Case Studies on UK & French Scallop Management: Lessons for the wider English Channel

Report for Environmental Defense Fund

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ACRONYMS

CEFAS	Center for Environment, Fisheries and Aquaculture Science
CEO	Chief Executive Officer
EDF	Environmental Defense Fund
DEFA	Department of Environment, Food and Agriculture (Isle of Man)
DEFRA	Department for the Environment and Rural Affairs (England and Wales)
EMS	European Marine Site
EU	European Union
FMZ	Fisheries Management Zone
GPS	Global Positioning System
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries Conservation Authority (England)
IFREMER	French Research Institute for Exploitation of the Sea
LPUE	Landings Per Unit Effort
MFPO	Manx Fish Producers Organisation
MLS	Minimum Landing Size
MNR	Marine Nature Reserve
MMO	Marine Management Organisation
MPA	Marine Protected Area
MSC	Marine Stewardship Council
NAFC	NAFC Marine Centre: educational and scientific institute
NM	Nautical Mile
PO	Producer Organisation
RO	Regulating Order: Shetland Islands Regulated Fishery (Scotland) Order
SAC	Special Area of Conservation
SEASALT	EDF defined attributes associated with successful fisheries management
SFA	Shetlands Fishing Association
SNH	Scottish Natural Heritage
SSMO	Shetland Shellfish Management Organisation
TAC	Total Allowable Catch
TURF	Territorial Use Rights for Fisheries
VMS	Vessel Monitoring System

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Executive Summary

EDF commissioned a series of European case studies to investigate the effects of different kinds of secure tenure in various scallop fisheries and to consider the applicability of the lessons learned to the English Channel context. This work followed from EDF's involvement in the EU funded GAP-2 Programme which facilitated UK and French industry discussions on improved management of English Channel scallop resources.

Management of the English Channel scallop resources is recognised as presenting a series of challenges. In the Channel (apart from within 12nm of the French coast, which forms one of the case studies) there is no exclusivity to the resource. Within 6nm of the UK coast access is restricted to UK vessels but there is no limit set on numbers for specific areas, and in offshore waters a range of vessels from UK, France, Belgium, Netherlands and Ireland target scallop resources with no specific Channel limit on number of overall EU licenses. The EU Western Waters Effort Management Regime restricts the effort of the over-15m scallop vessels but these limits are not linked to an understanding of the biological status of the resource. Lastly there is no overarching co-management structure that covers scallop resources within the Channel.

This report reflects on these challenges and reviews where lessons from the case studies can be applied to the English Channel context.

Analytical Framework

Case studies were selected where there was some level of exclusivity and security of tenure enabling industry to take strategic decisions on when to fish (to maximise market returns), how much to fish (to maintain sustainability) and where to fish (to protect vulnerable habitats). The main case studies included:

- Ramsey Bay, Isle of Man
- Shetland Islands Regulating Order
- Inshore France: Bay of Seine

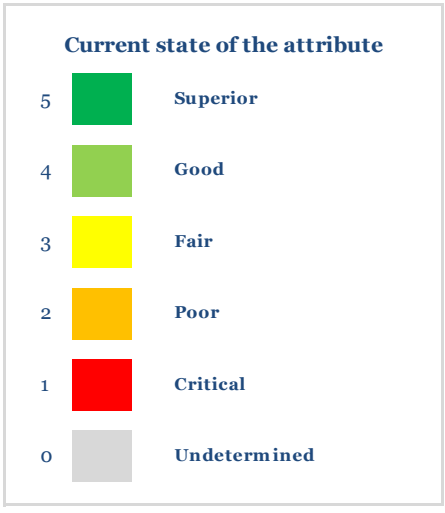
The case of the Cardigan Bay SAC scallop fishery was also investigated as there is the potential to move this fishery towards an ecosystem-based approach subject to the outcome of an ongoing consultation process. Irrespective of the outcome of the consultation, the potential approach to management provides useful insight to a different potential model of management for other areas.

For each of the three main case studies, the following topics were considered:

1. Institutional set-up
2. Performance: economic and environmental
3. Issues and opportunities
4. Lessons applicable to the wider English Channel context

The institutional set up was analysed against the EDF SEASEALT criteria which describe attributes of secure tenure systems that have been found by EDF to lead to better-managed fisheries. The EDF Seasalt Excel tool was used which scores each attribute using a traffic light system.

S	**Security of use-rights**
E	**Exclusivity**
A	Assessment levels of fisheries mortality
S	Scaled approach to management
A	**Accountability**
L	**Limited fisheries mortality**
T	Transferability



Key findings

The case studies explored in this report illustrate a range of models for achieving secure tenure, as described in these brief overviews.

Ramsey Bay Lease Arrangement, Isle of Man

Ramsey Bay is a small (but economically important) area in the Isle of Man which was closed to scallop dredging in 2009 due to concerns about over-exploitation. Following a 5-year closure, a strictly controlled fishery was re-opened with a lease awarded to the Manx Fish Producers Organisation (MFPO) for access to the scallop fishery within certain conditions, including maintaining the ecological integrity of the site. The MFPO took the novel approach of setting up a profit-share system, contracting a small number of their member boats to fish the total allowable catch and then sharing the profits between its members. Fishing has been targeted within certain areas and timed to coincide with peak market prices, giving both economic and environmental benefits.

Shetland Island Regulating Order

In the Shetland Islands a Regulating Order, established in 2000, has allowed for the devolution of management of shellfish fisheries within the 6nm zone to the Shetland Shellfish Management Organisation (SSMO). In effect licences are limited providing fishermen with exclusive rights to the area and the SSMO is governed by local stakeholders. The SSMO has been able to define management measures such as restricting dredges to 5 per side and introducing a night-time curfew and prohibiting dredging within any area that contains biogenic reef. The scallop fishery was awarded MSC certification in 2005 and the Scottish Government's assessments have concluded that without the RO there could be an over-supply of scallop on the local market in the short-term and over-exploitation in the long-term.

Bay of Seine limited area-specific licences

In the Bay of Seine, within 12nm French vessels have exclusive access and responsibility for management through Regional Fisheries Committees. This security and involvement in management has allowed industry to take a lead role in managing the resource, and to maximise the value of the resource by having an opening date for the inshore area in December to target peak market prices. However outside of 12nm the Bay is open to other European vessels with no overarching management beyond EU effort limits for over-15m vessels. In this area there are a number of challenges including difficulties in matching effort to the state of the resource, and a race to fish resulting in a glut on the market earlier in the year.

Performance

The case studies presented in this report strongly support the general finding that assigning secure tenure can eliminate or at least reduce the 'race to fish'. The best results from both economic and environmental perspectives are found where the rights are the strongest. For instance in the Ramsey Bay lease arrangement, the industry supports a TAC that is agreed in line with the state of the resource and there is no incentive to attempt to catch the TAC ahead of other members as each member gets the same share of the profits. Access rights in the Shetlands and in France are weaker as individual licences are only allocated for a year and do not include catch allocations, however these examples are still a significant improvement on the current situation in the offshore Channel area. Rather than a 'free for all', the limited number of licences linked to a certain area allows for improved exclusivity and a sense of stewardship which can express itself through effective co-management structures.

The case studies also illustrate some of the tensions surrounding equity of access and a fair process. For example in both the Shetland and French example, it was felt important that access did not become a right that could be traded, possibly leading to a concentration of access. As a result licences are allocated on an annual basis and returned to a collective pool when retired. There is a

trade-off with security for licence holders (which would be stronger with a longer access right) and an on-going pressure to open up access to a wider group which requires clear criteria and a transparent process of licence allocations. Much of the tension surrounding access is dispelled in a profit-share system within the Ramsey Bay example where the PO holds the lease for access. In this case, fishing capacity can be reduced and tailored to the resource for everyone's economic benefit. The tension here in the future may be access to membership to the PO which will also need clear and transparent criteria to ensure access is considered fair and to avoid dilution of the exclusivity.

A key element for success within all three cases was found to be the close involvement of the industry, for instance in the Shetland Islands it was the Shetlands Fisherman's Association that led the search for ways to gain more control over their fishing waters, which was granted for shellfish through the Regulating Order. Similarly in France and in the Shetlands, institutions have been set up that allow the industry to be clearly involved in decision making. Changing the institutional structures is often crucial both for changing incentives for the fishing industry from 'catching at all costs' to 'maximising the value of the resource'; and for allowing industry to play a role in agreeing management that achieves this objective.

One aspect that is missing from all the case studies presented, however, is a discussion on where benefits from a secure tenure system will fall. For instance one consideration is whether access privileges should be charged for (as in other sectors where rents are extracted) which could be invested into the wider community or back into management. This issue is being addressed in part in the Bay of Seine, where the industry has recently agreed to increase licence fees to help fill a short-fall in funding for the annual scallop survey. However, it is perhaps a point for wider discussion which is often missing in practice when allocating secure tenure in fisheries.

Lessons for the wider English Channel

UK Inshore Area

Within the context of the UK inshore English Channel area, secure tenure approaches could be applied to the 6nm off the English coast through the Inshore Fisheries Conservation Authorities' (IFCA's) ability to limit the number of permits and create exclusive access. One of the reasons this approach has not yet been used is the concern that rights will be concentrated with consequences for employment and local communities. The examples in this report show that there are different ways to address this issue, illustrating how design can be tailored to achieve specific objectives. The table below presents some of the different options that could be discussed and the different outcomes in terms of security and an ability to control fishing morality in line with the resource.

Some options when allocating user-rights to IFCA-managed scallop resources

Increasing security of access →

Organisational level	Annual Lease to organisation	Organisational lease for <5 years	Organisational lease for 5+ years
Individual level	Annual individual permits	Longer term individual permits TAC agreed	Longer term individual licences, TAC agreed and individual catch allocations *or* profit share system

→ *Increasing control on fishing mortality in line with resource*

Offshore Area

Within the offshore context, secure tenure systems may be more challenging to design given the complexity of the current institutions and regulations; however, there are a number of principles that still apply with an overarching need to develop secure and exclusive access as a foundation of management on top of which a range of management tools can be applied. These principles are summarised below and are matched against the key challenges in the current offshore scallop management regime that were highlighted.

Challenges with Offshore Channel Scallop Management highlighted by SEASALT Analysis	**Principles of Secure Tenure that could be applied**
No exclusivity to scallop resources leading to a 'race to fish'	Create secure and exclusive access as a foundation of management
No overarching management for scallop resources within the Channel and no coordinated means of co-management or participation of stakeholders	Create an institution that can coordinate management between catching nations and their fleets
No recent assessment of the distribution and state of scallop resources in the Channel	Understand the distribution and state of scallop resources
Controls on fishing mortality are not linked to the state of the resource	Link adaptive fishing controls with the state of the resource

In the last point of the table 'adaptive controls' include options of introducing 'real time temporary area closures' linked to thresholds both for the state of the scallop resource measured through catch per unit effort and also to the state of the benthic habitat measured through habitat disturbance quotas that can be tailored to the characteristic of the environment (i.e. higher allowances for robust habitats with high levels of natural disturbance and lower allocations for the opposite).

Common to both the inshore and offshore areas, the case studies clearly illustrate the importance of having a good working relationship between the industry and scientists in facilitating discussions on management. This is enhanced by collaborating on surveys (such as in the Isle of Man), regular contact and discussion (as in Normandy, France) and through making scientific data accessible in an intuitive form (for example the map-based programme developed in the Shetland Islands.) In all the examples a sense of trust has developed between industry, policy makers and scientists, in many cases enhanced by close-knit communities and open communication channels.

Suggested Way forward

There are a number of ways these lessons on scallop management could be taken forward into the English Channel context:

1. Facilitate stakeholder engagement on secure tenure approaches for scallops in the Channel to explore different systems and their likely benefits and draw-backs as well as how different designs can have different outcomes;
2. Identify possible scallop management units within the Channel and provide economic and environmental evidence for the benefits of secure-tenure systems for selected units;
3. Support collaboration between French & UK (and other nations) scientists and industry to improve scientific data and advice for effective management;
4. Test secure tenure approaches within the Channel through pilots, potentially within the inshore UK zone as a first step.

1 Introduction

1.1 Background context

Since 2014, Environmental Defense Fund (EDF) has been involved in the EU funded GAP-2 programme[1] which facilitated a series of workshops involving the UK and French fishing industries as well as other relevant stakeholders to discuss options for improved research and management of the English Channel Scallop resources.

As part of this process, WWF (EDF's partner in the process) funded a review of the baseline economic situation of UK and French scallop fisheries in the Channel and an analysis of potential rents from scallop resources with secure and limited access rights. The study found that the French and UK landings from the Channel are currently worth €90 million per year in first sale value. Using bench-marking, it was estimated that with secure tenure the scallop resources could generate resource rents of some €75 million per year which would come from a mixture of increased landings value due to improved marketing and reduced fishing costs linked to changes in fishing arrangements (Tindall & Cunningham, 2015). Such results have been found internationally across a range of fisheries and have been demonstrated within this report in the Ramsey Bay case.

EDF were interested to explore means of introducing secure and limited access rights into the English Channel scallop fisheries. The WWF work revealed a number of cases where secure tenure has been established in scallop fisheries, and EDF was particularly interested to explore the UK and French examples to determine the issues and options for the application of such approaches to the wider Channel. Although not continuing its work on scallop fisheries in 2016, EDF is keen to hand over the lessons learned from these cases to other organisations that can take on such a facilitation role.

1.2 Project objectives

EDF commissioned a series of case studies on scallop management to identify transferable lessons that may be applicable to the wider English Channel context. The objectives of the case studies are to examine how the institutional set up can provide secure tenure and discuss the resulting economic and environmental benefits.

1.3 Selected case studies

Three main case studies were selected:

- Ramsey Bay, Isle of Man (Section 2)
- Shetland Islands Regulating Order (Section 3)
- Inshore France : Bay of Seine (Section 4)

In addition to these three, a case study was selected to examine how it could be possible to manage scallop resources specifically within a protected area using an ecosystem based approach to management:

- Cardigan Bay SAC scallop management (Appendix 1)

[1] http://gap2.eu/

1.4 Analytical framework

For each of the three main case studies, the main areas considered were:

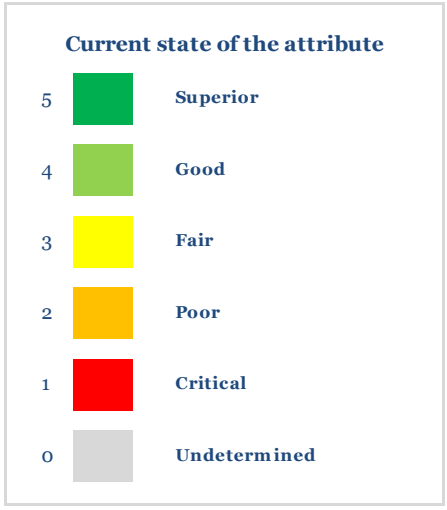
1. **Institutional** set-up (and change where there has been change)
2. **Performance**: economic and environmental
3. **Issues** and opportunities
4. **Lessons** applicable to the wider English Channel context

1. Institutional set-up

In each case study the institutional set up was described in terms of access to the resource, conditions associated with access, co-management arrangements and scientific assessment of the resource.

The institutional set up was then analysed against the EDF SEASALT criteria which describe attributes of secure tenure systems that have been found by EDF to lead to better managed fisheries (in terms of economic and environmental benefits – see list below). Based on EDF guidance, most emphasis was placed on assessing the extent of Security, Exclusivity, Accountability and Limited fishing mortality. The EDF Seasalt Excel tool was used which provides a scoring for each attribute using a traffic light system.

S	**Security of use-rights**
E	**Exclusivity**
A	All Sources of fishing mortality are included within assessments
S	Scaled approach to management
A	**Accountability**
L	**Limited fisheries mortality**
T	Transferability



2. Performance

The impact of institutional arrangements on economic and environmental performance was assessed for each case study based on available information.

3. Issues and drawbacks

Issues and challenges were also discussed for each case study highlighting where there are tensions and also how these are being addressed or what new opportunities are emerging.

4. Lessons

Lastly, the case studies are reviewed in the concluding sections of the report providing:

- A cross-comparative analysis of the different approaches within the case studies and the effect on outcomes (Section 6);
- Transferable lessons to the wider English Channel context, with specific lessons for management of scallop resources within protected areas (Section 7).

2 Ramsey Bay, Isle of Man Case Study

Brief overview

Ramsey Bay is a small (but economically important) bay within the territorial waters of the Isle of Man. The Isle of Man has exclusive control over its 3nm zone and given its limited layers of administration is able to make relatively quick decisions in collaboration between the industry and the administration, such as the decision in 2009 to close Ramsey Bay to scallop dredging due to concerns of over-exploitation. Although many of the smaller vessels operating out of Ramsey were affected by the restriction, many had called for the closure to allow for recovery of the resource. Subsequently the area was designated as a Marine Nature Reserve (MNR) that incorporated a Fisheries Management Zone (FMZ). After closure to dredging for 5 years, the Manx Fish Producers Organisation (MFPO) was allocated a lease to manage and fish the FMZ.

At the end of the 5-year period and following extensive cooperation between fishers, scientists at Bangor University and government, a strictly-controlled dredge fishery was re-opened. The MFPO took the novel approach of contracting a small number of their member boats to fish the total allowable catch and share the profits between its members. This approach meant that, rather than allowing the entire fleet to target the area (which would have been inefficient with high fuel bills and low return per vessel); two vessels fished the area in 2 days. Fishing was also timed in December to achieve maximum prices linked to the Christmas market. Survey data made available prior to the fishery opening ensured that fishing was targeted where there was the highest density of scallops, and dredging therefore only affected 3% of the seabed within the entire MNR. Without the insights provided by the pre-harvest survey, dredging would have occurred in a much wider area as fishermen would have had to 'guess' where the scallops were on the seabed and this would have caused more benthic impact. Another benefit has been reduced conflict with pot fishermen who have had unrestricted access to the bay during the majority of the year, and improve communication between potters and dredgers when they are both operating in the Bay (i.e. in December). The pot fishers effectively remove scallop predators through their fishing activities.

The key to success was that the lease gave the Producer Organisation (PO) clear ownership of the area, which allowed strategic decisions to be taken to maximise value and minimise impact of the catch and avoided a 'race to fish'. It is noteworthy however that during the following year the PO diluted this approach due to pressure from its members which resulted in more vessels entering the area and a less economically efficient fishery. Some reasons for this change were put forward such as fishermen wanting to see the change in the resource for themselves and the 'competitive nature' of the rest of the fishery which still requires a mindset change. Further research would be useful to understand what drives this behaviour and whether it will change if additional areas are managed under the lease system. Even though subsequent years have been less economically efficient than the first, the current system is a vast improvement from the situation prior to the closure of the Bay and still provides significant economic and environmental benefits compared to an 'all-in scenario'.

2.1 Institutional set-up

Ramsey Bay: Designated Marine Nature Reserve

Ramsey Bay is a 94.4km^2 area within the 3nm zone of the Isle of Man coast which was designated as a Marine Nature Reserve (MNR) in 2011, after being proposed by the fishing industry. An emergency closure of the king scallop fishery had been in place since 2009 as the area had been over-fished including a known settlement/source area for scallop. In the words of the CEO of the Manx Fisheries Producer Organisation (MFPO): "The problem was there were no scallops, it had been totally overfished. The Isle of Man is a honey pot for visiting fishermen and there is huge pressure on the resource with the number of boats visiting increasing rapidly".

Extensive consultation led to a zoning plan for the Bay which included a Fisheries Management Zone (covering 45.9 km^2) where the right to fish for scallops is leased to the MFPO via a 5-year agreement. Figure 1 illustrates the zoning and Table 1 indicates the permitted and not-permitted activities within each zone.

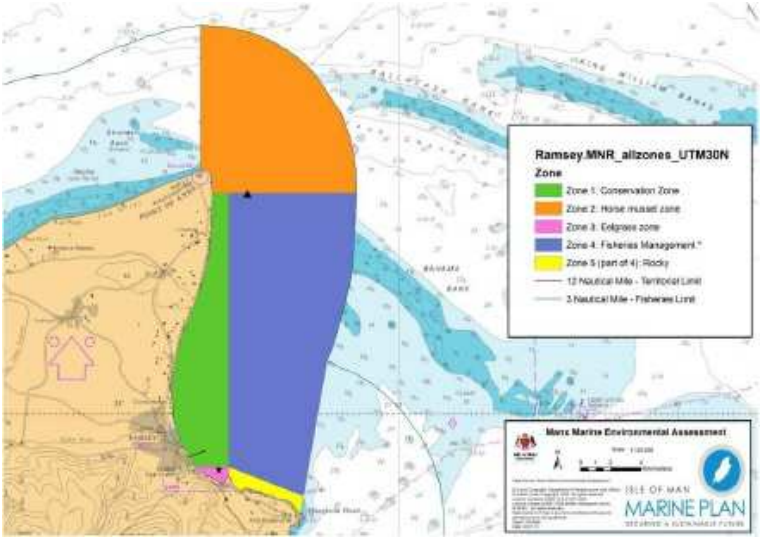


Figure 1 Zoning Plan for Ramsey Bay MNR

Name of Zone	Location	Area (km^2)	Permitted	Not Permitted
Conservation Zone	Inner Ramsey Bay	13.9	Potting, Angling	Trawling, Dredging, Other extraction of scallops and queenies
Horse Mussel Zone	Point of Ayre to Ballacash Channel	31.0	Angling	Potting, Trawling, Dredging, Other extraction of scallops and queenies.
Eelgrass Zone	Southern corner of Ramsey Bay (Port Lewaigue to Ballure)	0.5	Restricted bait digging, keep pots	Potting, Trawling, Dredging, Angling, any extraction of living resources
Fisheries Zone	Outer Ramsey Bay	47.4	Potting and Angling. Restricted Trawling, Dredging and scallop diving under MFPO and DEFA control.	Trawling and dredging not authorised by MFPO and DEFA.
Rocky Coast Zone	Narrow strip from Gob ny Rona to Maughold Head	1.6	Potting, Angling	Trawling, Dredging, Other extraction of scallops and queenies

Table 1 Permitted and non-permitted activities within Ramsey Bay MNR zones

Access to resources: Lease between government & producer organisation

The lease between the Department of Environment, Food and Agriculture (DEFA) and MFPO is for 5-years and gives the MFPO exclusive access to king-scallop resources (and now also queen scallops) within the Fisheries Management Zone (FMZ). A series of conditions are attached to this lease including the requirement to set an annual Total Allowable Catch (TAC) which is based on scientific assessment and agreed with DEFA[2].

A select number of vessels fish the quota and there is then a system of profit sharing between the 30 (approx) members of the PO. The first year the selection of vessels was arranged very formally by the MFPO and only 2 boats fished the quota. In the following two years, the system has evolved and the fishermen decide between themselves who will fish and phone the PO to book a slot, with now around 7 boats taking part. A maximum of five boats are allowed in the bay at any one time. While this approach has still led to a precautionary fishery, as discussed above it would be interesting to explore why the fishermen diverted away from the more economically efficient model pursued in the first year of the fishery.

The system is still in its early days and has evolved over the three years:

Year	Survey	System of setting quota	Quota	Time of harvest	No. vessels	Value of harvest	£/kg (shell-on)
2013	DEFA survey Industry survey	DEFA proposal	23,940kg	December	2	£64,000 [Est] Net profit: £51,300 (1)	£2.67/kg
2014	DEFA survey Industry survey	DEFA proposal – industry negotiation	28,766kg	December	7	£100,000 (2)	£3.48/kg
2015	Joint DEFA-Industry survey	Industry proposal based on joint survey – accepted as reasonable by DEFA	38,000kg	December	7	£132,000 (3) [Est]	£3.47/kg

Notes: (1) Net profit of £300 per hectare (of 171ha fished) reported in Dignan et al., 2014
(2) Personal communications/Interview CEO MFPO December 2015
(3) Estimated based on 2015 quota and 2014 values

The success of this approach has allowed the lease to be extended to also cover queenie resources, for which a TAC is also agreed and fishing generally takes place between September and October.

Lease conditions

There are a number of conditions attached to the lease, with the overriding requirement to 'maintain the ecological integrity of the site'. This requirement has not so far been defined in the

[2] This is in addition to overarching EU regulations that govern the Minimum Landing Size of 110mm in the Irish Sea (Council Regulation EC N850/98) and restrictions on the number of days allowed for 15m & Over (≥15m) vessels to fish for king or queen scallops as specified by the EU Western Waters Effort Management Regime (WWEMR) (Council Regulation (EU) No. 1954/2003).

sense of trigger levels but is measured through indicators such as catch per unit effort, and a reasonable distribution of year classes of scallops within the zone (Fiona Gell, DEFA, Personal Communications). Further to this, the government undertakes habitat surveys to monitor the flora and fauna within the zone to ensure the fishing activity is not damaging the habitat. Surveys were conducted in 2011 (4 years after the initial closure and before managed fishing resumed) and in 2013 and another survey is planned this year (2016). Finally there is a requirement for vessels to carry VMS (plus a GPS system that records vessel position at a higher frequency than VMS) and return detailed catch records. The data generated thus enables a more accurate assessment of the footprint of the fishery and its economic performance.

The MFPO has established a clear set of fines and penalties for any transgressions and undertakes spot checks of boats on landing, taking sample weights of their catch as well as checking landings data with processors. Faced with the overarching penalty of having the lease revoked, the MFPO and its members are keen to show that they are able to manage the zone responsibly so they may have the opportunity to lease other areas in the future. To date, MFPO has not needed to discipline any of its members and the only issue has been with non functioning GPS-loggers leading to a requirement to carry two units when fishing within the FMZ.

There is a presumption both by DEFA and MFPO that the lease will be renewed for another 5 years provided the ecological integrity condition is maintained.

Co-management arrangements

The timing and quota for the scallop fishery in Ramsey Bay is agreed jointly by DEFA and MFPO. In the first two years, DEFA made the original proposals followed by a negotiation with industry, but this has moved towards a more industry-led system. Last year industry took the lead by making a proposal based on the 2015 survey, which was accepted as reasonable by government.

Another key development has been the establishment of a Ramsey Bay Management Advisory Group, which has a specific 'Ramsey Bay' focus and represents a range of stakeholders including: DEFA, MFPO, 3 scallop fishermen, 1 potting fisherman, scientists, and representative of a local conservation group. It is intended to become the primary decision-making body for the Ramsey Bay fishery and plans to do further work including:

- Support marketing of scallops from Ramsey Bay
- Coordinate further research to answer questions on defining ecological integrity
- Look at options for re-seeding areas
- Investigate other gears such as lower-impact sled-dredges and diving

Scientific assessment of the resource

Industry participation in the scientific assessment of the resource has also developed. In the first two years (2013 & 2014) DEFA and MPFO undertook separate stock surveys but last year (2015) they collaborated to develop a joint survey design and included representatives of the other group when doing their surveys. The MFPO is moving towards taking on more of the survey work, including an element of habitat and ecosystem monitoring.

The 2015 survey gave encouraging results indicating large numbers and sizes of immature scallops (many within the 79-90mm range which is below the minimum landing size but shows good recent recruitment). The CEO of the MFPO commented that, "There is a real contrast in the scallops within Ramsey Bay compared to those just outside in catch rates, size and age-structure. I really think it is because of the management zone."

2.2 Seasalt Analysis

Analysis of Ramsey Bay scallop management against the EDF Seasalt attributes is illustrated below and shows how the system performs well against the criteria. The analysis indicates that the lease allocated to the MFPO provides exclusivity and a degree of security which would be greater if the lease were awarded for a longer time period. Annual catches are limited in line with scientific advice, and the MFPO is held accountable to enforce the annual TAC.

Exclusivity is good but not superior as there is currently no means to prevent dilution of the profit share if new members join the MFPO, although the PO is planning to look at this issue. As Ramsey Bay is a relatively small area it does not cover a discrete stock and the king-scallop populations throughout the northern Irish Sea are connected (Hold et al. unpublished report). However it does cover an important recruitment area and also acts as a source for other areas around the Isle of Man.

SEASALT Analysis: Ramsey Bay Scallop Management

	SEASALT Attributes	Current state Comments
Secure	*Length of privilege tenure*	5-Year Lease
	Renewal of the privilege	Clear conditions for renewal
	Access and allocation privileges are defendable by law	Defendable but early days for examples of court cases
Exclusive	*Defined quota or area-based allocations to entities*	Annual TAC agreed and profit share
	New entrant conditions	Share not fully protected from dilution through new MFPO members but no evidence this is occuring or likely to occur
	Penalties for infringement of access privilege	Penalties for infringement e.g. Fines & suspension
All Sources	*Allocation for landings and discards/by catch*	95% survivability of discards
	Fishing controls incorporates other fleets or recreational users	All king scallop fishing included in TAC
	Monitoring systems are in place	GPS, VMS, Catch records, Processor records
Scaled	*The stock is under a single or coordinated accountable management unit (such as with other fleets)*	Scallop stock spans outside of Ramsay Bay - some limited coordination with other designations.
Accountable	*Fishery regulations or other rules state that fishermen have to comply with controls on mortality*	Annual TAC is set and MFPO ensures this is adhered to.
	There are mechanisms to enforce regulations, rules and/or community agreements	Compliance reported to be high
	Participatory management of the resource	Co-management of the resource through dialogue and Advisory Management Board
Limited	*Use of best available science to limit the fishing mortality*	Annual industry-government surveys to set annual TAC
Transferable	*Informal or formal mechanisms to transfer shares*	Lease is awarded to MFPO and is non-transferable
	Regulations or limitations on transfers of permits and/or quotas	

2.3 Performance

2.3.1 Economic Impacts

Although the new management system has only been in place for 3 years, it is possible to identify some initial economic impacts:

Value of fishery

The revenue of the fishery has increased from £64k to an estimated £132k as the resources in the bay recover, although it's also important to consider the effect of scallop prices which can vary due to a number of factors.

Maximised prices

By focusing the fishery in December, during peak-prices (rather than in May at the end of the king scallop season in the Isle of Man), the MFPO has achieved higher prices/kg, for example in 2013 prices of £13.50/kg meat were achieved compared to £9.50/kg meat in May – *a differential of £4/kg meat* (Dignan et al., 2014).

Reduced costs

By avoiding the race to fish and using only a few vessels to operate on behalf of the lease-holder, the number of fishing miles was 100 in 2013 compared with a potential of 1,536 if all vessels had been active as previously (Dignan et al., 2014). However there would have been greater fishing miles in the following two years due to additional boats taking part. A full economic appraisal would be useful to inform fishers of the benefits offered by different approaches to address the fishery.

Profit share

Profits from the Ramsey bay scallop fishery are paid to MFPO members as a dividend, which was approximately £1,500 per share in 2013. As non-Manx vessels are excluded from the Marine Reserve the economic benefits from the fishery are entirely captured by the Isle of Man.

Reduced gear conflict with potters

Potters using the Ramsey Bay have benefited considerably from the new system with almost no gear conflict compared to prior to the closure. Potters have access to the bay almost all of the year and the new management advisory board provides a direct means to communicate (and negotiate) the location and timing of the scallop fishery. Potters also benefit from the profit-share to all PO members (although this remains contentious).

2.3.2 Environmental

Recovery of the scallop resources in the Bay

Annual surveys are showing a recovery of scallop resources in the Bay following the 2009 closure and the limited annual fishery. In 2015, surveys showed high densities of scallops within a specific fishing zone (171 ha area), larger sizes, high growth rates and good recruitment (Source: December 2015 Scientific Symposium).

Fewer vessels & zoning translates to lower impacts on the benthic environment

Compared to an all-in scenario, the targeted fishing only affected only 3-4% of the Fisheries Management Zone. The zoning system also means that there are large areas of the bay that are fully protected from dredging.

Targeting fishing in December allows scallops to spawn undisturbed during summer

Although the MFPO is considering a fishing season in May as well as December, the current system of only fishing in December allows for scallops to spawn undisturbed during the summer months.

Industry demonstrating responsible stewardship for the resource

With the exclusivity awarded by the lease, sustainable management of the scallop fishery in Ramsey Bay is becoming more industry-led. As mentioned above, this year the industry put forward the proposal for the quota which was accepted by government as being responsible. The industry has seen such a clear benefit from the scheme that the MFPO is keen to extend such a leasing arrangement to other areas within the territorial sea.

2.4 Issues & Opportunities

Drawbacks & future plans

Both government and the MFPO during discussions were keen to point out that it is still early days for the Ramsey Bay management system and it is in some respects a work in progress. Some of the ongoing challenges that were discussed include:

- There are currently more vessels fishing in the bay than is strictly necessary, making the fishery slightly less efficient, but there have been reasons for this including the fishermen wanting to see the recovery of the resource for themselves. The CEO of the MFPO believes that the first-hand experience by fishermen plays a role in learning about the effect of the reserve.
- Currently the PO is unable to avoid value of catch shares being diluted, and the CEO is considering ways to tighten up criteria for PO membership or beneficiaries from the Ramsey Bay scallop fishery. At present members targeting other species (such as Potters) get the same profit share from the Ramsey Bay scallop fishery which is contentious among scallop fishers.
- Marketing of scallops from Ramsey Bay is still a challenge as current buyers in France will not pay significantly more for a better product. This does however open up an opportunity to create a marketing story around the marine reserve and target specific high-end restaurant markets. This will be one of the focuses for the Management Advisory Group.
- The discard ban may present a challenge in the form of choke species which are caught in small quantities but for which the MFPO does not have quota. The PO and the management group are looking at options to improve selectivity and argue for either a *de minimis* or a survivability exemption to the discard ban legislation.
- Despite the success of the system there are still a wide variety of opinions between fishermen and members of the Management Advisory Board, for instance some feel the fishery is at the correct level where others consider that more could be fished and have concerns for the effect of predators and natural mortality. The board has the opportunity to direct research to answer some of these questions and also consider other management approaches such as rotational management and different methods of capture.

2.5 Lessons

Key factors in the Ramsey Bay success are the definition of a valuable but manageable area, the representation of all scallop fishers by a single organisation and the existence of clear communication channels (and trust) between government, industry and scientists. It is therefore considered that the lessons from Ramsey are most applicable to the UK inshore zone of the English Channel, where a relatively similar system of limited entry could be established for the 6nm zone. However, some of the wider principles could also be applied to the offshore English Channel area as described in Section 7.2.

Exclusive Rights allow fishermen to fish to the market

The benefits from the Ramsey Bay Scallop Management system would not be possible without the exclusive right awarded to the MFPO. This allows the MFPO to be strategic and select specific areas and times to fish, unlike the previous 'all-in scenario' which generated a race to fish and ultimately over-exploitation.

Sustainable fishing within protected areas is possible

The Ramsey Bay example illustrates how a targeted scallop fishery with the right institutional set up (i.e. exclusive and secure rights) can take place within a small part of a protected area and still maintain the ecological integrity of the site, by creating the conditions that encourage the minimisation of the environmental footprint of the fishery (i.e. it is spatially, economically and environmentally efficient).

Good science and industry relationship promotes agreement on management decisions

Good science is fundamental for setting appropriate catch limits. Equally important in the Ramsey Bay example is the level of trust between the industry and the scientists, with industry moving after three years from independent surveys to a jointly designed and executed survey. Notably the results of the surveys provide clear guidance that assist industry and government to agree an annual TAC.

Leadership

The engagement of the industry in making the lease work has undoubtedly been supported by the role of the CEO of the MFPO who has a science background and can therefore help to bridge the discussion.

Adaptive management allows decisions to be responsive to the state of the stock

The system of setting an annual TAC following a scientific survey allows for the management to be responsive to the state of the stock. The TAC can be increased or decreased on an annual basis directly depending on the state of the resource, and is agreed between the administration and industry to ensure future sustainability of the resource.

3 Shetland Island Regulating Order Case Study

Brief overview

The Shetland Island Regulated Fishery Order, established in 2000, allowed for the devolution of management of shellfish fisheries within the 6nm zone to the Shetland Shellfish Management Organisation (SSMO). In effect licences are limited (non-transferable entry permits) providing fishermen with exclusive rights to the area and the SSMO is governed by local stakeholders.

This management right has allowed SSMO to define management measures such as restricting dredges to 5 per side and introducing a night-time curfew and prohibiting dredging within any area that contains biogenic reef (e.g. maerl or horse mussel). The SSMO has been able to sustainably manage stocks and gained Marine Stewardship (MSC) certification in 2005. Since then, catch levels have remained stable.

3.1 Institutional set up

Institutional structure: Fishery Regulating Order

The Shetland Islands Regulated Fishery Order delegates management of shellfisheries to the Shetland Shellfish Management Organisation (SSMO) within 6nm around the coast of the Shetland Islands (covering ~6,000km^2). This includes not only scallops, but also crabs, lobsters, queen scallops, whelks, oysters, mussels, cockles, clams and razor shells[3].

After consideration of a number of options, a Regulating Order emerged as the most appropriate instrument and was the first time it has been applied to a relatively large area covering a wide variety of species. The Shetlands Fishermen's Association (SFA) led the request to take on greater control of their fisheries and the regulating order was made possible following the devolution of the Scottish Parliament in 1999.

Before each renewal (in 2009 and again in 2012) the Scottish Government has undertaken a business and regulatory impact assessment (BRIA), and in both cases concluded that not renewing the Regulating Order would lead to a regulatory vacuum which could lead to oversupply of the local market in the short term and over fishing and compromised sustainability in the long-term. Wide-ranging consultations for both renewals found overwhelming support for the RO from local fisheries interests and fishing vessel owners and no objections (Scottish Government, 2009; Scottish Government, 2013).

Table 2 gives details on the dates and durations of the Shetland Islands Regulated Fishery Orders. There has not been any significant difference in the text of the Regulating Order since its inception, beyond an increase in the annual licence fee (see below).

Table 2 Record of Regulating Order Legislation

Name	Dates	Duration
The Shetland Islands Regulated Fishery (Scotland) Order 1999 (No.194)	2000-2010	10 years
The Shetland Islands Regulated Fishery (Scotland) Order 2009 (N. 443)	2010-2013	3 years
The Shetland Islands Regulated Fishery (Scotland) Order 2012	2013-2028	15 years

[3] This management sits under overarching EU regulations that govern the Minimum Landing Size of 100mm in Eastern Scottish waters (Council Regulation EC N850/98) and restrictions on the number of days allowed for 15m & over (≥15m) vessels to fish for king or queen scallops as specified by the EU Western Waters Effort Management Regime (WWEMR) (Council Regulation (EU) No. 1954/2003).

Co-management structures

SSMO is governed by local stakeholders with the board comprising 4 local fishermen, 1 local processor, two local authority councillors and an independent chair drawn from the local community council. This structure has evolved over time with the Shetlands Inshore Fishermen's Association gaining seats on the board in 2000 to support inshore fishermen seeking a licence, and Scottish Natural Heritage (SNH) stepping down as an active member but retaining external stakeholder status.

SSMO's governance structure is given in Figure 2 which also illustrates the new development of a Core Advisory Group. One of the responsibilities of this group is to act as a licensing sub-group which scores licence applications based on set criteria. The board is responsible for approving new licensing rounds and the ultimate decision on how may licences to allocate based on stock assessment information. Transparency has been improved recently with all new licensing rounds being advertised on the website and local press, and review decisions also being clearly communicated (Acoura, 2015).

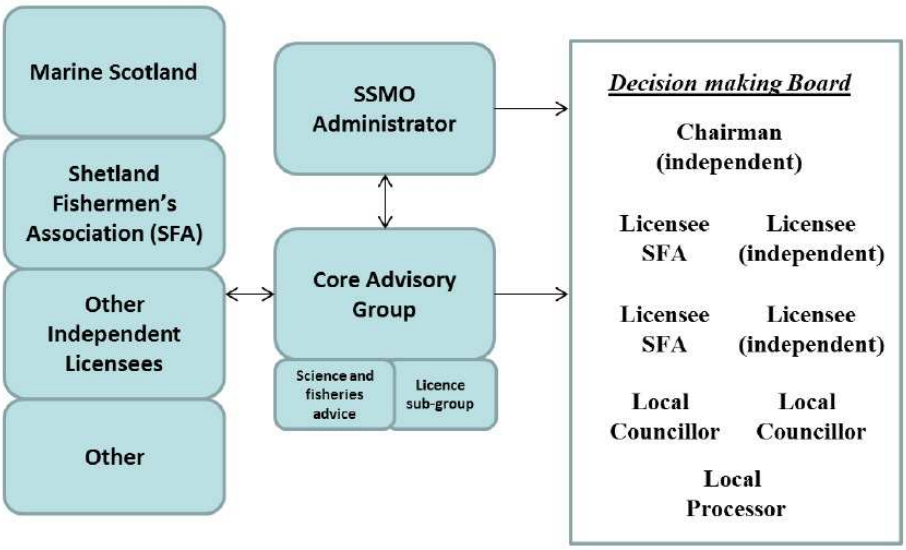


Figure 2 SSMO governance structure (Source: Acoura, 2015)

Access to resources: Licence system

Access to shellfish resources within the SSMO remit is restricted via a licence system, but these were intentionally made non-transferable to avoid concentration of access. Licences are therefore valid for a year but automatically renewed unless the vessel has been in serious breach of regulations (see: http://www.ssmo.co.uk/page4.htm). There is therefore only spatial management of the fishery with an effort cap on the number of licences allocated, but no individual catch limits allocated.

When the Regulating Order was first granted, all fishers with a historical track record were awarded a licence, and all species are included so that fishing effort would not be simply redirected onto species outside the scope of the Order (Goodlad, 2000). Over 170 licences have been issued but the number of licences has reduced over time as some of the original applicants have not renewed their licences. Of these, there are currently around 33 vessels using dredges for scallops (MSC, 2012). Recently the SSMO has been granted permission to issues species-specific licences so the licensing system might change in the future.

The licence annual fee was initially set at £100 per year, but has increased to £340. This is sufficient to cover the ongoing management costs of the SSMO, but would not be able to cover funding for

scientific assessments. For the current time the Island Council has made a commitment to supporting inshore fisheries science and management in the Shetland Islands.

Conditions of the Permit

Through the Orders, the SSMO has the authority to award licences, put restrictions on effort and technical gear and create reserves. As a result vessels are restricted to under -17m, and to five dredges a side. Other restrictions include a night-time curfew and recently the SSMO worked with the NAFC Marine Centre to identify and close vulnerable habitats (such as mearl and horse mussel beds) to scallop dredging. Fishers are also required to complete logsheets providing a significant dataset on catches and landings per unit effort (LPUE), and Marine Scotland Compliance is mandated within the Regulating Order to provide support on enforcement.

Scientific Assessment and management advice

Landings data is enhanced with observer programmes and annual surveys, leading to an assessment of the scallop stock including annual estimates of yield, fishing mortality, spawning stock biomass and recruitment[4].

The scientific assessment currently guides management of the scallop stock through the SSMO's decision on whether to increase the number of licences in any given year. The harvest control strategy initially set a reference point of 23 scallops per hour per dredge with a series of management actions triggered if the LPUE fell below this level (Figure 3).

In theory, if the LPUE falls below a certain limit, the scallop harvest control rules could result in certain areas being closed to allow recovery, in effect setting up a system of 'rotational management'. In practice the LPUE has not fallen below the target level since 2009 and so no areas have been closed. SSMO are also in the process of updating these harvest control rules for scallops; however the new system has not yet been published.

Target LPUE level & Trigger Reference Points	LPUE (number of scallops per hour per dredge)	Management Action
Target Reference Point	23	No management action required
Trigger Reference Point 1	<22	No further entry to the fishery through issue of new licences
Trigger Reference Point 2	< 20	Research and sampling review
		Consider area closure by SSMO grid square
Trigger 3	<18	Increase MLS
		Extended closure
Trigger 4	<16	Close scallop fishery until TRP is reached
		Research and sampling

Source: SSMO

Figure 3 SSMO Harvest Control Rules for the scallop fishery (MSC, 2012)

Discussions between scientists and the industry have recently been facilitated by the NAFC's Marine Centre's development of a new fisheries database with a map-based front-end so that assessment data is more accessible to fishers and data can be seen in real-time and per area, as well as information on landings, effort, habitats and VMS data.

[4] Through the use of Virtual Population Analysis (VPA).

3.2 SEASALT Analysis

Analysis of Shetland scallop management against the EDF SEASALT attributes is illustrated below and shows how the system performs against the criteria. The analysis indicates that there is high security within the Regulating Order (assigned for 15 years) with annual licences offering medium security to individual fishers. Fishing mortality is not directly limited via a limit on catches and as the scallop resources span outside 6mn, management is not scaled to the stock. However there is good participation and strong co-management through institutional structures.

SEASALT Analysis: Shetland Islands Regulating Order

	SEASALT Attributes	Current State Comments
Secure (SSMO lease)	*Length of privilege tenure*	The Regulating Order is in place for 15 years from 2013-2028. Individual area-based licenses are assigned on an annual basis but automatically renewed unless there is a serious breach of regulations.
(Individual licenses)	*Renewal of the privilege*	Track record of renewal of Regulating Order
	Access and allocation privileges are defendable by law	Marine Scotland assists with compliance
Exclusive	*Defined quota or area-based allocations to entities*	Area-based licenses but no individual allocations or individual area-based allocations for scallops
	New entrant conditions	Clear formal conditions for new permits but ongoing pressure for new permits
	Penalties for infringement of access privilege	Medium to high compliance based on community controls
All Sources	*Allocation for landings and discards/by catch*	Discards not taken into consideration but also not considered a large problem in scallop fishing (relatively high survivability)
	Fishing controls incorporates other fleets or recreational users	No other fishing methods for scallops within SSMO remit.
	Monitoring systems are in place	All fishermen have VMS and complete log-sheets but no 100% observer coverage or ability to track what vessels catch at all times.
Scaled	*The stock is under a single or coordinated accountable management unit (such as with other fleets)*	Management is not scaled to the stock as this spans outside of 6nm.
Accountable	*Fishery regulations or other rules state that fishermen have to comply with controls on mortality*	Fishermen have to comply with effort and technical controls
	There are mechanisms to enforce regulations, rules and/or community agreements	Relatively good compliance
	Participatory management of the resource	Participatory management achieved through SSMO with good representation of fishing industry and wider community.
Limited	*Use of best available science to limit the fishing mortality*	Scientific advice used to decide on whether to allocate additional licenses but no specific limits on fishing controls.
Transferable	*Informal or formal mechanisms to transfer shares and/or quota or fishing area (in the case of a TURF)*	No Transferability of licenses.
	Regulations or limitations on transfers of permits and/or quotas	

3.3 Performance

3.3.1 Economic Benefits

Landings of scallops into the Shetland Islands were worth £1.955 million in 2015[5]. Anecdotal evidence suggests that the RO has resulted in economic benefits with suggestions that 'economically scallop fishers are doing well and the scallop fishery being 'buoyant[6]'; but there is currently limited data available to illustrate this quantitatively. Those involved closely with the fishery feel that the Regulating Order and the permit limit prevented effort from creeping up and that without the Order there would be greater effort, reduced stock and lower incomes (Personal Communications, John Goodlad, SFA). In his view the limited number of dredges has also kept the fishery as a middle-sized fishery where fishermen are able to make a sustainable living.

However experience around the world strongly suggests that all licensing systems suffer from an economic perspective due to effort creep. In the future, it may be important to distinguish between the number of licences and their effective effort. The usual well-known difficulty is that even if the number of permits does not change, effort can and does still increase with technical progress however there is not sufficient information from the Shetlands to know whether effort has increased since the RO has been in place. It is possible that having the long-term Regulating Order in place changes the dynamic because of the close involvement of the fishers, but this requires further study. It is also possible that the system may need to evolve towards some kind of catch-based arrangement to prevent effort creep.

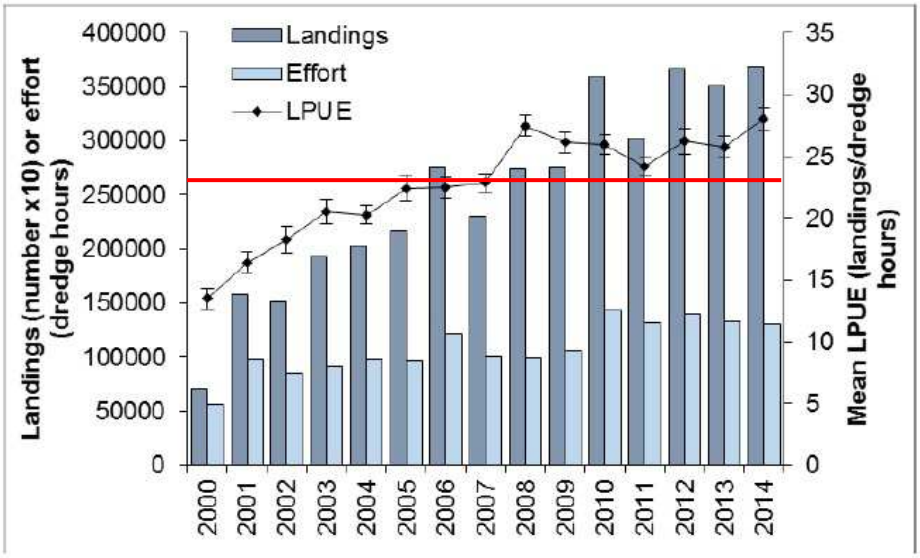
Prior to being awarded the Regulating Order SSMO had to put a document together to give evidence on the stock, governance structure and also whether it would be in the public interest. As well as presumably illustrating economic benefits to the Shetland Islands, the document had to show that the permit system would allow an entry point for future generations. This is achieved through allowing new licences if LPUE is above a certain level and retired licences going back into the pool. The Scottish Government Business and Regulatory Impact Assessment of the 2012 Order concluded that, "The SSMO operates a transparent licensing regime, and applicants are all scored on a standard set of criteria. This creates a level playing field and equal competition within the fishery" (Scottish Government, 2012).

One noticeable and understandable feature of the system is that the Regulating Order places fishers at the centre of the debate. However, this means that economic benefits are interpreted somewhat narrowly, for instance whether fishers are able to make a sustainable living. At some point, it may be useful to re-consider the economic benefits obtained from the exploitation of Shetland's shellfish resources and set them into a broader context. Drawing on the Ramsey Bay experience, would a catch share or profit-share system increase the net benefits and what impact might this have on the Shetland economy under different scenarios?

3.3.2 Environmental Benefits

Shetland Islands inshore scallop (as well as brown and velvet crab) fisheries were certified as sustainable by the Marine Stewardship Council (MSC) in 2012. Subsequent audits have found the scallop resources to be fished at a sustainable level with LPUE remaining above the target of 23 scallops per hour per dredge (Figure 4). NAFC also report that there was strong recruitment in 2006, with this year class now passing through the fishery but the stock remaining stable (Personal Communications, Beth Mouat, NAFC).

[5] Carole Laignel, SSMO, Personal Communications
[6] John Goodland, SFA, Personal Communications



(Source: NAFC Marine Centre)

Figure 4 Landings and effort of the Shetland Island's inshore scallop fishery (2000-2014)

Note: Graph cited in Acoura, 2015

Another key environmental benefit of the SSMO structure has been the agreement within the Shetland Islands Marine Spatial Plan to prohibit fishing from vulnerable benthic habitats such as maerl and horse mussel beds (Figure 5). VMS maps compiled by the NAFC Marine Centre illustrate that the protected areas have been respected by scallop fishermen (FCI, 2014).

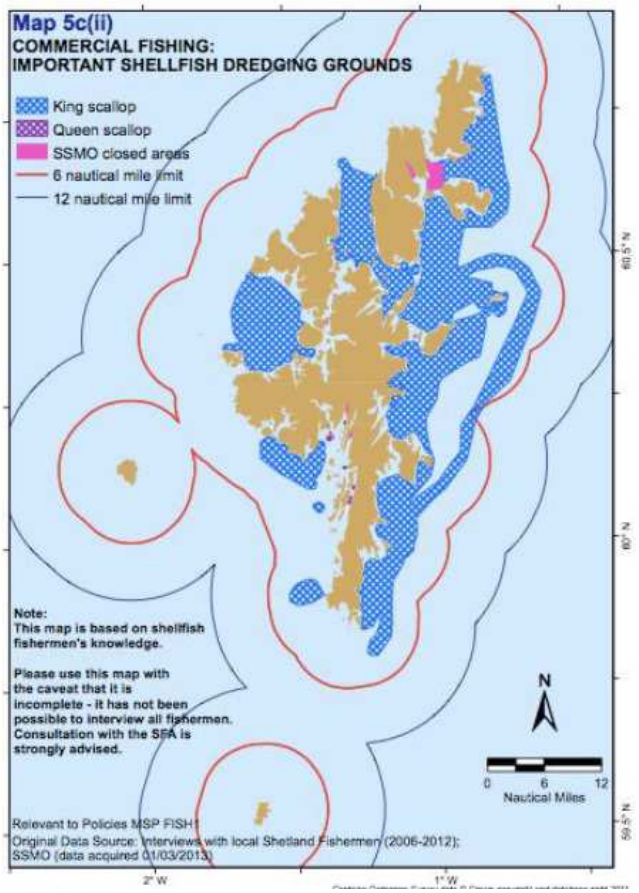


Figure 5 SSMO closed areas to protect vulnerable habitats from dredging

3.4 Issues and opportunities

Challenges

One of the major challenges of the RO has been balancing scientific recommendations with the pressure for more permits. This has been addressed in part by linking new licences to a harvest control rule and by recently separating licence evaluations from the main SSMO board. This challenge arises because benefits are perceived (rightly) by fishers to be linked to the number of permits – so that to benefit from the fishery, you have to be a fisher. It is for this reason that a wider consideration of "benefits" may be helpful to try to break the link between the perception of benefits and the pressure for more permits. For a profit-share system may allow fishers to benefit from a share in profits without having to actively fish for scallops.

Another current issue is the sustainability of funding for scientific assessments. Historically the Shetland Islands Council has supported the NAFC surveys and stock assessments, and while they have currently committed to supporting management of the inshore fisheries sector, some observers have suggested there may need to be administrative cuts in the future. SSMO collect sufficient resources through the licensing fee to support the ongoing management of the organisation but this does not cover the cost of scientific assessments.

Opportunities

As well as opportunities for the fishing industry to get more involved in the scientific assessment of the resource, there are also discussions on whether the Regulating Order could be extended to 12nm and in the past there have been discussions on the potential benefits of re-stocking areas.

3.5 Lessons

Regulating Order allows for exclusive and secure access

The Regulating Order provides security to the SSMO. This security has encouraged management of the fishery with sustainability in mind, with fishers agreeing to closed areas and a cap on new permits if catches per dredge fall below a certain level. However, security at the individual fisher level depends on SSMO decisions. For the moment, an effort-based licence system is used. It provides some exclusivity to fishers but the allocation on an annual basis can limit individual security.

Strong co-management systems supported development and ongoing management of the Regulating Order

The role of the Shetland Fishermen's Association in leading the development of the Shetland's Regulating Order was critical in getting buy-in from the industry. This led to the development of the Shetland Shellfish Management Organisation (SSMO) which includes the critical stakeholders and has been able to evolve in order to better represent different interests, such as the addition of two representatives of the inshore fisheries sector.

Harvest control rules based on LPUE per area allow in theory a form of 'rotational management'

The harvest control rule that has been used for scallops could be used as a form of 'rotational management' where areas are closed to fishing if landings per unit area fall below a certain level. This approach may be useful in the English Channel given that the Industry (during GAP2 workshops) have discussed the potential of 'real-time closures' when catch per dredge falls below a certain level. Some representatives of the industry consider this a 'common sense approach', and the real-time closure system put in place to protect juvenile cod, (in exchange for additional effort days) has been considered to be successful.

It is possible to provide secure and exclusive access without assigning a monetary value to the 'access right'

The SSMO permit system avoids concentration of rights, as permits cannot be transferred or sold and retiring permits are returned to the pool to be reallocated. This does not allow market-measures to reduce capacity within the fishery, but it ensures that access rights do not take on a tradable value which may be desirable in some contexts. For instance some IFCAs have expressed concern on allocating permits which may then become a tradable right and change the character of the inshore fisheries sector. However, it is worth bearing in mind that in some other fisheries, fishers have found ways to transfer theoretically-non-transferable licences in situations where these have become valuable and regulations have to be carefully designed if this wants to be avoided.

Cooperation between scientists and industry has been facilitated by sharing data

The close relationship between the SSMO and scientists and sharing of data has facilitated cooperation in a number of ways. Consultations with the industry allowed the NAFC Marine Centre to focus surveys which led to identification of vulnerable habitats for the Marine Spatial Plan. Furthermore, the development of the map-based database for scallop assessments has allowed industry to further understand the survey and assessment results and engage meaningfully in management discussions at the level of the SSMO board.

4 Bay of Seine, France Case Study

Brief overview

The Bay of Seine is one of the main scallop-producing areas of France (the other key area being the Bay of St Brieuc) and the scallops within the Bay are considered to be a discrete stock. The majority of the Bay is open only to French vessels and is managed by Regional Fisheries Committees with national oversight. However there is also an area of the Bay (outside of 12nm known as the Proche Exterieur) that is open to other European vessels. An annual survey of exploitable biomass and recruitment is undertaken and helps inform management of French vessels within the Bay concerning the number of licences, daily catch limits and closed season. However there is no overarching management linked to the state of the resource that governs other EU fleets operating outside of 12nm.

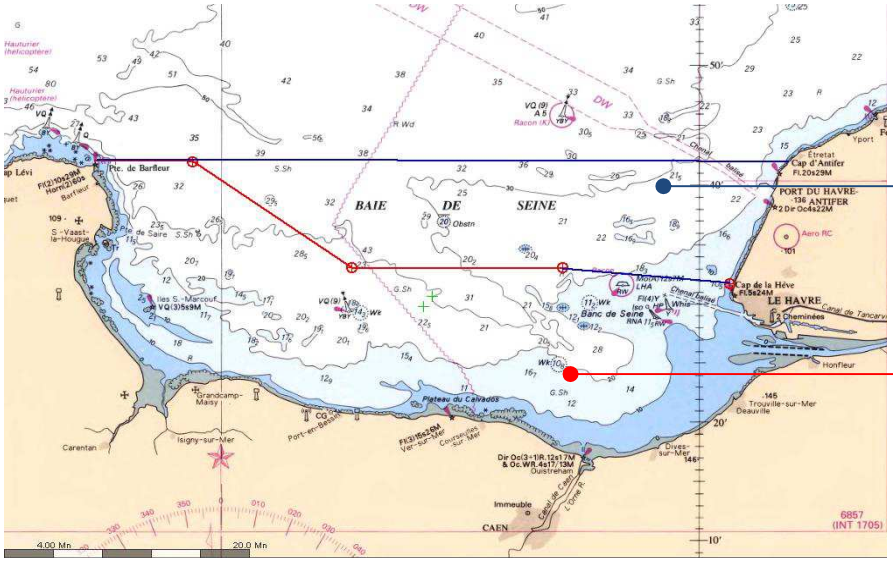
The exclusivity of access to the inshore area for a limited number of French vessels, as well as the institutional structures, allows the industry to take a lead role in managing and safeguarding the resource. It also allows the Fisheries Committees to set an opening date for the fishing season within 12nm in December which coincides with peak market prices. The proximity to marketing channels in Paris and a focus on quality have also been given as reasons for a relatively high price compared to other ports.

However, there are still aspects of the system (e.g. minimum prices offered by Producer Organisations) that potentially drive the price down lower than it could be. Management of the area of the Bay outside of 12nm also remains a challenge. Here the season opens earlier in November and owing to a lack of exclusivity in this zone, the race to fish often leads to a glut on the market and depressed prices.

4.1 Institutional set up

4.1.1 Bay of Seine: Primarily exclusive to French vessels

A key characteristic of the Bay of Seine is that a large proportion of the area, up to 12nm, is exclusive to French vessels while a smaller part of the bay, outside of 12nm and known as the Proche Exterieur, is open to other EU vessels (mainly UK vessels with a smaller number of Belgian, Dutch and Irish boats) (Figure 6). The other key scallop fishing ground along the French coast is within the Bay of St Brieuc, but this area in contrast falls entirely within the 12nm zone. The French industry catches 75% of scallops within their territorial waters, with the rest caught in offshore waters. As a comparison, UK vessels have exclusivity out to 6nm of the south coast of England for scallop fisheries and catch the majority of scallops from the English Channel (>80%) within offshore waters.



The area within the red line is within 12nm and exclusively open to French vessels.
The area outside the red line and within the blue line is open to all EU vessels and known as the 'Proche extérieur'.

Figure 6 Bay of Seine, France

The scallops within the Bay are considered to be a self-recruiting discrete stock (Catherall, 2015). From this perspective it would clearly be advantageous if management covered the entire Bay. There are some EU regulations that apply to all EU fleets (such as a minimum landing size and effort restrictions for >15m vessels) but there are a number of national regulations that differ. For instance all French vessels are required to observe a closed season whereas other EU vessels can legally fish in the Proche exterieur during these months. These differences have led to tensions, escalating to the 'scallop wars' of 2012, but have since been partially resolved through an on-off negotiation known as the 'Bay of Seine Agreements' between the UK and French industry, with the administrations present as observers, which in effect gives the UK over-15m fleet more days at sea in return for staying out of certain areas along the French coast during specified periods (Box 1).

Box 1: Bay of Seine Agreements

In recent years, the UK and French scallop industry have negotiated the Bay of Seine Agreement in order to defuse tensions within the Channel. However this agreement does not cover Belgian, Irish or Dutch vessels.

The first agreement in 2013 gave UK over-15m vessels additional effort days in return for respecting the closed season in the Proche exterieur and not fishing in other areas off the coast of France at other points in the year. This provided a clear benefit to UK over-15m vessels that are considerably restricted by EU effort-limits, and was advantageous to the French industry that only use around 25% of their effort-limits and could negotiate to exclude UK vessels from contentious areas.

In 2013 a set amount of effort days for Over-15m scallop dredges were therefore transferred to the UK in exchange for staying out of the following areas:

- All of the Western English Channel (Area VIID) between 1st August and 1st October;
- Bay of Seine between 1st August and 1st November; and
- An area off the West Brittany Coast (North Finistere) between 1st August and 31st December.

In 2014 and 2015 the same agreement was extended. However at the end of 2015 there were tensions again as the French opened the Bay of Seine up to their own vessels 2 weeks before the agreed date, mainly as a response to concerns that Belgian and Irish vessels (not subject to the agreements) had been fishing in the Proche Exterieur during the closed season. Negotiations are ongoing to reach an agreement for 2016.

4.1.2 Co-management arrangements

A key feature of the French system is that the industry has a leading role in managing the scallop resources within the Bay. This is achieved through delegation of fisheries management from government to Fisheries Committees that exist at the local, regional and national level (Figure 7) composed of representatives of fishers, fish farming businesses, producer organisations and marine cooperatives.

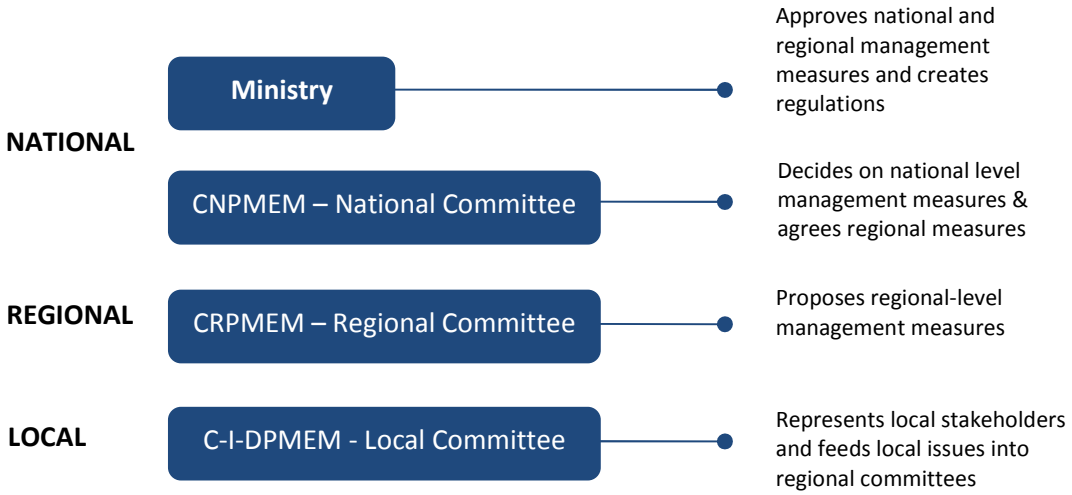


Figure 7 Fishery Committee Structure

At each level of the Fisheries Committees there are Shellfish Commissions that deal with specific management issues related to scallops and other shellfish. In the case of the Bay of Seine, there is one Shellfish Commission that represents all the three regional committees specifically for scallops in order to take decisions on the number of licences and other effort controls. The three areas cover: Basse Normandie, Haute Normandie and Nord Pas de Calais/Picardie, as illustrated in Figure 8. AT the national level, the Fisheries Ministry[7] is responsible for issuing national licences; ensuring French vessels adhere to EU regulations[8]; and approving regulations produced by Fisheries Committees.

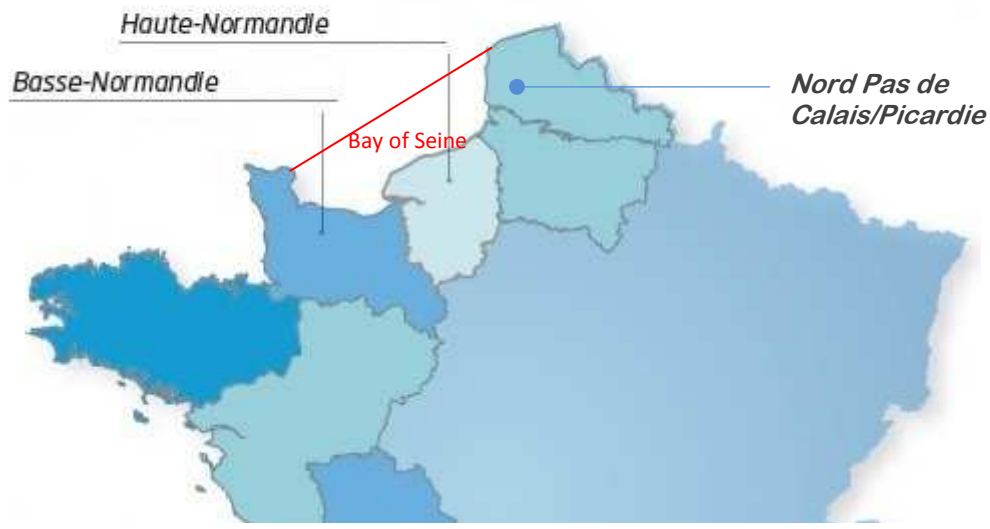


Figure 8 French regions bordering the Bay of Seine (NOT TO SCALE and divisions of the inner and outer part of the Bay not shown in this map)

[7] Ministère de l'Ecologie, du Développement durable et de l'Energie

[8] Particularly effort restrictions for over-15m scallop vessels (under the EU Western Waters Effort Management Regime) and the EU Minimum Landing Size of 100mm.

4.1.3 Access to resources: Individual licences

For French vessels, access to scallops within the Bay of Seine is granted though a limited number of individual licences allocated on an annual basis. Vessels are required to have both an annual national licence issued by the Ministry which permits fishing for scallops (under terms of a national closed season, minimum landing size, and limited dredge ring size); and an annual regional licence issued by the regional fisheries committees in order to fish within specific zones – of which the Bay of Seine is one. Details of licences for 2014/15 fishing season for the three regions surrounding the Bay of Seine are given below:

Regional Committee	Location	No. Licences	Type vessels
CRPMEM Basse Normandie	West of Bay	158	Vessels tend to be smaller in the West
CRPMEM Haute Normandie	East of Bay	54	Vessels tend to get larger to the East and North of the Bay
CRPMEM Nord Pas de Calais/Picardie	North/East of Bay	10	

Source: CNPMEM (2014) Délibérations du Bureau No. B23/2014: Relative à l'organisation de la pêche a la coquille Saint-Jacques dan le secteur de la Manche Est sur le gisement classé de la Baie de Seine.

In the Proche Exterieur, in addition to the limited number of French vessels, there are other EU vessels fishing under their own licensing rules. For UK vessels there is a capped number of UK over-10m scallop permits that can dredge for scallops in any waters open to the UK (allocated by the UK government in 1999), but they are not restricted to certain zones. For instance, in 2014 there were approximately 78 UK over-10m vessels active in the Channel but there were an additional 267 scallop permits that could have legally been used in that area but were active in other areas of the UK (MMO, 2014 data).

4.1.4 Conditions to the licences: technical measures

The main controls in the Bay of Seine after licences are fishing time (effort) restrictions. Fisheries committees agree the number of days a week and the hours per day that can be fished and this can be staggered at various intervals according to the state of the resource (for instance effort might be tightly controlled at the beginning of the season if growth rates are slow, allowing more time for Age 2 scallops to reach the MLS).

The closed season from 31st March until 1st October is universal, but there are different opening times for different areas which may change slightly each year:

- Offshore (outside of Bay of Seine): 1st October
- Proche Exterieur (>12nm in the outer Bay of Seine): 1st November
- Inner Bay of Seine (<12nm): 1st December

The range of technical measures and those that apply to the Bay of Seine are given below (Table 3). As well as effort restrictions there are daily catch limits, but these mainly concern the beginning of the season when there is a large biomass. There are also controls on the size of vessel and the number of dredges allowed. It is important to point out that there is a strong element of adaptive management in the French system. For instance based on scientific advice the exact date of the season can vary each year, and other measures can be changed by the Bay of Seine Shellfish Commission during the season e.g. closed areas, fishing time restrictions, and catch limits.

Table 3 Technical measures that apply to French scallop dredgers operating in the Bay of Seine

Measure	Bay of Seine
Dredge restriction (No. Dredges)	16 dredges
Dredge ring size *(national reg)*	92mm
Dredge design restrictions?	Yes (dredge width 12.8m max)
Vessel size/power restrictions	16m (330kW)
MLS	110mm
Closed season	Approx March – 1st Oct but can also extend until December (*Varies each year & generally season opens after 1st Oct – also differs in each zone of Baie de Seine – based on advice of Shellfish Commission*)
Closed areas	The shellfish commission agrees to close certain areas during certain months to protect juvenile scallops. The closed areas are both within and outside 12nm (Personal Communications, *Delphine Ciolek, CNPMEM, Jan 2015*).
Fishing time restriction	4 days/week open (& hours/day limited to 4hours in December and 6-12 hours after)
Option to close shellfish beds	Yes
VMS	Yes – for all vessels
Catch limit/boat	1800kg/day max (depending on length of boat)
SOURCE	*ICES, 2013*

4.1.5 Scientific assessment of the resource and management advice

The management of scallops within the Bay of Seine is based on science, with the French Research Institute for Exploitation of the Sea (IFREMER) undertaking annual surveys to determine the exploitable biomass and indices of recruitment in both areas of the bay (within and outside of 12nm). This can then be used by the Shellfish Commission (that meets three times a year) to take management decisions on dates for opening the season, number of licences and effort restrictions.

In the Bay of St Brieuc, a Total Allowable Catch (TAC) has been set so that that the scientific advice can be directly related to fishing mortality. It was possible to come to an agreement of a TAC in this area of France given that there is more of an even-playing field with similar sized boats operating from one fisheries committee.

In the Bay of Seine, it has not been possible to agree a TAC as there is much more heterogeneity and therefore no level playing field. In particular, fishers from Basse Normandie (in the West) are concerned that if a TAC was set, the larger boats (operating from the East) would take the majority of the allocation. The Bay of Seine is a much larger area (compared to the Bay of St Brieuc) and involves three different regional Fisheries Committees. The structure of the fleet is also very different with smaller vessels operating from the West of the Bay (10-16m) and much larger vessels (15m+) operating in the East and North. There are also different fishing strategies, with the smaller boats in the West going for lower quantities and higher quality; while those in the East/North fishing for greater periods of time, catching larger quantities and targeting a more industrial market (lower quality/higher quantities). As there is no TAC, IFREMER is not able to give advice on total fishing mortality for the Bay of Seine, but can give advice on effort controls, such as the number of days or hours of fishing time permitted for different areas, and their effect on yields.

National-level funding for the scallop assessments is being reduced, but the Bay of Seine Fisheries Committees have recently increased licence fees to be able to contribute to the costs. The administration wants to move to a situation where 50% is paid for by the national level and 50% from regional contributions including the fishing industry.

4.2 Seasalt Analysis

The SEASALT analysis illustrates a striking difference between the institutional arrangements in the inner and outer part of the bay, with the Inner Bay of Seine showing stronger attributes for exclusivity, an ability to limit mortality (through controls on fishing) and a certain degree of security through annual licences. (Although not explicitly a right the privilege given to fisheries committees to manage scallop resources has been equated here to the lease given to the SSMO in the Shetlands example). In comparison, within the Outer Bay of Seine (Proche Exterieur) the institutional set up allows for no exclusivity or security and limited ability to directly restrict fishing mortality. Given that the stock spans the entire Bay, it is not possible within the current institutional arrangements to manage and control fishing mortality at the scale of the stock.

SEASALT Analysis: Inner Bay of Seine, France

	SEASALT Attributes	Current State Comments
Secure	*Length of privilege tenure*	High security of managment control via Regional Committees. Medium security in annual individual licenses
	Renewal of the privilege	There are a clear set of criteria for renewing licenses but numbers of licenses have been reduced over time.
(Individual Licenses)	*Access and allocation privileges are defendable by law*	Licenses are clearly enforced.
Exclusive	*Defined quota or area-based allocations to entities*	Area based licenses via regional licenses but no individual catch allocations.
	New entrant conditions	There are clear criteria on eligibility for a licenses and a system for prioritising requests.
	Penalties for infringement of access privilege	Licenses are enforced
All Sources	*Allocation for landings and discards/by catch*	Assume that scallops have high survivability and allocations not required for discards
	Fishing controls incorporates other fleets or recreational users	Dredge fleet is the main fleet targeting scallops. Assume that IFREMER have good data on scallops from all sources.
	Monitoring systems are in place	Most vessels fitted with VMS
Scaled	*The stock is under a single or coordinated accountable management unit (such as with other fleets)*	Discrete stock within Bay of Seine but part of these lies within 'Proche Exterieur' which is managed under different conditions
Accountable	*Fishery regulations or other rules state that fishermen have to comply with controls on mortality*	Fishermen have to comply with a range of rules on effort limits, Minimum Landings Sizes, closed seasons, temporary closed areas, dredge and vessel limitations.
	There are mechanisms to enforce regulations, rules and/or community agreements	Assume that there is medium level of compliance as some comments on some IUU e.g. Fishing out of season
	Participatory management of the resource	Fishing industry is clearly involved in management decisions through clear co-management rules and structures.
Limited	*Use of best available science to limit the fishing mortality*	IFREMER conducts annual surveys and results show that catches do not exceed estimated 'exploitable biomass'
Transferable	*Informal or formal mechanisms to transfer shares and/or quota or fishing area (in the case of a TURF)*	Licenses are not transferable
	Regulations or limitations on transfers of permits and/or quotas	

SEASALT Analysis: Outer Bay of Seine, France (Proche Exterieur)

	SEASALT Attributes	Current state Comments
Secure	*Length of privilege tenure*	As the Proche exterieur is shared between EU states with no overall cap, there are no fishing privileges
	Renewal of the privilege	No fishing privilege for renewal
	Access and allocation privileges are defendable by law	No fishing privilege legally defined
Exclusive	*Defined quota or area-based allocations to entities*	There are only area-based licenses relevant to the French fleet and not to other EU fleets
	New entrant conditions	Other nations vessels also target scallops in this area and therefore dilution can occur
	Penalties for infringement of access privilege	There is no exclusive access privilege
All Sources	*Allocation for landings and discards/by catch*	Discards in this fishery are considered to be low (less than 5% of the catch)
	Fishing controls incorporates other fleets or recreational users	Total landings in this area can be calculated but not all fishing controls are related to the state of the stock or total catches
	Monitoring systems are in place	All vessels have VMs and landings are recorded by national authorities
Scaled	*The stock is under a single or coordinated accountable management unit (such as with other fleets)*	The stock spans into the inshore area and there is no coordinated management (across all EU states) for the Bay of Seine stock as a whole
Accountable	*Fishery regulations or other rules state that fishermen have to comply with controls on mortality (effort controls, size limits, catch limits and quota, etc.)*	Fleets are required to comply with EU effort controls and rules associated with national licenses
	There are mechanisms to enforce regulations, rules and/or community agreements	Assume that enforcement results in medium-level compliance
	Participatory management of the resource	French industry involved in French management but overarching management of the area with co-management arrangements
Limited	*Use of best available science to limit the fishing mortality*	The areas is assessed by IFREMER and good knowledge of total catches but this is only linked to French effort limits
Transferable	*Informal or formal mechanisms to transfer shares and/or quota or fishing area (in the case of a TURF)*	There are no fishing privileges that can be transferable. French fishing licenses are not transferable. UK Over-10m permits are transferable with a vessel.
	Regulations or limitations on transfers of permits and/or quotas	

The following table illustrates the key differences between the inner and outer part of the Bay:

	Inner Bay of Seine <12nm zone	**Outer Bay of Seine** Proche exterieur (>12nm)
Strong SEASALT attributes	✓ Well defined area with limited number of licences ✓ Science leads management decisions ✓ Fishing industry involved in management decision-making	✓ Limited number of French licences
Weak SEASALT attributes	× Licences allocated for 1 year so not fully secure × Management does not cover the entire extent of the stock	× No exclusivity or security as other EU vessels dilute access rights × Management not at the scale of the stock × No coordinated management or shared rules

4.3 Performance

4.3.1 Economic

Relatively good prices achieved but could be higher

On average the prices for Bay of Seine scallops are good (compared with average prices within UK English Channel ports and within the Western Channel ports in France). The average price between 2009 and 2013 ranged from €2.7-2.9/kg but can reach much higher levels (€4-5/kg) during peak demand.

Country	Ports	Average prices €/kg (2009-2013)
France	**Eastern Channel (Bay of Seine)**	**2.7-2.9**
	Western Channel	2.0-2.3
UK	English Channel Ports	2.1-2.3
	All UK	2.5-2.8

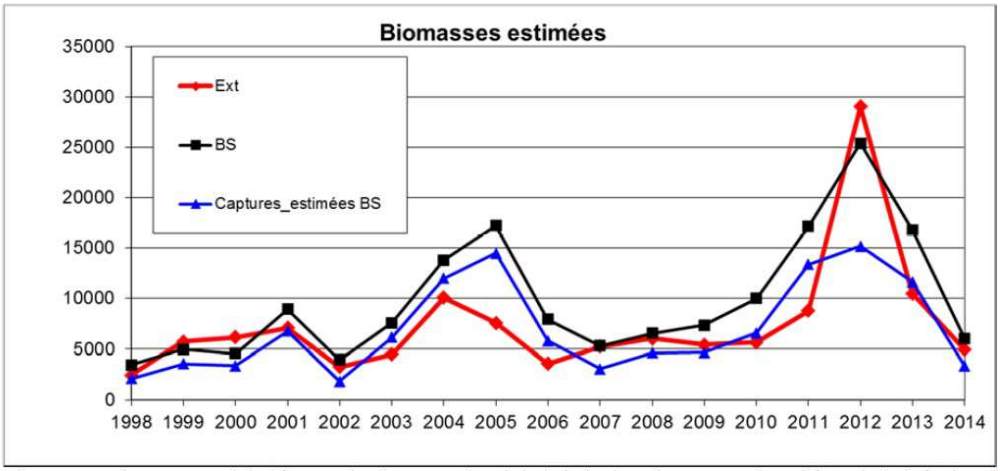
However, a report carried out in 2013 (Le Gallic, 2013) suggested that prices could be higher if there were not a race to fish in the outer areas of the Bay (>12nm). The season here opens in November which can lead to over-supply and depressed prices before peak demand in December and January. The report suggested that another part of the problem is a minimum price system operated by Producer Organisations whereby they will buy scallops from fishermen if the price falls below a minimum threshold. These scallops are then sold through other channels or frozen and sold at peak demand. This gives fishermen security of a minimum price but means that production is not tailored to the market.

4.3.2 Environmental

Stock sustainability

IFREMER's annual assessments of scallop resources in the Bay of Seine appear to suggest that the stock is fished within sustainable limits (Figure 9). For instance, estimated catches within the 12nm limit (blue line) are consistently below estimates of exploitable biomass (black line).

Figure 9 Exploitable scallop biomass (t) < 12nm (BS) and > 12nm (Ext) of the Bay of Seine

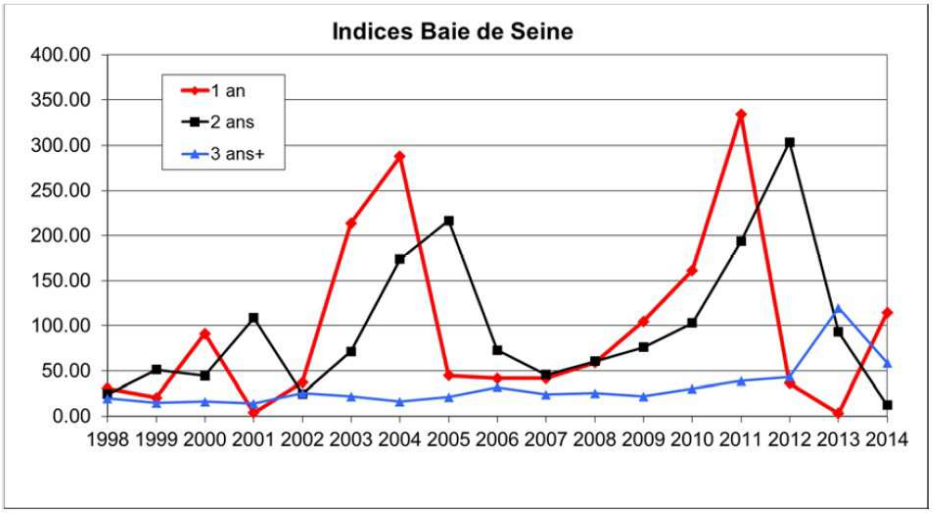


Source: Foucher, 2014

From IFREMER's perspective the fishery is maintained at a fairly sustainable level given that French boats within 12nm will stop dredging as soon as yield goes down to a level that is no longer economically viable, leaving sufficient whole scallops behind to support ongoing reproduction. The growth of scallops in the Bay of Seine is also very fast- reaching MLS in 2 years, compared to 4-5 in the UK and 6-7 years in Norway.

However, IFREMER recognises significant weaknesses in the system. One weakness is that the fishery is reliant on good annual recruitment as the stock is dominated by Age 2-3 scallops (Figure 10). The fishery could survive with one year of poor recruitment but it could seriously affect the fishery if there were 2-3 years of poor recruitment. This has not yet happened, but is a possibility given that recruitment is strongly related to climatic conditions such as temperature and wind. The fishery is also reliant on good growth rates: in some years of slow growth rates not all Age 2 scallops will have reached the minimum landing size by the opening of the season.

Figure 10 Evolution of indices of abundance per age group of scallops in the Bay of Seine



Source: Foucher, 2014
Notes: Recruitment of age 1 scallops was high in 2004 and very high in 2011, but fell to a low level in 2013 and increased slightly in 2014.

Another key weakness is the open-access nature of the Proche Exterieur and the lack of common rules, which leads to a 'race to fish' in this area. The Shellfish Commission is often reluctant to limit the number of effort-days within the Proche Exterieur knowing there are no such restrictions on other EU vessels.

4.4 Issues and opportunities

Challenges

Despite the many benefits of the Bay of Seine system, there are a number of issues that have been raised, in particular that there is still a 'race to fish' within the Proche Exterieur and IFREMER is concerned that there is too much effort within the fishery to allow for a robust stock in the long-term. This is less of a concern within the Inner part of the bay where fishing only begins in December and boats will only fish for a few weeks throughout the season. However, there is still some tension and competition within the inner part of Bay of Seine as it is managed by three regional committees representing considerable differences (i.e. in size of vessels and approach), although this is resolved to some degree through coordination at the Bay of Seine Regional Shellfish Commission.

However, the main area of concern regarding the 'race to fish' is the Proche Exterieur (>12nm), where most of the scallops are caught early in the season (Nov), with smaller quantities available during the peak season when prices are higher (Dec/Jan) (Abso Conseil (2010). The lack of exclusivity for French vessels compounds this situation, as well as the minimum price offered by Producer Organisation which weakens the incentive to wait for higher prices later in the season. However a key challenge in this area is clearly the lack of coordinated management between the different catching nations involved in scallop fishing within the Proche Exterieur.

Opportunities for improved management

There are a number of opportunities to improve management within the Bay of Seine:

- Shared management is needed for the Proche Exterieur: the obvious platform would an agreed set of rules at the EU regional level (e.g. closed season, technical restrictions), however the industry is wary of EU regulations and would prefer to be able to find a solution multi-laterally than have additional EU rules imposed on them.
- IFREMER recognises that scallops lend themselves well to quota allocations, however there are a number of concerns from the industry:
    - Concerns that larger boats would have a greater allocation of a TAC;
    - Concerns that if individual quotas could be sold they would be bought up by bigger boats/industry with nothing left for the smaller operators; and
    - Mistrust of the EU quota system.

However, despite this reluctance IFREMER Normandy has started discussions on a system where sold quota could be given back to the administration from where it could be reallocated (i.e. leased out to fishermen).

4.5 Lessons

Exclusive rights

Limiting licences per area and having only French vessels within the 12nm zone provides a certain level of secure tenure where fishing is conducted within sustainable limits. This approach could be applied within the rest of the Channel restricting the number of licences to different fishing areas. However, the French system does not give is not full security given that licences are only valid for a year, so that management still relies on a large range of technical measures. Further security would be given with longer licence periods, and greater sustainability with an ability to directly limit fishing mortality in line with the state of the resource.

Strong coordinated co-management

Through the institutional structures of the Fisheries Committees, the fishing industry plays a lead role in managing the scallop resource and owing to the levels of secure tenure within 12nm have a strong incentive to ensure they are sustainable. There are also important levels of coordination, with one Shellfish Commission for the Bay of Seine representing the three Fisheries Committees that border the Bay. Such coordination is vital for the English Channel context, both at the level of the IFCAs within 6nm of the UK coast and between management structures within different EU catching nations.

Adaptive management

There is a significant amount of adaptive management built into the French system where Shellfish Commissions can make changes to certain measures at the beginning and throughout the season. Currently there is no scope for adaptive management of the offshore and UK English Channel Scallop resources as the main limits e.g. EU MLS; WWEMR effort limits and UK scallop capped permits cannot be changed on a regular basis and have not been set in relation to the state of the resource.

Good science

There is a good understanding on the scallop stock in the Bay of Seine and management takes into consideration the state of the stock and indicators of recruitment and growth. There is a recognised need for stock assessment of the scallop resources within the offshore and UK areas of the English Channel, as well as clarity on what information is needed to support improved management.

Good relationship between scientists and industry

There appears to be a good level of trust between the scientists and the industry, with IFREMER invited to meetings of the national and regional Fisheries Committees to present their latest scientific advice, and present advice in a way that can easily be used to make management decisions. Some of the reasons for this level of trust include[9]:

- Continuity of personnel for 15+ years (with a working relationship that took time to develop but has been founded on common ground i.e. a wish for there to be scallop biomass in future years);
- Proximity of the IFREMER offices to the docks allowing scientists to meet with fishermen on the quay frequently and have ongoing discussions;
- Respect by the scientists for the knowledge of fishermen;
- Personal contacts via regular meetings and mobile phone.

The International Council for the Exploration of the Sea (ICES) has a Scallop Working Group which includes collating information on English Channel scallop resources. There are opportunities to develop working relationships between scientists and industry to gain a better understanding of the resource and determine information needs for management.

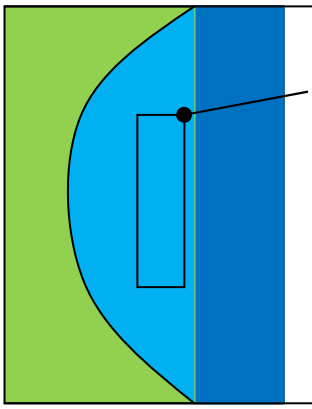
[9] Personal Communications, Eric Foucher, IFREMER, 19th January 2016

5 Cross-comparative analysis

5.1 Institutional means to achieve secure tenure/use-rights

The case studies explored in this report illustrate a range of models for achieving secure tenure or allocating use-rights. These are illustrated figuratively below, along with their key characteristics.

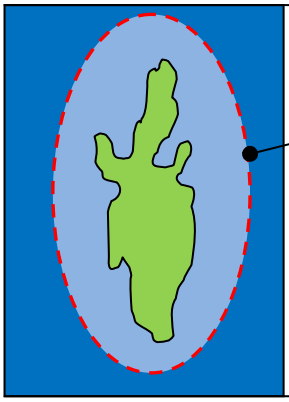
Ramsey Bay Lease Arrangement



- 5-Year Lease given to Producer Organisation (PO)
- Annual TAC agreed
- Profit share among members of the PO
- Detailed scientific assessments supports decision on TAC

- o No 'race to fish'
- o No issues on whether a 'level playing field' as all profits shared equally
- o Institutional set-up facilitated by trust between members of the PO and good working relationship with authorities & scientists

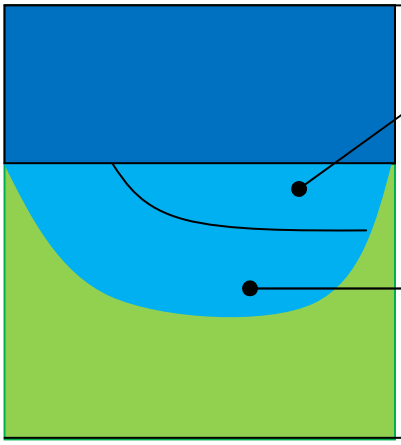
Shetland Island Regulating Order



- 15 Years Regulating Order awarded to Shetlands Shellfish Management Organisation
- Limited number of individual licenses within 6nm zone
- No TAC or individual catch shares

- o Medium levels of exclusivity
- o Institutions and rules facilitated by good working relationships with authorities and scientists
- o Close knit community facilitates good

Bay of Seine Limited Area-specific Licences



- Fisheries committees have delegated responsibility for managing fisheries within 12nm
- Limited number of French annual licences within <12nm but EU boats not limited >12nm
- No TAC or individual catch shares

- o Good levels of exclusivity within 12nm – less race to fish
- o No exclusivity >12nm – greater race to fish
- o Strong French co-management structures for inshore zone
- o Good working relationships between French scientists & industry

5.2 Drivers of change

From the examples presented in this report, it emerges that a key element for success is the close involvement of the industry. For example in the Shetland Islands, the Shetlands Fisheries Association (SFA) led the search for ways to gain more local control over their fishing waters which was granted through the Regulating Order (RO).

The fishing industry has every reason to support stock and habitat conservation but existing institutional structures often incentivise a race to fish. Changing the institutional structures is crucial in changing incentives for the fishing industry from catching at all costs towards sustainable profit objectives that will deliver stock productivity and conservation objectives as a by-product. For example in Ramsey Bay, the producer organisation is strongly incentivised to maintain the ecological integrity of the marine reserve in order to maintain the economic benefits of the lease arrangement. Similarly in the Shetland Islands, with the RO in place, the Shetland Shellfish Management Organisation (SSMO) led the proposal to close vulnerable habitats (such as maerl and horse mussel beds) to scallop dredging.

5.3 Benefits of change/allocation of use-rights

The case studies presented in this report strongly support the general finding that assigning secure tenure can eliminate or at least attenuate the 'race to fish'. As expected, the best results from both economic and environmental perspectives are found where the rights are the strongest. The Ramsey Bay lease arrangement, with a TAC and profits shared among all members of the PO, has allowed the industry to specifically target fishing to peak demand on the market. Moreover, the industry supports a TAC that is agreed in line with the state of the resource and there is no incentive to attempt to catch the TAC ahead of other members as each member gets the same share of the profits.

The economic benefits in the Ramsey Bay example are tangible with the value of harvests increasing so far on an annual basis from £64,000 in 2013 to an estimated £132,000 in 2015, and the Producer Organisation and fishermen keen to apply the lease-arrangement to other areas around the island. On an environmental level, Ramsey Bay has been zoned with key vulnerable habitats protected and a small managed fishery allowed within a specific time frame and conditions that maintain ecological integrity. The full range of benefits apparent from the Ramsey Bay example are summarised in Table 4 below.

Table 4 Summary of economic and environmental benefits from the Ramsey Bay Lease Arrangement

Economic benefits	Environmental Benefits
+ Value of harvest increased by £68k since 2013 + Price increase of £4/kg (scallop meat) +Reduced fuel costs with 1,400 less miles travelled (in 2013) + £1,500 member profit share in 2013 + Potters benefited from exclusive access during scallop closed season	+ Recovery of scallop populations with high densities, large sizes and good recruitment + Fishing impact on the seabed limited to 3-4% of FMZ + Undisturbed spawning during summer months + Industry showing increased stewardship

Similarly in the Shetland Islands the economic and environmental benefits of secure use rights have been felt, with the scallop industry described as 'buoyant' and the SSMO considering applying to extend the Regulating Order out to 12nm. Furthermore key vulnerable habitats have been protected

and the fishery awarded Marine Stewardship Council certification which assesses the sustainability of the stock, effective management and impacts on the wider environment.

In the Bay of Seine the number of scallop licences is limited. and within 12nm there is exclusivity for French vessels. For these areas regional fisheries committees have been able to agree an opening of the season in December to coincide with the peak market and to effort levels that will maximise yield. However in the areas outside of 12nm within the Bay of Seine that are open to other European vessels, there is still a race to fish starting in October, often leading to a glut on the market. The committee responsible for the Bay of St Brieuc (in another area of France) has been able to go further and agree a TAC which works given that most vessels are of a similar size, unlike in the Bay of Seine where significant differences between fishing vessels and approaches has made it difficult to agree to a TAC.

Allocating secure tenure does not necessarily lead to a concentration of 'rights'

The examples in this report illustrate how it is possible to create some level secure tenure without leading to a concentration of 'rights'. For example in France, licences are allocated on an annual basis and are only valid to a skipper and his specific vessel. In this case there is a trade-off with security of this access which would be greater if licences were allocated for a greater time period. In the Ramsey Bay example allocating the lease to the Producer Organisation for 5-years and making it non transferable provides greater security than the French example and means that the benefits are not concentrated but shared among the membership to the Producer Organisation. Similarly in the Shetland Islands a licence is automatically renewed on an annual basis giving high security, but when a fishermen retires the permit returns to the pool and is not a 'right' that can be sold or passed on. Apart from the licence or permit fees, none of these case studies have considered extracting 'rents' from the fisheries in question or debated where these dividends could be allocated to support the wider economy or communities.

5.4 Attributes of secure tenure: SEASALT analysis

Comparison of the three cases against the SEASALT principles reveals the similarities and differences between the different approaches, and also illustrates the marked difference with the current situation in the Offshore Channel area (last row). The four key SEASALT attributes: Security, Exclusivity, Accountability and Limited fishing mortality are given below.

Case study	Use-right arrangement	Validity	Security	Exclusivity	Accountability/ Compliance	Limited: Capacity in line with resource
Ramsey Bay, Isle of Man	Authority gives lease to PO with an associated TAC within specific zone. PO organises profit-share of catch.	Lease valid for 5 years	Medium security	High exclusivity for PO (including area catch allocations)	Strong co-management structures and good compliance	Fishing mortality directly linked with state of the resource & good scientific assessment of the resource
Shetland Island	Delegated authority gives out limited licences to specific area 6nm around Shetland Islands	Regulating Order in place for 15 years. Licences valid for 1 year: automatically renewed unless breach of regulations	High security (of the Regulating Order) Medium Security of individual licences	Medium exclusivity for licence holders (no catch allocations and pressure to increase number of licences)	Strong co-management structures and relatively good compliance	Good scientific assessment but fishing mortality not directly linked to state of resource. Effort limits required & would expect some 'effort-creep'
Inshore Bay of Seine, France	Authority gives out limited Licences to a specific area	1 year	High security in management control of Fisheries Committees (delegated authority rather than 'access right') Medium security for individual licence-holders	Medium exclusivity for FR vessels within 12nm (but no catch allocations)	Strong co-management structures and relatively good compliance	Good scientific assessment but fishing mortality not directly linked to state of resource. Effort limits required & would expect some 'effort-creep'
Offshore English Channel	French vessels limited in number and to zone; UK over-10m vessels permits limited in number but not to zone and could legally increase in Channel by over 3X	FR: 1 year UK: Tradable permit not linked to a zone or catch share	Medium security	No exclusivity to permit/Licence holders	No cross-boundary co-management structures for off-shore area	No scientific assessment, limits are not related to the state of the resource

Cross-comparison between case studies

Comparison of SEASALT attributes between the case studies illustrates the nuance in the similarities and differences between the examples. All three examples share high or medium exclusivity either through a limited number of permits/licences for a given area or by the award of a lease to a single organisation with a profit-share arrangement. Accountability is also good in all three cases with strong co-management structures and good working relationships between the industry and the authorities and scientists.

However it is worth noting that is often cascading levels of rights, for instance with organisations holding long-term leases at one level (for instance the 5-year lease for the MFPO in the Isle of Man and the 15 year Regulating Order to the SSMO in the Shetlands) who then choose to pass these rights onto their members in different forms for example licences (such as the annual licences in France and Shetlands) through to profit share arrangements (e.g. in the Isle of Man). The rights at these different levels are likely to have different impacts on incentives.

There are also differences in how fishing mortality is limited. The Ramsey Bay example is the only one where fishing mortality is directly linked to the state of the resource through use of a TAC, where in the Seine Bay and Shetlands example mortality is controlled through effort limits. Effort limits do appear to work where there is a strong sense of stewardship, but there is always the threat of 'effort-creep'.

The length of tenure is a key issue in use right systems. Economists often argue that permanent rights are required to release the full economic value of fish resources but policy-makers may be reluctant to go this far due to the potential cost of correcting any errors in the system design or implementation. Very short-term rights, such as annual renewable licences, are not considered to generate as significant security or economic benefits.

Renewal of limited duration rights is another important issue. It seems particularly important to avoid coming to the end of a period of rights for the obvious reason that the incentives to fish sustainably will diminish with the rights, and this is seen in the Shetland Islands where preparations for renewal of the Regulating Order begin a good year in advance.

Comparison with the current Offshore Channel situation

Comparing the three cases with the current situation in the offshore areas of the English Channel is revealing and illustrates some of the key missing elements in the current regime (in terms of SEASALT attributes). Firstly there is no exclusivity to the resource and while there are some limits set by individual EU nations and effort limits set by the EU, current numbers of UK vessels alone could legally increase by over 3x within the Channel. Secondly there is no overarching co-management structure that manages access and rules or allows for participation of the industry within management decisions, and there is no recent scientific assessment of the overall scallop resources within the English Channel. Lastly controls on fishing mortality (e.g. the EU effort limits) are not linked to the state of the resource.

5.5 Role of scientific advice: science/industry interaction

The case studies highlight the importance both of a good understanding of the scallop resource on which to base management, but also of a good working relationship between industry and science. For example in the Ramsey Bay example, initially the industry and the authorities undertook separate surveys but now both collaborate on survey design and implementation. This clearly assists with a shared understanding of the state of the resource.

A strong scientific/industry relationship is also important for ensuring that science directly supports management decisions. For example in the Shetland Islands, scientists provide assessment results in terms of LPUE which directly supports the harvest control rule while in Ramsey Bay assessments lead to calculation of a TAC. In the Bay of Seine IFREMER provides advice, based on annual surveys, on the number of effort days committees can open the fishery and the effect of different scenarios on scallop yields. This illustrates the need for clear management objectives so that scientists can provide clear advice linked to management of the stock.

In all the examples a sense of trust has developed between industry and scientists, in many cases enhanced by close-knit communities and open communication channels. For example, in the case of IFREMER's relationship with the fishing industry in the Bay of Seine, it has been linked to the proximity of the scientists' offices to the fishing docks enabling regular contact and discussions as well as respect of fishermen's knowledge and agreement on common goals. Similarly in the Isle of Man there is a very short distance between fishermen, scientists and decision-makers.

Importance of Adaptive Management

The institutional set up in all three cases allows for adaptive management of the resource. For instance a TAC and dates of fishing are agreed annually for Ramsey Bay, effort limits are agreed annually for the Bay of Seine, and there is an annual review of LPUE for the Shetland Islands scallops to determine whether any new permits can be issued.

5.6 Challenges

5.6.1 Equity of Access

When restricting access a key challenge is deciding who gets access and how the process can be fair. The ideal situation is to restrict access in line with the state of the resource, which in reality often requires reducing capacity. If access rights are transferable market measures allow for reduction in capacity, but in the case studies presented here this was avoided to prevent a concentration of benefits. Instead in some examples (e.g. Bay of Seine and Shetland Isles) retired permits are returned to the pool and can either be reallocated or removed from the pool to reduce overall capacity.

The case studies illustrate some of the tensions surrounding equity of access, and the ongoing pressure often apparent to open up access to a wider group. For example in the Shetland Islands, the Inshore Fishermen's group developed a group to lobby for more permits for smaller-scale operators, which they achieved with representatives of the group added to the SSMO management board. It appears important to have clear guidelines and criteria on how access rights are allocated, for example the SSMO has now separated licensing decisions from the main SSMO board and set out clear criteria as well as transparency on review procedures.

The debate about transferability of rights versus the risk of concentration is a common one. To some extent, it arises because people inherently feel that it is fair that the benefits of exploiting the fish resources should be spread widely and equitably but they tend to see such benefits only in terms of fishing itself. Once the economic benefits from fishing are divorced from the act of fishing, as is the case in Ramsey Bay with the dividend system, a different set of considerations come into play. In particular, this raises the question of what allows someone to be a shareholder and hence qualifies them to receive a dividend. Issues like this have long been resolved in other sectors but they remain novel in the case of fishing, and it is important that these issues are debated widely.

5.6.2 Funding research

Another key challenge apparent in many of the case studies is the reduction in centralised funding for scallop surveys and stock assessments. For example in France, the Ministry of Research is not able to provide all the funding required in future years and as a result the industry is starting to address this shortfall by increasing the cost of annual Licences in order to contribute to scientific research. In other areas of France (e.g. Brittany), the industry are involved in data collection with surveys designed and analysed by IFREMER scientists.

6 Lessons for the English Channel Context

6.1 Applicability of lessons to the UK Inshore Area

IFCAs could provide exclusive and secure access to scallop resources within the 6nm zone

The examples given within this report are on a relatively small scale, which makes it easier to imagine applying the lessons to a restricted zone such as the UK inshore area of the English Channel, where IFCAs are responsible for fisheries management up to 6nm and UK vessels have exclusivity to scallop resources. Between 6 and 12nm UK shares access with France in all areas apart from off the Devon coast, and outside of 12nm there are British, French, Belgian, Irish and Dutch scallop vessels operating.

The following diagram illustrates the main IFCAs responsible for management within the <6nm area that borders onto the English Channel (Figure 11: Not to Scale).

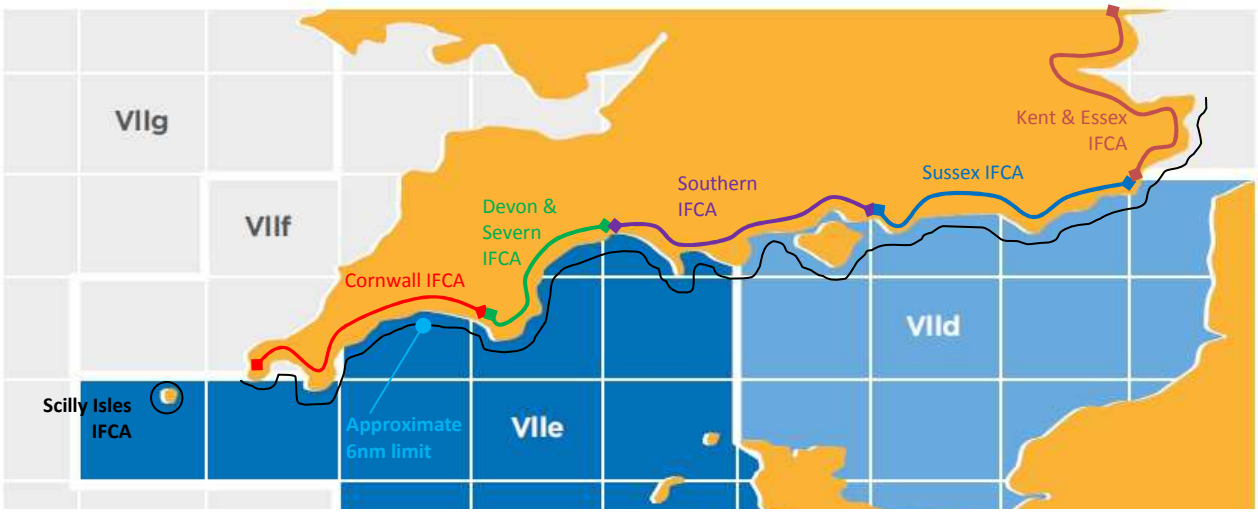


Figure 11 IFCAs bordering the English Channel (NOT TO SCALE)

In theory the five English IFCAs along the south coast bordering the English Channel have the legal powers to create permits for scallop dredging within 6nm and restrict their numbers in order to provide exclusive access. As an example of this principle in action, the North Eastern IFCA (outside of the English Channel) has limited the number of fixed nets in order to protect bass stocks. Permits are allocated on an annual basis based on criteria and are non-transferable.

Based on the examples reviewed in this report there are a range of ways IFCAs could provide secure tenure with potentially different outcomes. Table 5 below illustrates some of the options, including limiting licences to a certain area with or without a TAC (as in France) and with or without individual allocations, each with different effects on the security of access and the ability to limit fishing mortality in line with the state of the resource. It also illustrates the different levels of rights that can be applied, for example at the organisational level and at the individual fisher level.

Table 5 Some options when allocating user-rights to IFCA-managed scallop resources

Increasing security of access →

Organisational level	Annual Lease to organisation	Organisational lease for <5 years	Organisational lease for 5+ years
Individual level	Annual individual permits	Longer term individual permits TAC agreed	Longer term individual licences, TAC agreed and individual catch allocations *or* profit share system

→ *Increasing control on fishing mortality in line with resource*

Along these lines, Devon and Severn IFCA has introduced mobile-gear permits within its remit that have to be renewed each year allowing the IFCA to set adaptive conditions without having to publish new by-laws. There are currently no plans to limit these permits as there is concern it may push out smaller operators.

However, the examples reviewed here illustrate that it is still possible to allocate exclusive access without concentrating benefits (although there is a likely trade-off with security of access and economic efficiency). For example both in France and the Shetland Islands licences are non-transferable and return to the collective pool if not renewed, whereas in the Ramsey Bay example allocating the licence to the producer organisation and making it non-transferable means that the benefits cannot become concentrated, as long as criteria for membership to the Producer Organisation remain inclusive and transparent. In the English Channel context, producer organisations may not be the right institution to lease rights (as not all fishermen are members) but it may be possible to set up a more representative organisation.

Understanding scallop resources within and outside the IFCA 6nm zone with industry involvement

There is evidence to suggest that scallop resources along the English coast (from the east side of Fal Bay to the Sussex coast) can be considered a single stock and could form a useful fisheries management unit. However this stock is not restricted to the 6nm zone and it would therefore be important to understand the state of this stock both within and outside 6nm, and consider how management would be coordinated across the boundary.

Overall, there is a significant lack of information on the state of scallop resources both along the English coast and further offshore in the Channel. However, some IFCAs are starting to collect information on catches within their zones through the use of Inshore VMS (e.g. this has become a condition of the Devon & Severn mobile gear permits). The UK Center for Environment, Fisheries and Aquaculture Science (CEFAS) and Bangor University are also developing an assessment methodology for the Department for the Environment and Rural Affairs (England and Wales) (DEFRA) to assess English scallop stocks which would complete this picture, although it is not clear when the assessment will be implemented and how it will be financed.

The case studies clearly illustrate the importance of having a good working relationship between the industry and scientists in facilitating discussions on management. This is enhanced by collaborating on surveys (such as in the Isle of Man), regular contact and discussion (as in Normandy, France) and through making scientific data accessible in an intuitive form (for example the map-based programme developed in the Shetland Islands.)

IFCAs need coordination specifically on scallops within the English Channel

If IFCAs were to take on more active control and adaptive management of scallop resources within the 6nm zone they would need a system of coordination, specifically on scallops, between all the 5 relevant IFCAs (as well as with management outside of 6nm). Currently there are a range of different technical measures, such as limits on the size of vessels, night-time curfews and maximum dredge numbers that apply within different IFCAs. IFCA-membership includes fisheries representatives but also has a strong conservation influence. It may be possible to set up a Scallop Committee (as in the Bay of Seine) which represents the different regions and has a stronger fisheries contingent to support co-management of the resource, possibly as a sub-group of the Association of IFCAs[10].

Adaptive Management

IFCAs have the ability to attach certain conditions to permits which can be changed on an annual basis. IFCAs are also able to bring in emergency by-laws such as the closure of scallop beds if there is evidence that resources are severely depleted or there is high number of juveniles. Such a remit could be utilised to foster adaptive management of scallop resources in the Channel.

6.2 Applicability of lessons to the Offshore Channel area

Issues of Scale

The success of the case studies within this report is to some degree facilitated by their small-scale nature. For instance the close-knit nature of communities on the Shetland Islands and the Isle of Man goes a long way to facilitate community consensus and help agree on institutional set-up and management regulations. Similarly in France it was found that a level of homogeneity between the fleet in the Bay of St Brieuc helps to agree on mechanism such as a TAC and allows for a more level-playing field that would be important in the absence of individually allocated catch shares.

However, despite this leaning towards small-scale examples there are a number of principles within these cases that could be applied to the offshore context, although there are likely to be greater challenges given the context of different countries' level of involvement and a variety of approaches and existing rules that span different boundaries. These principles are summarised below and are matched against the key challenges in the current offshore scallop management regime that were highlighted as part of the SEASALT analysis in Section 7.4.

Applicability to the Offshore context

The key suggestion is that it is critical to create secure and exclusive access as a foundation of management, on top of which a range of management tools can be applied. As with the inshore situation this exclusive access could be applied in a number of different ways ranging from individual allocations, to lease arrangements at the country or producer organisation level. A novel approach for example, would be define fisheries management zones within the offshore area of the Channel and to establish a fisheries management companies made up of all the EU vessels currently fishing within these zones. These companies or organisations would then be responsible for managing the scallop resources within these areas to the benefits of their members either allocating access permits or setting up profit share systems.

[10] http://www.association-ifca.org.uk

Challenges highlighted by SEASALT Analysis	Principles that could be applied
No exclusivity to scallop resources (outside FR territorial waters) leading to a 'race to fish'	Create secure and exclusive access as a foundation of management
No overarching management for scallop resources within the Channel and no coordinated means of co-management or participation of stakeholders	Create an institution that can coordinate management between catching nations and their fleets and involve industry through co-management structures
No recent assessment of the distribution and state of scallop resources in the Channel	Understand the distribution and state of scallop resources
Controls on fishing mortality are not linked to the state of the resource	Link adaptive fishing controls with the state of the resource

Clearly before any of this can be achieved there needs to be some form of overarching management institution for the Channel either at the EU level or agreed between the key catching nations (France, UK, Netherlands, Belgium and Ireland), with clear means to represent industry and facilitate co-management. While there is an EU system of scallop effort limitation through the Western Waters Effort Management Regime, effort levels are set at an arbitrary level and cannot to changed in response to the state of the stock. Currently both the French and UK industry are wary of further EU regulations, yet discussions may reveal different ways of creating secure tenure without falling into the perceived pitfalls of the EU quota system.

There is also a need for a scientific understanding of the resource as well as agreeing management objectives so that scientific advice can be tailored to support management. Lastly, fishing controls need to be linked to the state of the resource. It could be envisaged that TACs could be agreed for specific areas, although this works best where there is a level playing field and a number of technical regulations (e.g. closed seasons) would need to be harmonised in this case. Another option would be to establish 'real-time' closures when catches fall below a certain level and this is discussed in more detail in Section 7.4.

Challenges

Applying this type of approach to the offshore context faces a range of challenges, not least the complex array of current rules and institutions that exist and the very different approaches between catching nations which has often led to misunderstandings and mistrust. Building trust and cooperation at all levels, as well as setting up institutions that provide a fair representation of stakeholders will be important for ongoing discussions.

There are also current institutions and regulations that would need to be untangled. For instance the current EU-limits on effort for the over-15m scallop fleet under the Western Waters Management Regime would need to be reformatted if secure tenure was established and potentially replaced with limits on fishing morality that were linked to the state of the resource. There would also be issues with the current UK over-10m permits that have been allocated as rights but are not limited to specific areas. This may require the UK to change regulations or 'buy-out' certain permit rights to fish within the Channel in order to limit numbers that can legally fish in this area.

6.3 Management approaches for scallop fishing in protected areas

Sustainable scallop dredging is possible within a protected area

Drawing specifically on the Ramsey Bay and Cardigan Bay examples, it is possible to see that if fishing is restricted to certain zones and under specific conditions it can be possible to manage scallop fishing within a MPA while still maintaining the protected features of a site.

In the Ramsey Bay example fishing is allowed within a fisheries *management* zone, and management is key here, as it is not simply a 'free for all'. However, the specific lease-arrangements that create secure tenure for the producer organisation means that quite simple conditions can be placed on access and as the PO has a high incentive to maintain the lease, the administration does not need to apply a range of technical measures beyond a TAC. The lease to the PO and a profit share arrangement between members is beneficial to the ecological status of the site as it means fewer boats fish the area equating to less damage to the sea bed. Effective ownership of the resource allows the PO to agree to catch limits and harvesting periods in order to maximise market value, increase long-term yield of the resource and promote resilience of the ecosystem.

Fishing zones can be allocated based on habitat type and levels of natural disturbance

Scallop fishing can be managed within MPAs taking into consideration habitat types and levels of natural disturbance. The impact of dredging on the benthic environment depends both on habitat types (with reef structures and slow-growing communities being more susceptible) and the level of natural disturbance (with areas of high natural disturbance showing resilience to fishing disturbance). Hence the zoning in Ramsey Bay protects vulnerable habitats, while in Cardigan Bay it was found that in certain areas the specific conditions of the Bay allow the benthic environment to recover very quickly from fishing disturbance meaning that fishing can be allowed within controlled and monitored areas.

Ecological Criteria can be directly linked to thresholds for disturbance

A development in the research conducted in Cardigan Bay is the calculation of thresholds for acceptable levels of fishing disturbance that maintains ecological integrity. These could be applied to management by allocating quota for time spent dredging the sea-bed, but would need to be tailored to specific environments and their conditions. This idea is explored further in the next section.

6.4 Potential approaches to rotational management

Within an overarching framework of secure tenure, rotational management has been seen to be an effective tool in scallop management in other areas of the world; for example it has been used effectively in the management of the North East America Sea Scallop to increase productivity of the stock (Beukers-Stewart & Beukers-Stewart 2009). Within these case studies, there are also examples of rotational management including the use of a LPUE threshold within the Shetlands Islands to potentially close areas until recovery, and the proposal to rotate open-areas within the management of scallop fishing within the Cardigan Bay SAC to allow for recovery of scallop stocks and restoration of seabed features.

During the GAP2 scallop discussions industry representatives proposed the idea of closing areas when catch rates fall below a certain area. This is along the lines of how fishermen currently fish, leaving an area when yields fall below a certain level or are no longer economically viable. There may be the option to use VMS technology to instigate 'real-time closures' as information is fed back directly from fishing vessels, and thresholds can be tailored to specific scallop stocks (dependant on biomass, growth rates and recruitment); and to different habitats (specific to habitat type and levels of natural mortality.

An option for further discussion would therefore be to design thresholds that would **instigate 'real-time closures' if**:

1. Catches per unit dredge fall below a certain level thereby closing an area to allow for stock recovery; and
2. Effort (dredge time) per m^2 goes over a certain threshold (specific to each habitat or zone) to allow for recovery of the seabed.

6.5 Models for science/industry collaboration

An ongoing challenge is funding the science needed to support scallop management. While none of the examples given in this report have yet fully resolved this issue, there have been some interesting changes, for example:

- French fisheries committees have recently agreed to increase their licence fees to contribute towards scientific surveys
- In Brittany, although not included here, there are examples where scientific institutions design the surveys and analyse the results, with the fishing industry undertaking the surveys
- In Ramsey Bay industry and administration are collaborating on survey design and implementation with the industry gradually taking on more responsibility for undertaking surveys.

Fishing into the Future (a UK -fishing industry led NGO) is currently initiating a project to look at how the scallop industry can contribute to data collection. It would appear to be beneficial to look at the models of science/industry collaboration within the case studies presenting in this report. The industry is more likely to invest in research if they have secure and exclusive access to the resource and the results of assessments are tailored to support management decisions.

6.6 A Suggested Way Forward

There are a number of ways these lessons on scallop management could be taken forward into the English Channel context:

1. Stakeholder engagement on a secure tenure approach for scallops in the Channel:

There is an opportunity to discuss the outcomes of this study with stakeholders in the English Channel scallop fishery (for the UK this includes the UK industry, IFCAs, DEFRA and MMO). Discussions could be based around:

- Results of the case studies and their benefits/drawbacks
- How a secure-tenure approach could be applied to the English Channel context
- Differences between different use-rights systems (e.g. how the EU quota system differs from the examples presented here)
- Exploring how design of a secure-tenure system can affect outcomes (e.g. economic & social outcomes)

2. Identify possible scallop management units within the Channel and provide economic supportive evidence for the benefits of secure-tenure systems for selected units

- Identify the distribution of scallop resources within the Channel
- Identify possible management units and map the distribution of the stock against current management institutional boundaries
- Value potential rents generated by different secure-tenure management arrangements at the level of 'management units' e.g. the inshore UK area or offshore Eastern Channel areas

3. Support collaboration between French & UK scientists and industry to improve scientific data and advice for effective management:

There are examples in this report of science/industry partnerships that can be built on as well as a cross-channel approach to:

- Agree assessment protocols that can be applied in different areas and by different actors (e.g. industry)
- Explore ways industry can take a greater role in assessments as well as having greater access to map-based synthesis of data
- Identify how scientific advice can be structured to support management decisions

4. Move towards secure-tenure management approaches in the management units

Secure tenure can be gradually introduced into the management units both at a cross-channel level with collaboration between France, Ireland, UK, Belgium and the Netherlands, and into the various management units in inshore UK waters under the IFCA remit. Some of the steps would include:

- Get buy-in from key stakeholders
- Set up a coordination body
- Agree overarching objectives and desired outcomes (i.e. in economic, environmental and social terms)
- Develop management framework with chosen secure-tenure system in the centre
- Develop details of the framework to achieve the desired outcomes
- Assist gradual implementation or pilots across management units

Appendix 1: Cardigan Bay Case Study

6.7 Cardigan Bay: example of potential ecosystem-based management

Background

Cardigan Bay is designated as a European Marine Site (specifically a Special Area of Conservation or SAC) primarily for site features that include cobble reef and dolphin populations. Scallop fishing had been ongoing in this area for 30+ years on a seasonal basis (permitted from Nov-April), yet following an increase in fishing pressure within the bay in 2009, conservation groups flagged the issue to the EU arguing that site features of the EMS were being compromised. The Welsh Government risked a multi-million pound infraction from the Commission, compared to the £3-4 million landed value of the scallop fishery and the immediate Government response was to close the fishery while further data was collected. (Since this time, DEFRA has changed its policy to require assessment of all fishing activities within EMS, see Box 2).

Further data was collected by Bangor University to assess the extent and occurrence of the designated features of the site and determine if it was possible to re-open a proportion of the area to fishing without impacting upon these features (Hinz et al., 2010). Participatory mapping with scallop fishermen developed heat maps of the priority fishing areas within the SAC where sampling was focused. The survey found that cobble and boulder habitats were rare within the priority fishing areas which were characterised by fields of mobile sand with pronounced sand waves in line with the main tidal current. It revealed that the area was a highly dynamic environment that was likely to be affected more strongly by natural processes than by fishing disturbance, with no trace of dredging following a 7 month closure (see also Sciberras et al. 2013).

As a result of the survey a limited area of the Bay was re-opened to fishing on a seasonal basis (Nov-April), and ongoing monitoring has been undertaken to assess whether over time a difference in the benthic environment can be detected between the permanently and seasonally closed areas. A series of surveys have revealed that over a 2 year period (2009-2011) no significant difference in epibenthic communities can be observed between the two areas, and that over the period the seafloor substrate has been redistributed by natural oceanographic processes such as bed transport, tidal currents and wave erosion (Sciberras et al., 2013).

Box 2: Requirement to assess and manage fisheries within European Marine Sites

European Marine Sites in the UK are not automatically closed to mobile fishing gear, but are managed on a site by site basis. A significant development, however, has been the recent requirement for fishing activity within all European Marine Sites (EMS) in England to be assessed for their impacts. Historically many fishing activities had been allowed to carry on without any additional management in these sites. DEFRA's new policy requires new fisheries management regulations to be in place by 2016[11]. DEFRA has approached this review by undertaking a risk-assessment[12] of gear types against different protected features. Any gear-type that is flagged as a red or amber risk has to be assessed in more detail and the relevant fisheries management applied. This has led to a number of EMS to be closed to mobile gear including scallop dredging. For example the Cornish IFCA has recently closed all SACs to towed gear[13].

[11] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/345970/REVISED_APPROACH_Policy_and_Delivery.pdf

[12] https://www.gov.uk/government/publications/fisheries-in-european-marine-sites-matrix

[13] https://secure.toolkitfiles.co.uk/clients/17099/sitedata/Byelaw_review/closed-areas-ems-no2-byelaw.pdf

Current situation

The current hypothesis is that the highly dynamic nature of the Cardigan Bay environment – characterised by shallow habitats, high bed shear stress, and exposure to prevailing southwest and west gales – means that the effect of fishing is masked or highly modified by natural disturbance (Sciberras et al., 2013). Similar effects have been reported for other energetic environments such as off Maine and in the Bering Sea (Stokesbury and Harris 2006; McConnaughey and Syralja 2014).Bangor University are further developing their work by assessing thresholds for different areas within the SAC; for instance looking at recovery rates of the benthic environment at different fishing intensities. Initial results have showed recovery of the Cardigan Bay benthos in certain areas within 3-4 months.

At a wider level, studies have shown that it is possible to compare fishing disturbance and natural disturbance at a greater spatial scale (Diesing et al, 2013). This study produced maps of the English Channel and the English part of the North Sea, illustrating the probability that natural disturbance exceeds fishing disturbance (and vice versa). Towed fishing gear (such as trawling and dredging) may not adversely affect benthic environments where natural disturbance is very high. Conversely, fishing disturbance is likely to have greater impacts in areas where natural disturbance is low such as muddy or deep habitats beyond the intertidal zone (Hiddink et al. 2007; Diesing et al., 2013; Van Denderen et al. 2015).

The future

The Welsh Government has recently published a consultation paper to develop a permit scheme for scallop fisheries within Cardigan Bay SAC (Welsh Government, 2015). This scheme would involve spatial restrictions for areas of the SAC that have been found through the research to include cobble reef or to be sensitive to dredging. However, it could also involve opening up further areas of the Bay to dredging that are not characterised by the protected 'cobble reef' feature, have high scallop densities and benthic environments that area able to recover from dredging within a 3-4 month period with no reduction in prey for fish populations (that dolphin populations may depend on).

An annual permit system could create a system of exclusive access although the consultation document does not specify whether the number of permits would be limited. However it does specify that an annual TAC would be set, divided into vessel catch limits. It also suggests that the number of days dredging would be limited to reduce disturbance to the seabed, as well as other management measures including rotational closed areas and technical restrictions (size of vessel, engine size).

6.8 Issues

Cardigan Bay is a specifically dynamic environment

Cardigan Bay is a particularly dynamic environment so that the conclusions could be applied to other areas with a similar wave environment, tidal shear stress and primary productivity, but would not apply to less dynamic or sensitive habitats. However, for any area there are a number of principles that apply:

1. Collaboration between scientists and fishermen can identify economically important fishing-areas and work pragmatically to find management solutions;
2. It is possible to study the resilience of habitats (or use natural disturbance proxies) to determine the resilience of those environments to scallop fishing which would inform management approaches that are compatible with other considerations such as conservation priorities.

Opening further areas of Cardigan Bay SAC to scallop dredging has been criticised

The potential of opening up further areas of the Bay has been strongly criticised by within an article written by Guardian journalist George Monbiot (9th November 2015) concerned that reopening parts of the SAC to scallop fishing goes against its protected status and would have damaging effects on the protected dolphin populations within the Bay[14]. Bangor University responded[15] to these concerns in an article that explained in more detail the research that has been undertaken and the results that suggest the protected features of the site, including cobble reef and dolphin populations, would not be adversely affected by the proposed managed scallop fishery.

The consultation document suggests that if permission is given for scallop fishing to be pursued elsewhere within the Cardigan Bay SAC, a management plan would require the development of management targets for the site and ongoing monitoring of fisheries to routinely assess against targets that relate to both the fishery and conservation features of the site.

6.9 Lessons

Possibility of managing scallop dredging within MPAs

The Cardigan Bay example highlights the importance of assessing levels of natural disturbance in relation to fishing intensity (as well as habitat types) when considering the location of MPAs or management of fisheries within their boundaries (Sciberras et al., 2013). Greater investment in science can lead to a better understanding of habitat extent and hence risk of fishing pressure to designated features. Without this understanding a blanket ban on dredging may emerge in a number of EMS where it may in fact be possible to responsibly manage the fishery within certain parameters.

Ecosystem-based management that allows for habitat type and levels of natural disturbance

Scallop fishing can be managed within MPAs if full consideration is made of habitat types and levels of natural disturbance. The impact of dredging on the benthic environment depends both on habitat types (with reef structures and slow-growing communities being more susceptible and almost certainly incompatible with towed bottom fishing gear) and the level of natural disturbance (with areas of high natural disturbance showing resilience to fishing disturbance). With good information on the benthic habitats and levels of natural disturbance, management can potentially select areas where fishing could be managed within defined conservation thresholds.

Habitat Disturbance Quotas: potential to combining ecosystem-based management with economic efficiency

Management proposals for the Cardigan Bay SAC are exploring the options for setting the levels of fishing intensity that will allow management targets to be met. There is an opportunity for economic principles to be applied in the allocation both of a scallop quota to effectively manage the stock as well as a Habitat Disturbance Quota expressed in Dredge-time units.

Benefits of collaboration between industry and scientists

This example clearly illustrates the benefits of strong collaboration between the industry and scientists. Research can be designed with the objective of benefiting both the environment and the fishing industry, allowing managed fisheries within a MPA rather than exclusion. The use of heat maps illustrating areas of economic importance to scallop fishing industry has potential applications outside of the fisheries sector, including assessing potential impacts of other developments (e.g. wind farms) to the industry.

[14] http://www.theguardian.com/environment/georgemonbiot/2015/nov/09/allowing-scallop-dredging-in-strictly-protected-dolphin-reserves-is-madness

[15] http://cfooduw.org/will-scallop-dredging-in-cardigan-bay-be-an-environmental-disaster/

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