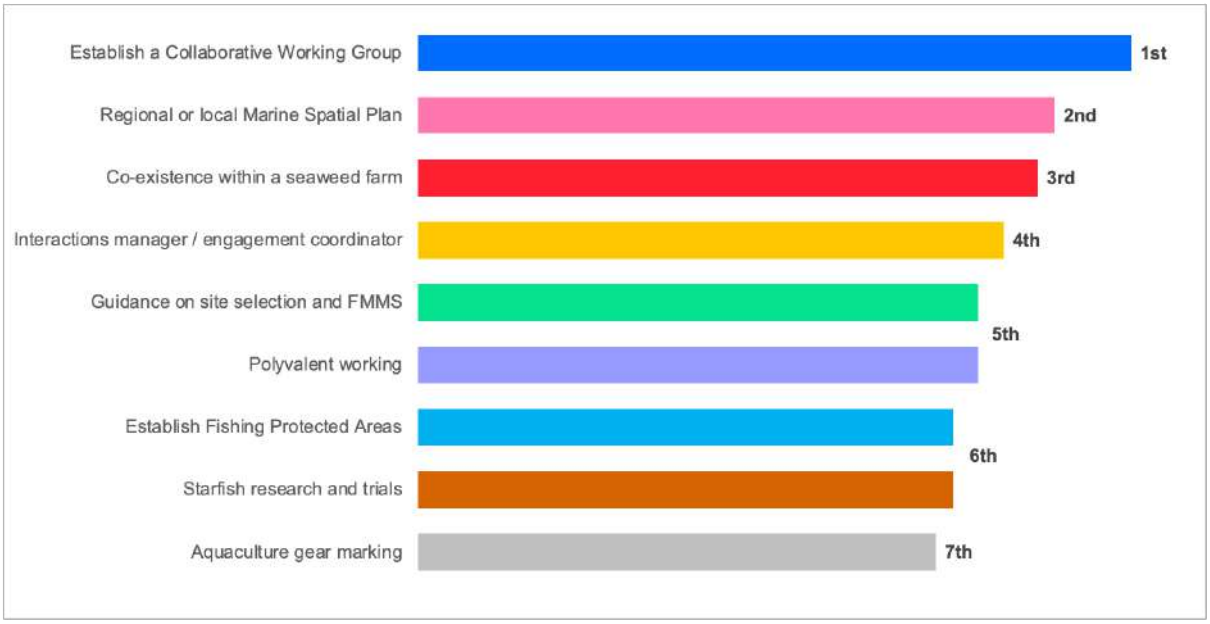

Figure 5.2: Result of ranking potential pilot projects in order of preference (number of respondents, n = 16)

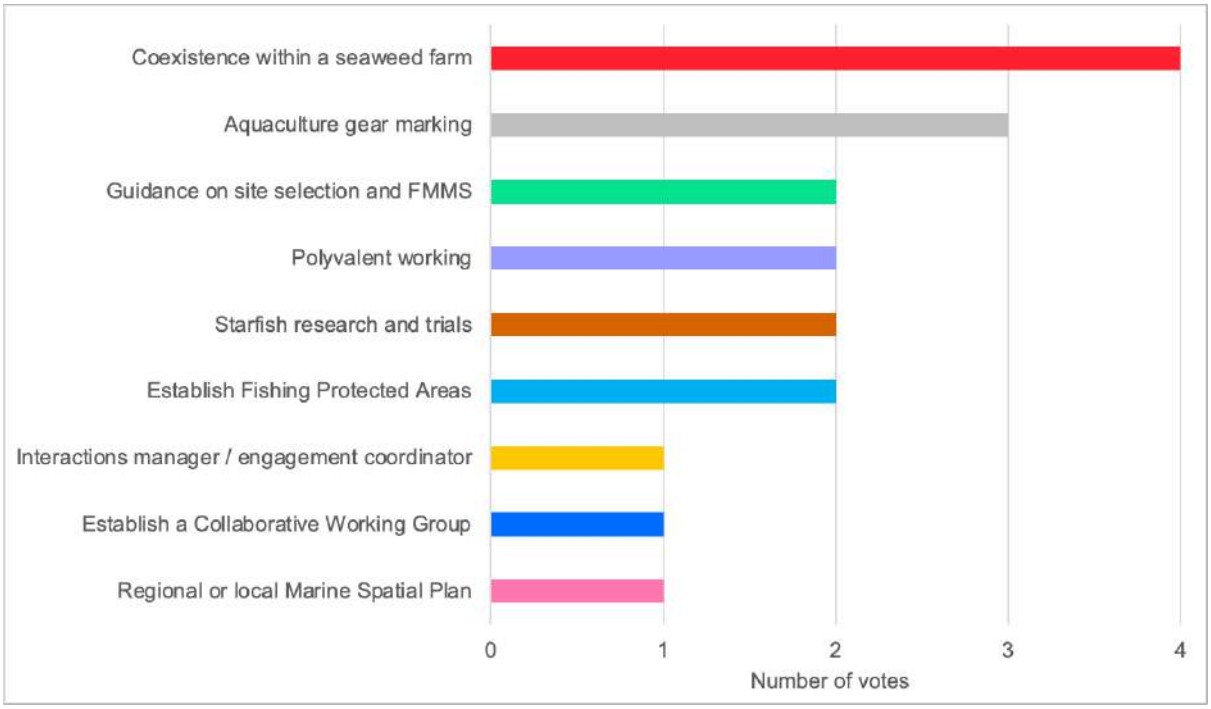

Figure 5.3: Result of selecting one top pilot project (n = 18)

Workshop attendees were asked to select where in Scotland would be appropriate for their chosen top pilot project to be delivered, including options for West coast, Western Isles, Orkney Islands, Shetland Islands, East coast and Scottish wide (Figure 5.4). Results do not show a clear preferred location but do indicate interest throughout Scotland.

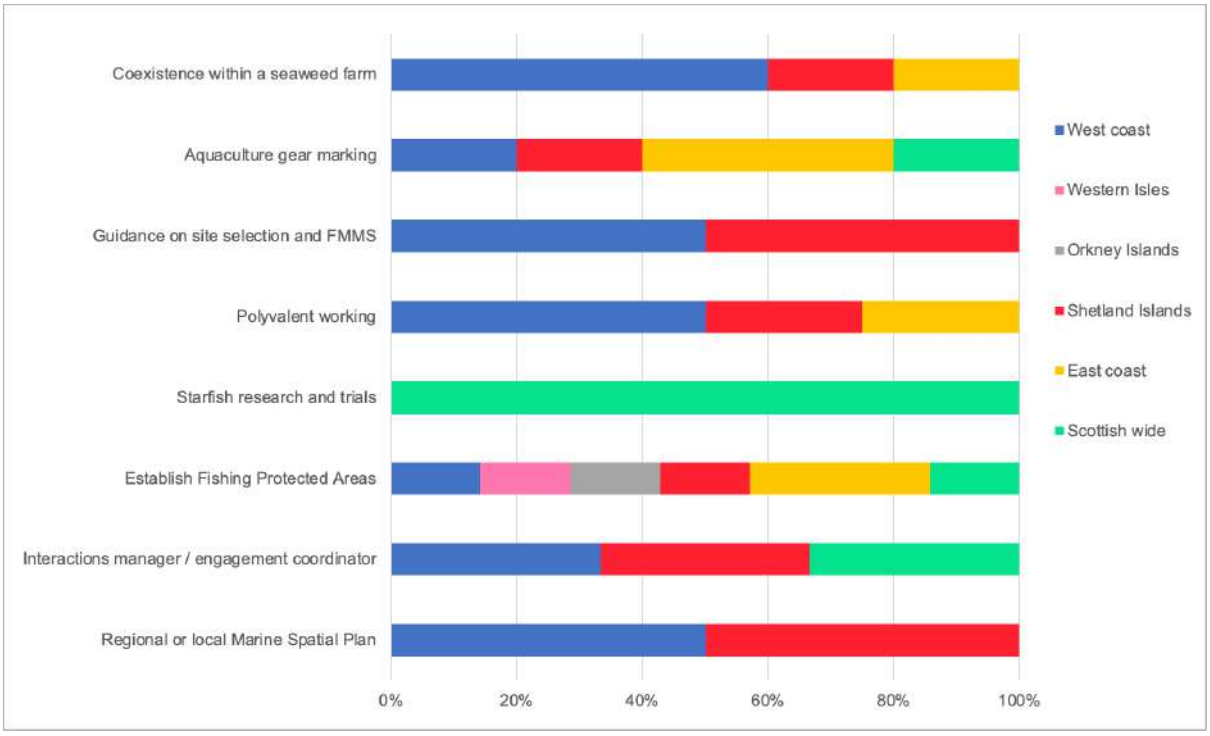

Figure 5.4: Result for where chosen top pilot project might be delivered (n = 16)

5.2.3 Discussion

The workshops provided a good opportunity for discussion between fisheries, aquaculture and governing authorities. Some observations related to the pilot studies are provided below.

Polyvalent working – There is certainly interest from both commercial fisheries and seaweed aquaculture developers in the prospect of utilising available fishing industry expertise to support seaweed harvesting periods. While this is most likely to apply in quite niche locations and/or circumstances where communities have scope to work multiple jobs seasonally, there is opportunity to explore mutual benefits of such working approaches via a pilot study. For instance, the potential around vessel modifications to allow seaweed harvesting.

Co-existence in seaweed farm – There has been consideration of seaweed design to allow fishing access, primarily at demonstration scale. There is opportunity to explore co-existence potential as seaweed proposals are submitted, although commercial confidentiality / competition may become a hindrance to open and transparent discussions required to inform early farm design and facilitate co-existence.

Starfish research – This specifically relates to mussel culture and was cited to be a Scotland-wide issue. There is opportunity to utilise academic expertise in focused research of this issue and management solutions. It is noted that additional funding is likely to be necessary to proceed with aspects of this research.

Fishing protected areas – The potential to define key fishing areas was met with mixed opinions, and an understanding that as soon as boundaries are drawn it can imply to others that out with those boundaries fishing is not important. In addition, any specified fishing protected areas would need to offer a degree of flexibility over time to allow for moving of stocks / key fishing grounds which vary with time. Nevertheless, there is clearly a need for improved fisheries data, but this is being driven forward through the current implementation of iVMS.

Spatial planning – Challenges to further developing marine spatial planning include lack of clear prioritisation of marine sectors and requirement for improved inshore fisheries data (i.e. iVMS).

Collaborative working group – The workshops themselves formed an example of the discussion forum a working group might provide, facilitating collaborative working, sharing experiences and building knowledge and understanding across both sectors. There is opportunity to expand the current IFG Aquaculture Group to form a more strategic collaborative working group. It is also noted that participation in regional working groups is often a licence condition for offshore wind farms consented by Marine Scotland.

Interactions manager – This role would provide an opportunity to have the resource to organise and facilitate the collaborative working group and to deliver, manage and support any pilot studies taken forward. Of key consideration is how this role would be funded and recruited to ensure they work impartially and objectively. An interactions manager also provides opportunity to ensure a strategic overview of current aquaculture applications and activities is clearly communicated to the fishing industry.

Guidance on site selection and guidance on FMMS – There is scope to develop aquaculture site selection guidance that considers fisheries interests. FMMS is a mechanism for setting out the measures that an aquaculture developer will take to support and encourage co-existence. FMMS have become standard practice for Scottish offshore wind farm developments and views vary on how effective these have been to date. The FMMS does however prompt consideration of mitigation and ongoing liaison and requires them to engage with fisheries.

Gear marking – There is general agreement that aquaculture gear marking would be beneficial for both mobile and static gear interactions.

5.3 Recommendations

It is considered that all proposed short-listed pilot studies (Figure 5.1 and Table 5.1) remain viable options for delivery in Scotland.

Further discussion is required to define where in Scotland is most appropriate for implementation of each pilot study, and this will be dependent on which partners agree to collaborate.

The workshops were well attended and provided useful discussion and interest in perusing collaborative pilot projects. To build on this, and as a first step, it is recommended that a Scottish Fisheries and Aquaculture Collaborative Working Group is established. This could link with the existing Aquaculture IFG sub-group, or become a separate entity. It would be beneficial for an interactions manager to be in place to facilitate meetings, co-ordinate activities and support future pilot studies.

Further discussion is required to prioritise the delivery of the remaining pilot projects and agree participatory roles and responsibilities.

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Annex 1

Photographs of starfish fouling potting gear in areas fished in close proximity to mussel farms. The photographs are kindly provided by and printed with permission from the Shetland Shellfish Management Organisation (SSMO).

The photograph on the left shows a creel, which was targeting velvet crab off the North mainland coast of Shetland, full of starfish.

The photo on the right shows a creel with starfish hauled next to a mussel farm, which can be seen in the background, in Shetland.

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Annex 2

Workshop Attendees

Type	Organisation / company / authority
Inshore fisheries organisations, associations, federations and research	Scottish Fishermen's Federation
	Scottish White Fish Producers Association
	Orkney Fisheries Association
	Clyde Fishermen's Association and Community Inshore Fisheries Alliance (CIFA)
	Western Isles Fishermen's Association
	Shetland Shellfish Management Organisation
	University of Highlands and Islands Shetland
Shellfish / seaweed aquaculture developer	Inverlussa
	Kelp Crofting
Governing / consenting authorities	Marine Scotland
	Marine Scotland, Aquaculture
	Shetland Islands Council
	Crown Estate Scotland
	Cornwall Inshore Fisheries and Conservation Authority (IFCA)