

MACALISTER ELLIOTT AND PARTNERS LTD



Public Comment Draft Report Northern Menai Strait mussel (*Mytilus edulis*) fishery

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Report summary

This report is the Public Comment Draft Report for the MSC assessment of the north Menai Strait mussel fishery. The target species is the European mussel *Mytilus edulis*. The client is Bangor Mussel Producers Ltd. – a producer organisation representing all the mussel farmers from the northern part of the Menai Strait. The assessment was carried out by MacAlister Elliott and Partners Ltd., with a site visit by the assessment team in March 2010. The fishery is defined by MSC as an enhanced fishery, meaning that the assessment tree was adapted somewhat from the standard FAM – details are given in the main body of the report.

The fishery operates by collecting seed mussels with small dredges from two sites: Morecambe Bay (England, UK) and Caernarfon Bar (North Wales, UK). The seed mussels are relaid on the seabed (intertidal and subtidal) in areas (lays) that are within a designated Fishery Order area (for shellfish production). The mussels are grown initially in the intertidal and eventually moved into the subtidal – this husbandry ensures a robust and high quality product and minimises losses to predators (green crabs, starfish and oystercatchers).

The Fishery Order was managed by the North Western and North Wales Sea Fisheries Committee (formerly The Lancashire and North Western SFC) from its creation in 1962 until April 1st 2010. Due to a shift in responsibilities in Welsh fisheries following devolution, it is now the responsibility of a newly created management company (the Menai Strait Fishery Order Management Association) which includes representatives of all the key stakeholders.

The fishery lies entirely within or adjacent to statutory protected areas (Menai Strait and Conwy Bay SAC and Traeth Lafan SPA in Wales, Morecambe Bay SAC and SPA in England), which adds another layer of oversight and management obligations. The leases, which provide the companies tenured property rights over the lays, were last renewed in 2009, with the renewal subject to appropriate assessment for potential impacts on the SAC – the appropriate assessment must be approved by the Countryside Council for Wales (CCW) before renewal. The seed fisheries can also be subject to the scrutiny of a full appropriate assessment, and any seed fishing must in any case be approved by CCW (in Wales) or Natural England (in England) on an annual basis. The seed fishery in Morecambe Bay has in some past years been subject to a TAC, to ensure that enough seed remains for bird populations. In recent years, however, no TAC has been applied since either there was such a large settlement that the fishery could take what it required and still leave a lot on the bed (2006) or else there was no settlement at all or it was quickly washed away (2007-9). Management frameworks also exist to ensure i) that invasive non-native species are not brought into the Menai Strait with seed and ii) that the genetic structure of the target stock is not disrupted by translocation.

Under Principle 1, the fishery scored an average of 85, with no PI scoring less than 80. There were thus no conditions imposed on the fishery for Principle 1. In general,

although there is not a formal 'stock assessment' for this type of fishery, the stakeholder and team consensus was that the impact of the fishery on the target stock is negligible – or potentially positive.

Under Principle 2, the fishery scored an average of 87.7. One PI scored less than 80: by-catch information. The team considered that while it was likely that there are in fact no 'main' by-catch species (which would normally lead to a score of at least 80), the quantitative information available was not sufficient to justify this conclusion in a sufficiently precautionary matter. The fishery is therefore required to collect some quantitative or semi-quantitative information on by-catch of green crabs and starfish so that the issue can be re-considered.

Under Principle 3, the fishery scored an average of 85.75. One PI scored less than 80: research. The team noted that while the track record of this fishery in participating in research is probably one of the best in the UK, there is no formal research plan as such, as required for SG 80.

1. Introduction

1.1 General background

The Marine Stewardship Council (MSC) is a non-profit organisation which aims to use market mechanisms to support the long-term sustainability of marine fisheries. MSC has developed a standard for well managed and sustainable fisheries, and an associated methodology for assessing individual fisheries against the standard – this collectively is now called the Fisheries Assessment Methodology (FAM) (1). The standard and methodology is periodically updated. This assessment uses version 2 of November 2009 (with additions, described in detail below). Assessments are carried out by private companies (Certification Bodies – CBs) who are accredited to carrying out MSC assessments by the accreditation organisation Accreditation Services International (ASI).

This report is the revised Public Comment Draft Report for the northern Menai Strait fishery for mussels (*Mytilus edulis*) by Bangor Mussel Producers Ltd. The report has been prepared by an assessment team from the CB MacAlister Elliott and Partners Ltd. (MEP). The report will be available for comment on the MSC website, and MEP welcomes comments on the report at any time (contact details on the MSC website or at www.macalister-elliott.com).

1.2 Client

The client for this assessment is the Bangor Mussel Producers Ltd. (BMP Ltd.) – a grouping of four companies: Myti Mussels Ltd., Extramussel Ltd., Ogwen Mussel Ltd and Deep Dock Ltd. BMP Ltd. groups all the companies participating in the fishery.

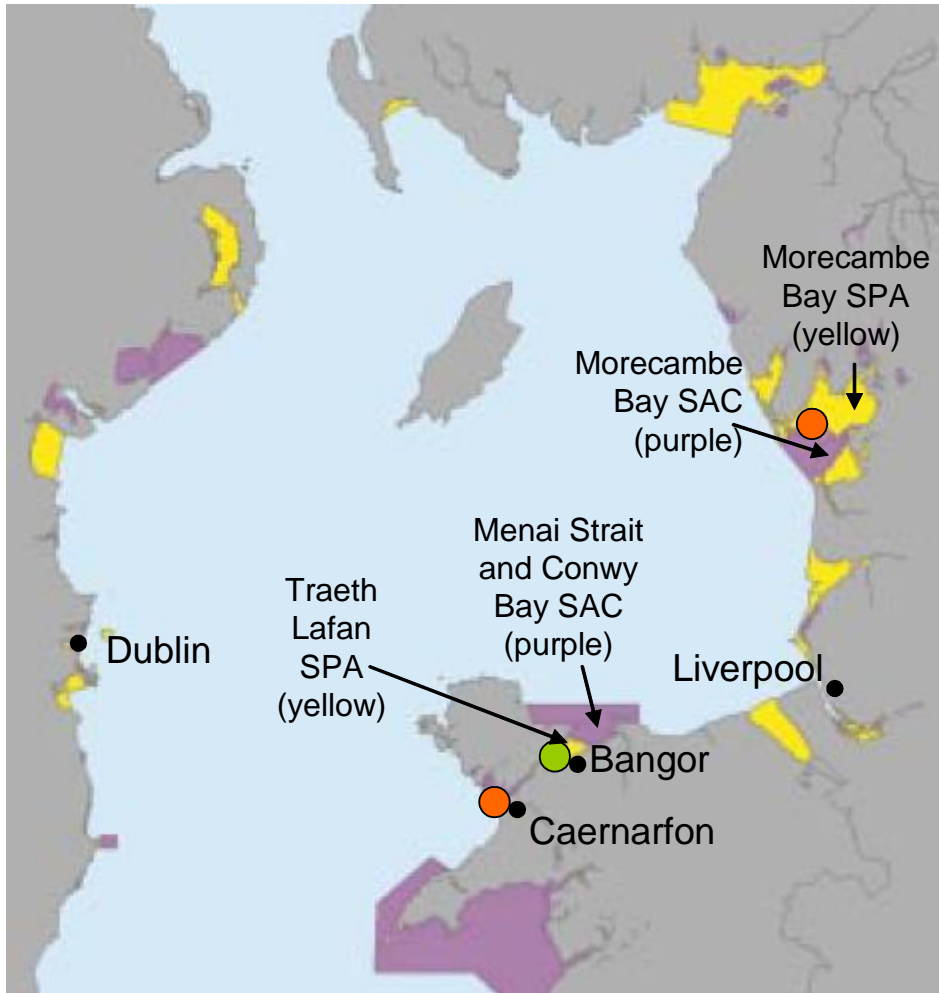
1.3 Unit of certification

The unit of certification defines exactly what is being assessed and certified. It is set out at the beginning of the assessment process (in the Notification Report to MSC).

The unit of certification has been defined as follows: mussels from bottom culture (wild caught seed) from the northern Menai Strait, Wales, UK. The mussels are produced by members of BMP Ltd, who account for all the farmed mussel production from the northern Menai Strait (mussels gathered by licenced handpickers are not included).

The seed for this production comes at present either from Morecambe Bay or from Caernarfon Bay. In the past, seed has been taken from other areas of Liverpool Bay – mainly Conwy Bay, although this has not happened in recent years. Seed taken from these and other areas (South Wales, southern England, Ireland or elsewhere) are not included in the unit of certification, and production from seed taken from these sources will not be eligible for certification.

Figure 1. Location of seed collection sites (orange) and mussel lays (green). The map also shows Special Areas of Conservation (SACs – for habitats) in purple and Special Protected Areas (SPAs – for birds) in yellow. Those relevant to this fishery are labeled. Note that the extent of Morecambe Bay corresponds to the purple area (Morecambe Bay SAC), since the SPA covers some of the surrounding terrestrial habitat (2).



1.4 Assessment team and peer reviewers

The assessment team was made up of three experts, each of whom have competences in fisheries assessment, marine ecology and fisheries management – i.e. in each of the three Principles of the MSC standard. All three experts therefore had equal input on the scoring of each PI in each of the three Principles. For the purpose of drafting the rationales and reporting, each member of the team took responsibility for one of the Principles, and their drafts were then reviewed and revised by the other two team members.

The assessment team was composed of the following individuals:

Dr. Jo Gascoigne: Jo is the Director for Fisheries Certification at MEP and a former research lecturer in marine biology at Bangor University, where she researched mussel beds and their ecosystem impacts. She has been involved in several previous and ongoing assessments. Jo was responsible for Principle 1.

Prof. Michel Kaiser: Mike is an internationally known expert in marine ecology – particularly the ecological impacts and management of fisheries and marine conservation. He is currently professor of marine conservation biology at Bangor University.

Dr. Clive Askew: Clive has more than forty years experience in shellfish culture and research, and is now retired from the Shellfish Association of Great Britain. He now works as a consultant on shellfish related topics, including ecology, management and health issues.

CVs for all three experts are available on the MSC website.

Note that Jo and Mike have in the past worked on research projects which were (to a small extent) funded by members of the Bangor Mussel Producers Ltd. – in all cases more than two years ago. This past connection was announced on the MSC website when the team was announced.

The peer reviewers were the following individuals:

Dr. Andrew Brand: Andy Brand worked for the University of Liverpool for 40 years at Port Erin Marine Laboratory, Isle of Man, retiring in 2006 as Director. He developed large, well-funded, research programmes on the biology, ecology, aquaculture and fisheries of bivalve molluscs, and on the environmental impact of bivalve fisheries. He has also been a member of ICES Working Groups on herring, scallops and ecosystem effects of fishing. He now works as an independent shellfisheries consultant. He has acted as an assessor and as a peer reviewer for MSC assessments for scallop, mussel and oyster fisheries in the Irish Sea, Faeroes, Denmark and Canada.

Dr. Colin Bannister: Colin Bannister retired from the Centre for Environment, Fisheries and Aquaculture Science at Lowestoft, UK, in 2004 after a career of nearly 40 years spanning research, stock assessment, programme management, and advice on the management of shellfish and finfish stocks. From 2000 until retirement he was the Senior Fisheries Science Advisor, providing high level advice to DEFRA and the fishing industry. From 1981-2000 he was head of the Shellfish Resource Group, responsible for research and advice on the management of an array of crustacean and molluscan stocks. He was also chair of the ICES Shellfish Committee for several periods during the 1990s. Colin has participated in four MSC certification assessment teams and two peer review teams.

Full CVs for the peer reviewers are available on request to MEP.

1.5 Previous assessments by MEP

MEP has completed one full assessment (the Euronor saithe fishery) and is working on six ongoing assessments (two other European saithe fisheries, a European and a South Atlantic lobster fishery, a toothfish fishery and this fishery). Euronor was given a certification without conditions, and so far no annual audits or recertifications have been carried out by MEP.

1.6 Report structure

The report is structured as follows:

Section 1: Introductory material;

Section 2: Background to the fishery – information on the target species; catches; interactions with bycatch species, protected species, habitats and ecosystems; interactions with other fisheries and non-fishing activities;

Section 3: The management system – including management organisations, legislative context, objectives and plans, rules and tools and evaluation;

Section 4: MSC fishery evaluation process – including the evaluation process and timeline, use of the Risk-Based Framework and additional PIs and stakeholder consultations;

Section 5: Scoring- methodology and weighing;

Section 6: Results of the assessment;

Section 7: Draft certification recommendation;

Section 8: Chain of custody – brief description and risk assessment;

Section 9: Client Action Plan – how conditions will be met by the fishery;

Annex 1: Assessment tree – detailed scores and rationales for each PI;

Annex 2: SICA and PSA Tables – details of risk-based scoring process for Principle 1 (PI 1.1.1)

Annex 3: References for main report, Annex 1 and Annex 2;

Annex 4: Summary of stakeholder comments during information-gathering;

Annex 5: Peer reviewer reports and responses;

Annex 6: Stakeholder comments on the PCDR, and responses from MEP

Annex 7: List of acronyms

2. Background to the fishery

2.1 Target species and population

The target species for the fishery is the blue, common or European mussel (*Mytilus edulis*). The species is ubiquitous around the UK, usually on rocky shores in the intertidal. It is reported that the UK comprises a single population (in genetic terms) (Andy Beaumont, School of Ocean Sciences, Bangor University, pers. comm., 3). The team decided that to be precautionary, they would consider the Irish Sea as the appropriate stock level for this assessment. This is taken to be the area between lines approximately from St. David's Head in SW Wales to Rosslare in Ireland, and from Straenraer (Scotland) to Belfast (Northern Ireland).

Two other *Mytilus* species are present in the UK: the Spanish mussel *M. galloprovincialis* and the Baltic mussel *M. trossulus*. The Spanish mussel has been present in SW England since at least the 1950s, probably through natural processes. The two species can hybridise and the hybrids are fertile. 'Gallo' and hybrids are present along the south coast of England and the west coast of Ireland and Scotland, but not in the Irish Sea (4). *M. trossulus* is native to the Baltic and is only reported to be present in the UK in Loch Etive (5).

2.2 The fishery

The fishery operates by collecting 'seed mussels' (recently settled mussels usually of around 20 mm shell length or less) from several specific areas and relaying them on 'lays' in the northern Menai Strait. They are grown on these lays for up to two years before being sold as adult mussels, generally on to the Dutch market.

2.2.1 The seed fishery

The most important sources of seed in most years are 'skears' – patches of cobble substratum of glacial origin - in Morecambe Bay. One skear in particular (called 'South America skear' because of its shape) is important to the fishery, since mussels often settle out on the skear at very high density (although in some years there is no settlement at all). South America skear is in the low intertidal – only uncovered on spring tides – and its distance from shore makes it inaccessible by foot even on a big tide. The second important site for seed collection is Caernarfon Bar (a shallow subtidal area of Caernarfon Bay immediately outside the southern entrance to the Menai Strait), where again seed settlement can be high in some years and negligible in others. Both these seed collection areas are inside, or immediately adjacent to, Special Areas of Conservation (the Morecambe Bay SAC (6) and the Menai Strait and Conwy Bay SAC (7)) and Special Protected Areas (Morecambe Bay SPA (8) and Traeth Lafan SPA (9)) (see Figure 1) so activities are subject to considerable scrutiny by the relevant statutory conservation bodies (the Countryside Council for Wales CCW and Natural England respectively). In past years, seed has been collected from other areas, including Conwy Bay, south Wales and southern England. However, concerns associated with the risk of introducing

invasive species into the Strait, plus improved husbandry practices which allow the mussel growers to ride out a year or two of poor seed supply, has meant that seed collecting in these areas has ceased. As noted above, these past seed collection areas are not covered by this assessment.

2.2.2 Operations in the Menai Strait

The seed mussels are collected by purpose built vessels using multiple small dredges, transported back to the lays in the Menai Strait and relaid – the growers have considerable expertise in controlling the positioning of the vessel during these operations and of the density of the mussels relaid per hectare of ground. Generally speaking, the mussels are laid initially in the upper intertidal at lower densities, where they grow relatively slowly but acquire thick shells, making them less vulnerable to predation and damage during harvesting. They are also (somewhat) protected from marine predators (green crabs and starfish) in the intertidal – these predators prefer smaller mussels, in contrast to terrestrial predators such as oystercatchers who prefer larger mussels. As the mussels grow, they are moved up to three times to different positions on the lays, generally progressing down in the intertidal and eventually into the subtidal where they can fatten quickly and in protection from birds before final harvest. Husbandry and harvesting is also carried out by dredge.

The lays are leased to the mussel companies via the Management body which holds the Fishery Order. The creation of a Several (& Regulating Order) is enabled through the 1967 Sea Fisheries (Shellfish) Act (10), although the Order was actually created in 1962 under previous legislation, and slightly amended in 1964 (11,12). The 1967 Act allows for areas of the sea bed to be set aside, effectively severed from the public fishery, for the specific purpose of improving the husbandry and cultivation of named shellfish (10). In the UK, some 55% of the foreshore is owned by the Crown and managed by the Crown Estate Commissioners. There are however a number of other private owners of the sea bed in this instance including the Penrhyn Estate & the Isle of Anglesey County Council.

Until recently (31st March 2010) the Order was administered by the North Western and North Wales Sea Fisheries Committee (NW&NWSFC – now the North Western Sea Fisheries Committee), but following a decision by the Welsh Assembly Government (WAG) to bring fisheries management issues in-house, the responsibility now falls to them to be the Grantor and administrator of the Fishery Order. The system under which the Fishery Order is administered is described in detail in Section 3 below.

2.3 Vessels

Details of the vessels involved in the fishery are given in Table 1.

Table 1. Vessel names, ownership, ports and licence details for BMP.

Vessel	Owner	LOA (m)	Registered port	Home port	Fishing licence type
Mare Gratia – B932	Deep Dock Ltd.	43.5	Belfast	Port Penrhyn	Mussel seed licence*
Valente – BS 8	Myti Mussels Ltd.	43.2	Beaumaris	Port Penrhyn	UK licenced fishing vessel
Lolipop – BS1	Myti Mussels Ltd.	21	Beaumaris	Port Penrhyn	No licence required; harvesting vessel only

* Licence for Collecting Mussel Seed issued under the Sea Fish (Conservation) Act 1967, issued by MFA.

2.4 Mussel landings and production

Table 2 gives figures for seed harvested and mussels harvested by financial year from 2000-1 to 2008-9 (the last year for which figures were available). The fishery is in general stable but it is clear that both seed availability and harvest is quite variable from year to year. This is a function both of seed availability and of environmental conditions in the Strait over the two or so years of growth.

Table 2. Amounts of seed harvested by BMP members, seed relaid in the Strait, seed relaid or sold elsewhere (not included in this assessment and final product harvested, by financial year (1 April – 31 March), from 2000-1 to 2008-9. All figures in tonnes.

season	seed harvested	seed relaid in the Strait	seed relaid outside Strait or sold on	mussels harvested
2000-1	8888	8888	0	3476.5
2001-2	7825	6385	1440	8478.5
2002-3	6000	5000	1000	10577
2003-4	8615	8615	0	15120
2004-5	4350	4050	300	7960
2005-6	4425	3625	800	8535
2006-7	10070	5130	4940	6420
2007-8	8370	3210	5160	5450
2008-9	6445	6195	200	7112

2.5 Retained species, by-catch and interactions with ETP species

2.5.1 Retained and by-catch species

Generally speaking, the vast majority of the biomass collected in the dredges, either during seed gathering or during mussel husbandry or harvest on the lays, is mussels. However, other species can be collected, depending mainly on the tidal position of the site in question. None of these species are retained for market, so they are all considered by MSC under ‘by-catch species’ rather than ‘retained species’.

As regards, seed collection, the by-catch from the two sites is different because one (Morecambe Bay) is intertidal, while one (Caernarfon Bar) is subtidal. From Morecambe Bay, the main by-catch species is green crabs (*Carcinus maenas*) – an abundant species around UK shores. The crabs are not sorted from the seed catch – they are brought to the Menai Strait and relaid along with the seed, and it is presumed that the majority survive, since they are known to survive well out of water. The only other reported by-catch species from Morecambe Bay is the occasional flatfish (usually plaice or dab) which if large enough is taken by the crew – this is, however, rare. From Caernarfon Bar, the main by-catch species is starfish (*Asterias rubens*). Again, these are not sorted from the seed mussel catch, but unlike green crabs they do not survive because the seed is relaid in the intertidal – outside starfish habitat. Green crabs are also caught as by-catch from Caernarfon Bar, as is the occasional fish. Other by-catch species from this area are whelks (*Buccinum undatum*), various flatfish and catshark (*Scyliorhinus canicula*), all in small quantities (for whelks around a bucketful per trip, for flatfish and catsharks a small number of individuals per trip or per year).

2.5.2 ETP species

MSC defines ‘ETP’ (endangered, threatened and protected) species as those which are legally protected. In this context, the main group of species that are relevant here are birds, which are protected under the designation of Special Protected Areas (SPAs) (i.e. under the EU Birds Directive). As noted above, these SPAs include Morecambe Bay (8) and Traeth Lafan (the Lavan Sands) (9) which abuts the mussel lays in the Menai Strait. In Morecambe Bay, the main species of concern is eider ducks, particularly since the population in the area is in decline. Natural England suggest that this may be due to issues around nest predation and breeding success; another suggestion is a parasitic infection – however at this stage these ideas are speculative. Natural England are launching a research project on the Morecambe Bay population during 2010 (R. Whiteley, Natural England, pers. comm. – see Annex 4). Eider ducks may feed on seed mussels to some extent, although they are probably not their main prey item; however there is the possibility of a TAC for seed mussels in Morecambe Bay to take bird predation into account. (In recent years, however, a TAC has not been set because settlement on South America skear was either enormous (2006) or negligible (2007-9); TACs have, however, been set for the handgathering mussel fisheries around Morecambe

Bay (Bob Houghton, NWSFC, pers. comm.). Traeth Lafan is designated due to its importance mainly for oystercatchers, as well as curlews and grebes. It is thought that oystercatcher populations in the area have been enhanced by the mussel lays (13). Key features for which the protected areas are designated (including protected species) are given under ‘ecosystem’ in the next section.

2.6 Habitat and ecosystem context

As already noted above, all three areas impacted by this fishery are protected as SACs (or in the case of Caernarfon Bar, abuts an SAC and so is susceptible to management in order to protect SAC features). Thus they clearly have important habitat features. Morecambe Bay and Traeth Lafan are also listed as SPAs – i.e. as providing important habitat for birds. The rationales for the listing of each statutory protected area are given in Table 3. The management consequences of these protected areas on the fishery are discussed in detail in the next section.

Table 3. Listings for statutory protected areas involved in the fishery.

Area	Designation	Key features	Ref
Morecambe Bay	SAC	Estuaries, intertidal mudflats and sandflats (largest single area in UK), shallow bays (second largest in the UK), perennial vegetation of stony banks, saltmarsh and salt meadows, dunes	6
Menai Strait and Conwy Bay	SAC	Intertidal and subtidal mud and sandflats, subtidal rocky reefs with diverse suspension feeders	7
Morecambe Bay	SPA	Breeding population of sandwich tern <i>Sterna sandvicensis</i> ; overwintering populations of pintail <i>Anas acuta</i> , pink-footed goose <i>Anser brachyrhynchus</i> , ruddy turnstone <i>Arenaris interpres</i> , dunlin <i>Calidris alpina</i> , red knot <i>Calidris canutus</i> , oystercatcher <i>Haematopus ostralegus</i> , bar-tailed godwit <i>Limosa lapponica</i> , curlew <i>Numenius arquata</i> , grey plover <i>Pluvialis squatarola</i> , shelduck <i>Tadorna tadorna</i> , redshank <i>Tringa totanus</i> ; on passage population of ringed plover <i>Charadrius hiaticula</i> . Common eider <i>Somateria mollissima</i> is present but not in sufficient numbers to form part of the formal designation, although the population is considered locally important.	8
Traeth Lafan	SPA	Overwintering populations of oystercatcher <i>Haematopus ostralegus</i> and curlew <i>Numenius arquata</i> ; on passage population of great crested grebe <i>Podiceps cristatus</i>	9

At the ecosystem level, the main concern for this fishery has been the risk that non-native invasive species are brought into the Menai Strait mixed with mussel seed from

elsewhere. This has occurred once (that is known about) in the past, when the slipper limpet *Crepidula fornicata* was found mixed with seed mussels brought from the south of England. There is also concern about a highly invasive tunicate *Didemnum* sp. which has recently turned up in Holyhead harbour, probably brought from Ireland by yacht traffic. Chinese mitten crab *Eriocheir sinensis* is also present in some parts of the Irish Sea during winter, and is another species of concern. BMP members have worked hard with CCW to address this risk, and the result is a Code of Good Practice for seed mussel movements (14) which is discussed in more detail below.

2.7 Interactions with other fisheries and non-fisheries activities

As regards seed collection, other fisheries or individuals would be entitled to apply for a licence to collect seed at either site, but in general, this fishery is the only fishery which actually does so. Hand gathering is impossible at Caernarfon Bar because it is subtidal, while at South America skear it is very difficult because it is generally inaccessible from shore except by boat or air. There is a small hand-gathering fishery in the Menai Strait Fishery Order area, which is carried out under licence, and the operators in this fishery are represented in the management framework for the Fishery Order, as described in more detail in Section 3 below. It is possible that the mussel lays may enhance this fishery by providing a supply of larvae, but more likely that all larvae produced by reproduction on the lays are advected out of the Strait before settlement due to the relatively short water residence time and north to south net flow in the Strait (15).

Aside from the mussel hand-gathering, the main fishery which interacts with the mussel fishery in the Menai Strait is a small fishery for green crabs. This fishery started as a predation-control measure on the mussel lays, but now continues as a separate activity which depends by-and-large on the market for green crabs (sold in France for fish soup or flavourings) – i.e. whether or not green crabs are fished in the Strait depends not on the perceived level of predation on the mussels, but rather on the price of green crabs on the French market. The fishery is prosecuted by a member of BMP as a separate business activity, and was considered by the assessment team to constitute a separate activity – i.e. it is not considered in this assessment. The rationale for this decision is explained in detail in the assessment tree (Annex 1, PI 2.1.1). As noted above, however, green crabs are considered as bycatch species, since they are caught in the mussel dredges during seed fishing and harvested.

There is some recreational fishing in the Menai Strait and on Caernarfon Bar (for bass mainly), but this does not interact with the mussel fishery. The area is also important for recreational boating and water-based tourism, but again no interaction with the fishery has been noted.

3. Management System

3.1 Organisations involved in management

The organisations involved in the management of the fishery are given in Table 4 below.

Table 4. Organisations involved in the management system for the mussel fishery

Organisation	Role
Bangor Mussel Producers Ltd. (BMP Ltd.)	Producer Organisation – client for this assessment
Welsh Assembly Government (WAG)	Grantor of Several Order lease and responsible for administration of the fishery – e.g. seed and sales statistics are provided to them.
Menai Strait Fishery Order Management Association	Organisation which acts as grantee of the Fishery Order. Made up of mussel producers (farmers and hand-gatherers), CCW, Environment Agency, local authorities (Anglesey and Gwynedd) and Bangor University School of Ocean Sciences (60).
North Western and North Wales Sea Fisheries Committee (NW&NWSFC)	Until 31 st March 2010 were responsible for the whole fishery under assessment as regulator of the wild seed mussel fisheries and as Grantee of the 1962 Order.
North West Sea Fisheries Committee (NWSFC)	On 1 st April 2010 the NW&NWSFC became the North West Sea Fisheries Committee (NWSFC), with a boundary that ends at the Welsh border. The NWSFC is responsible for managing the wild seed mussel fishery in Morecambe Bay, but now has no involvement in the management of the Menai Strait or Caernarfon Bar fisheries.
Countryside Council for Wales (CCW)	Responsible for oversight of Menai Strait and Conwy Bay SAC and Traeth Lafan SPA – Several Order lease cannot be granted without their approval of appropriate assessments for mussel laying and seed collection
Natural England	Responsible for oversight of Morecambe Bay SAC and SPA – must approve seed collection activities

3.2 Legislative and administrative context

The legislative and administrative context of this fishery is complex. The fishery is based upon harvesting seed mussel from wild stocks and then cultivating these mussels in a private fishery. Further complication is added because the fishery operates partly in Wales and partly in England, under different management regimes; and also because it operates almost entirely within areas that grant statutory protection to wildlife habitats and species.

3.2.1 The Menai Strait

The cultivation of mussels in the Menai Strait is carried out under legal protection which effectively grants the right of private ownership of mussels to the operators (10). This enables them to cultivate and manage the stock in a way that would be impossible in a wild fishery open to public access.

The mussel fishery in the Menai Strait is protected by the Menai Strait Oyster and Mussel Fishery Order 1962 (the 1962 Order – 11) which was made by the UK Government under the Sea Fisheries Act 1888 (the 1888 Act). The 1888 Act was consolidated and superseded by the Sea Fisheries (Shellfish) Act 1967 (the 1967 Act – 10).

The 1962 Order granted the right of fishery for mussels and oysters in the eastern end of the Menai Strait to the North Western & North Wales Sea Fisheries Committee (NW&NWSFC), formerly the Lancashire and Northwestern SFC, termed the ‘Grantee’ of the Order. As Grantee, the NW&NWSFC was able to lease areas of the Menai Strait to private companies for the purposes of shellfish cultivation; and the Grantee was also able to issue licences to fishermen who wished to gather any wild mussels in the Order area. These arrangements were put in place for a period of 60 years, and will expire in 2022 (10).

Following Welsh devolution, there have been some recent changes to the administration of the fishery. As of 1 April 2010, the Grantee of the 1962 Order is the Menai Strait Fishery Order Management Association. This Association is made up of a representative of the lease holders, the licence holders, the two local authorities from either side of the Strait (Gwynedd and Anglesey); the Environment Agency, the Countryside Council for Wales, and the School of Ocean Sciences (see Table 4 above). WAG participates as an observer and has oversight of the management of the fishery which is ultimately accountable to the Welsh Fisheries Minister.

There are currently 6 leased areas in the 1962 Order area. The leases to these areas were issued (renewed) in 2009 and are due for renewal in 2016. Leases and licences can only be issued with the approval of the Grantee and following satisfactory assessment under conservation legislation (see section 3.2.3).

3.2.2 Seed collection

Seed collection in England and Wales is administered separately, but the framework in each case is similar. Once seed has been found to be present on the seed beds, the mussel companies apply to the relevant authority for a permit to collect seed (in Morecambe Bay this is the NWSFC; for Caernarfon Bar this is WAG).

The location of the seed mussel beds within or adjacent to protected wildlife sites means that WAG and NWSFC have to consult with the relevant nature conservation agencies before they can consent to seed collection (see section 3.2.3 below).

WAG and NWSFC are able to regulate seed mussel collection in a variety of ways using their powers under fisheries byelaws and legislation. Typically they specify the area and period of fishing, and at least in the case of NWSFC may identify a TAC for the fishery that is based upon harvesting a proportion of the stock and leaving the rest unfished for stock and wildlife conservation purposes (note however that this has not been done for this fishery in Morecambe Bay in recent years because the level of settlement has been either too large or too small to warrant it, although it has happened in the past, and more recently for other mussel fisheries around Morecambe Bay). The fishery managers also require that logs of fishing activity are submitted regularly. More detail on management rules and tools is given below.

3.2.3 Protected areas

The fishery under assessment takes place within or adjacent to areas where wildlife habitats and species are protected. These areas create legal requirements to assess the potential effects of certain fishing activities before they take place. These legal requirements originate from the EU Wild Birds Directive and Habitats Directive which were transposed into UK law by the Conservation (Natural Habitats &c) Regulations 1994 (SI1994 No 2716) (16).

In brief, this legislation requires that fisheries managers consider whether an activity is likely to have a significant effect on the features of the relevant wildlife site before any consent to fish is granted. This decision is taken by the fishery manager, generally after consultation with the relevant nature conservation agency (CCW or Natural England). If the fishery manager concludes that a significant effect is likely, it then has to determine whether the activity concerned will adversely affect the integrity of the site. In doing this, there is also a requirement to consider how adverse effects could be avoided through management measures. The activity can only proceed once the fishery manager is satisfied that adverse effects are not likely.

For this fishery, the administrative effects of these requirements can be seen in the annual assessment of licences issued for fishing in the Menai Strait and the annual assessment of permits issued for fishing seed mussels in Morecambe Bay and at Caernarfon Bar. The leases for mussel cultivation are also subject to assessment on their renewal every 7 years (17,18). The practical consequence of these assessments can be seen in regulations that govern seed mussel collection, including the requirement to consider ‘likely significant effects’ before authorisation is given; and in the management arrangements agreed between the Grantee and CCW for mussel cultivation in the Menai Strait.

3.3 Management objectives and strategy

This fishery has at least three sources from which management strategies and objectives arise: i) political and legislative objectives arising from the legislation underpinning the fishery (notably the 1962 Order and the 1967 Act – 10,11), as well as political objectives set out by WAG as part of the new management structure for Welsh fisheries; ii) the management plans and objectives that underpin the protected areas; and iii) the policy objectives agreed by the fishery itself (i.e. of BMP Ltd.). These are discussed briefly below and set out in more detail in the assessment tree (Annex 1).

3.3.1 Political and legislative objectives

The main management objectives set out in the UK legislation underpinning the Fishery Order (e.g. the 1967 Shellfish Act - 10) is that the areas under lease should remain in use for shellfish cultivation. It is clear from the legislation that a failure by a lease holder to cultivate shellfish within the site could result in the rescinding of the lease (10,19).

The Wales Fishery Strategy (a long-term vision for managing and developing Welsh fisheries) includes specific mention of mussel farming and sets out several objectives for the industry: e.g. i) conformance with European protected area legislation; and ii) traceability and food hygiene standards (20). It also includes more general objectives around research, management, collaboration and representation, financial resources etc. (21). The strategy also encourages MSC certification as a long-term objective for Welsh fisheries. These objectives are intended to be implemented via an aquaculture implementation plan (included in the strategy) and an aquaculture stakeholder group. The implementation plan includes designation of responsibilities and a target timescale (21).

3.3.2 Protected area objectives

As noted above, CCW and Natural England have a responsibility to ensure that any activity taking place inside the protected areas (including seed mussel fishing or mussel cultivation) does not materially impact the habitats or species for which the area was listed. In essence therefore, the management plan and objectives for the SACs and SPAs (6,7,8,9) form another framework within which the management of the fishery is embedded. The key management objective for these protected areas is that the components (habitats or species – see Table 3 above) for which they were listed should remain in the same or similar condition as when the listing took place.

3.3.3 Fishery-specific objectives

BMP Ltd. has adopted a set of objectives which are structured loosely around the MSC standard – i.e. objectives on the target stock, retained and bycatch species, protected species, habitats, ecosystems, management, research and procedures, as well as Codes of Good Practice for genetics and for seed mussel movements (14,22,23). These are outlined

in detail in Annex 1 (PIs 1.2.5, 2.5.2 and 3.2.1). A similar set of policy objectives are proposed for the Menai Strait Fishery Order Management Association (24).

3.4 Management rules and tools

Management objectives and strategies are implemented in the fishery via the two management agencies: WAG in Wales and NWSFC in England. These agencies enforce management on the fishery via byelaws. WAG took over management of the fishery from NW&NWSFC on 1 April 2010, and so far maintains the same set of byelaws as were previously in place under NW&NWSFC (25).

The key byelaws that apply to the fishery are the following:

- Requirement of a permit to fish for seed mussels (the granting of this permit being subject to oversight by CCW or Natural England – see below);
- Mussel gear (dredges) must be of an approved type;
- Seed mussel beds may be closed at any time, subject to consultation and scientific advice and may remain closed for up to a year should that be deemed necessary.

The 1962 Order also puts management requirements on the fishery: notably the requirement to keep the site in cultivation (as noted above) and the requirement to supply data promptly and accurately (19). The seed fishery is also subject to the normal requirements for a Welsh fishery for licencing and for submission of catch and sales data. The fishing vessels may operate either under a standard fishing licence for non-quota species, or under a special shellfish licence – the vessels and licence types are given in Table 1 above. Data on seed and harvested biomass is submitted to the SFC, WAG and DEFRA – daily verbal reports and weekly written returns for seed catch and annual returns for production.

As far as the protected area management framework is concerned, the main implementation tool is the appropriate assessment. Appropriate assessments can be required annually for seed harvesting (depending on the outcome of a ‘test of likely significance’). The leases issued under the 1962 Order are also renewed periodically – most recently in 2009 and next in 2016. The renewal of the leases was subject to appropriate assessment (17).

In addition, as noted above, the industry (BMP Ltd.) has agreed a Code of Good Practice with CCW (14) in regard to seed mussel movements and the introduction of non-native invasive species; compliance is now a condition of the leases. The code essentially requires that the industry take seed mussels only from sources which are known to be free of invasive species, at least during the time of year when harvesting is taking place. So far, only Morecambe Bay and Caernarfon Bar have been approved as seed collection sites for this fishery. The code is further reinforced by this assessment, since mussels grown from seed from non-approved areas are not included in the unit of certification. A Code

of Good Practice is also in place to avoid genetic changes in the Menai Strait mussel population (23).

3.5 Evaluation of management

As already noted above, the management of the seed mussel resource in Morecambe Bay and Caernarfon Bar is subject to regular (annual) external review by Natural England or CCW, as part of their oversight of the protected areas. The management of the Menai Strait is also subject to regular internal and external review: the Menai Strait Fishery Order Management Association (which includes a range of stakeholders – see Table 4 above) provides internal review, while WAG and CCW provide external review. The management policy and actions of the NWSFC are similarly subject to internal review by the Committee Members (which includes a range of stakeholders), and also to external review by Natural England. WAG also proposes a structure that would be subject to regular review by stakeholders (26) although it is not clear whether this structure has been finalised.

4. Fishery evaluation process

4.1 MSC standard

This assessment follows the Fisheries Assessment Methodology and Guidance (FAM), version 2 from November 2009. The FAM sets out the MSC Standard against which the fishery is assessed, as well as setting out the assessment methodology and providing definitions of key terms (1).

The MSC Standard is composed of three Principles, as follows:

- **Principle 1:** A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery;
- **Principle 2:** Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.
- **Principle 3:** The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

Each Principle is divided into a series of Performance Indicators (PIs). Each PI can be either related to ‘outcome’ (i.e. the current situation in regard to the element described in the PI), ‘management’ (i.e. the management objectives, strategy or rules for that element) or ‘information’ (i.e. the available knowledge about that element).

For each PI, there are three Scoring Guideposts (SGs). The lowest SG corresponds to a minimum requirement for certification, under the condition that the situation can be improved; the middle SG corresponds to a minimum requirement for certification without conditions, while the highest SG corresponds to an optimal or ‘perfect’ scenario. These three SGs are assigned scores of 60, 80 and 100. The consequences for each score are set out in Table 5 below.

Table 5 - Categories of score for a PI, and the consequences of a given score for the overall outcome of certification (1).

Score	Consequence
< 60	If even one PI scores < 60, certification cannot be awarded
60 – 80	Certification is possible but with conditions: performance under any PI scoring between 60 and 80 must be improved to at least the 80 level within a time period specified by the assessment team
80 – 100	If all PIs score 80 or above, certification will be achieved without any conditions

Note that this assessment methodology (the FAM) differs from the methodology used in assessments prior to mid-2008, because PIs and SGs were previously defined by the CB. They are now set out in the FAM, and cannot be altered except under exceptional circumstances (see below).

4.2 RBF and additional PIs

4.2.1 RBF

Principle 1 (PI 1.1.1) was scored using the Risk-Based Framework (RBF). This is an alternative methodology for scoring some selected PIs, which is described in detail in the FAM (1). In summary, the RBF uses two methodologies to score a PI, instead of the standard SGs given in the FAM. The first methodology is a SICA (Scale Intensity Consequence Analysis), which takes the form of a structured discussion about the fishery with a representative set of stakeholders. If the score given by stakeholders is below 80, a second type of assessment is carried out: a PSA (Productivity-Susceptibility Analysis) (see below). If the PSA is required, the PSA score is the final score used for the PI. The exception to this rule is PI 1.1.1, where if the RBF used, the PSA score is always the final score used for the PI, even though the SICA still needs to be carried out and documented (1).

The RBF was used to score one PI: 1.1.1 (stock status: outcome). The SICA and PSA tables for this PI are given in Annex 2. The RBF also affects two other PIs: 1.1.2 (Reference Points) and 1.2.4 (Stock Assessment) – these are given a default score of 80 when the RBF is used for PI 1.1.1.

4.2.2 PSA for mussels

The PSA scores the likely productivity and resilience to fishing pressure of the population in question (target, retained or bycatch) against the likely susceptibility of the population to fishing pressure. On the productivity side, the analysis considers questions such as maximum size and age, size and age at maturity, reproductive strategy and trophic level. On the susceptibility side, the analysis considers the extent to which the population overlaps with the fishery in terms of geographic range, depth and habitat, and the susceptibility of the species to the gear. Each of these elements are scored using tables that group the possible outcomes into three categories (i.e. low, medium or high). Full details, tables and scores for the PSA are given in Annex 2.

Given the nature of this enhanced fishery, it was initially difficult to understand how to carry out a PSA for Principle 1 (target species). After consultation with MSC, it was decided that the PSA should be carried out for the seed gathering element only, but that the score could be modified at the team's discretion to reflect issues around the cultivation element of the fishery. In the event, however, the SICA and the PSA scores came out the same, so no further modification was required.

A second issue to contend with as regards the PSA is that 'selectivity tables' are not defined by MSC for most types of gear, including mussel dredges. Instead, the assessment team is required to define (and justify) their own tables for the gear type in question. The justification is set out in detail in Annex 2, and summarised here. Essentially, the team decided that the most straightforward way in which to group dredge selectivity into three categories was as follows:

1. Low risk score for selectivity for the species: Dredges which are made of a larger mesh size than the body size of the species in question, i.e. where the species can pass directly through;
2. Medium risk score for selectivity for the species: Dredges where only large adult individuals are caught;
3. High risk score for selectivity for the species: Dredges which catch a wide range of size classes.

Full details are given in Annex 2. MEP welcomes comments on this scoring strategy.

4.2.2 Additional PIs

This fishery is defined by MSC as an 'enhanced fishery' – i.e. that it includes an additional element of ongrowing / husbandry that most fisheries do not include. This inevitably raises issues that are not relevant to most fisheries. In discussion with MSC it was agreed that additional PIs should be added (not normally in the FAM) to deal with these issues.

The key issue identified as not adequately covered in the standard assessment tree (with or without RBF) was the question of genetic impacts on the wild stock through translocation of mussels from Morecambe Bay or Caernarfon Bay to the Menai Strait. To address this issue, three new PIs were added to Principle 1, on genetic outcome (1.1.4),

genetic management (1.2.5) and genetic information (1.2.6). These PIs, and their associated SGs were drafted by the assessment team and agreed with MSC before the start of the information-gathering phase of the assessment.

The PIs used to assess this fishery, and their scoring system, is shown in Table 6. The full set of PIs and SGs are set out in the assessment tree for this fishery, with the scores given for each PI and a detailed rationale for each score according to the SGs. The assessment tree is provided in Annex 1 of this report. The scores are also summarised in Section 7.

Table 6 - The full set of PIs for each Principle used to score this fishery.

Prin- ciple	Compo- nent	PI number	PI	Scoring system
1	Out- come	1.1.1 Stock status	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing	RBF
		1.1.2 Reference points	Limit and target reference points are appropriate for the stock	Given default score of 80 when RBF used above
		1.1.3 Stock rebuilding	Where the stock is depleted, there is evidence of stock rebuilding	Not required to be scored in this case
		1.1.4 Genetic outcome	The fishery has negligible discernable impact on the genetic structure of the population	new - devised by MEP
	Manage- ment	1.2.1 Harvest strategy	There is a robust and precautionary harvest strategy in place	FAM
		1.2.2 Harvest control rules / tools	There are well defined and effective harvest control rules in place	FAM
		1.2.3 Information / monitoring	Relevant information is collected to support the harvest strategy	FAM

		1.2.4 Assessment of stock status	There is an adequate assessment of the stock status	Given default score of 80 when RBF used above
		1.2.5 Genetic manage- ment	There is a strategy in place for managing translocations such that the fishery does not pose a risk of serious or irreversible harm to the genetic diversity of the population	new - devised by MEP
		1.2.6 Genetic information	Information on the genetic structure of the population is adequate to determine the risk posed by the fishery, if any	new - devised by MEP
2	Retained species	2.1.1 Outcome	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species	FAM
		2.1.2 Manage- ment	There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species	FAM
		2.1.3 Information	Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species	FAM
	By-catch	2.2.1 Outcome	The fishery does not pose a risk of serious or irreversible harm to the by-catch species or species groups and does not hinder recovery of depleted by-catch species or species groups	FAM
		2.2.2 Manage- ment	There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations	FAM
		2.2.3 Information	Information on the nature and amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch	FAM

	ETP species	2.3.1 Outcome	The fishery meets national and international requirements for protection of ETP species. The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species	FAM
		2.3.2 Management	The fishery has in place precautionary management strategies designed to: - meet national and international requirements; - ensure the fishery does not pose a risk of serious or irreversible harm to ETP species; - ensure the fishery does not hinder recovery of ETP species; and - minimise mortality of ETP species	FAM
		2.3.3 Information	Relevant information is collected to support the management of fishery impacts on ETP species, including: - information for the development of the management strategy; - information to assess the effectiveness of the management strategy; and - information to determine the outcome status of ETP species	FAM
	Habitats	2.4.1 Outcome	The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function	FAM
		2.4.2 Management	There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types	FAM
		2.4.3 Information	Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types	FAM
	Eco-systems	2.5.1 Outcome	The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function	FAM
		2.5.2 Management	There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function	FAM
		2.5.3 Information	There is adequate knowledge of the impacts of the fishery on the ecosystem	FAM

3	Governance and policy	3.1.1 Legal / customary framework	The management system exists within an appropriate and effective legal and/or customary framework which ensures that it: - Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; - Observes the legal rights created explicitly or by custom of people dependent on fishing for food or livelihood; and - Incorporates an appropriate dispute resolution framework	FAM
		3.1.2 Consultation, roles and responsibilities	The management system has effective consultation processes that are open to interested and affected parties. The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties.	FAM
		3.1.3 Long term objectives	The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach	FAM
		3.1.4 Incentives for sustainable fishing	The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing	FAM
	Fishery-specific management system	3.2.1 Fishery-specific objectives	The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2	FAM
		3.2.2 Decision-making processes	The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives	FAM
		3.2.3 Compliance and enforcement	Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with	FAM
		3.2.4 Research plan	The fishery has a research plan that addresses the information needs of management	FAM

		3.2.5 Manage- ment performance evaluation	There is a system for monitoring and evaluating the performance of the fishery-specific management system against its objectives. There is effective and timely review of the fishery-specific management system	FAM
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4.3 Assessment process

The steps to follow in the assessment process are set out by MSC in the Fisheries Certification Methodology (most recent version Version 6, September 2006 –27), and modified by various other documents issued by MSC¹. In summary, these steps are as follows:

1. Pre-assessment
2. Full assessment step 1: Preparation and scoping. This phase forms the start of the formal assessment process, and includes i) the formal notification of the assessment to MSC, stakeholders and public; ii) the selection and approval (including the possibility of stakeholder input) of team of experts and iii) selection of the appropriate assessment methodology (as described above). For this assessment, due to its relative complexity, a preliminary meeting was held involving MEP, the client and selected stakeholders.
3. Full assessment step 2: Data gathering and evaluation. In this phase the fishery is assessed using data from a variety of sources including: i) published and unpublished scientific data, reports and other similar sources; ii) a site visit by the expert team; and iii) stakeholder consultations via face-to-face interview, phone or email. On the basis of the information gathered, the fishery is scored against the standard (using the FAM or RBF). A preliminary assessment report is produced, which is reviewed by the client and by two external peer reviewers. The resulting Public Comment Draft Report is then made available for stakeholder comment.
4. Full assessment step 3: Final report and objections procedure. In this phase, the CB produces a Final Report which must present and respond in full to all comments by reviewers and stakeholders. The Final Report is made available on the MSC website, and stakeholders are given the opportunity to object formally to the determination made by the CB. If such objections are received, the CB must respond in detail to the objector and to MSC. A final determination decision is then made, either by the CB or in the case of a formal objection by an external independent reviewer.
5. Ongoing review of certification. A certified fishery is audited every year and re-assessed every five years.

The publication of this Public Comment Draft Report on the MSC website marks the end of step 3 of the assessment process for this fishery.

¹ TAB Directives and Policy Advisories – see <http://www.msc.org/documents/scheme-documents>

4.4 Assessment of Menai Strait mussel fishery

Pre-assessment: MEP prepared out a pre-assessment study of the northern Menai Strait mussel fishery in June 2008. The outcome of the pre-assessment led BMP to decide to apply for MSC certification. The intention to proceed with full assessment was announced by MEP on the MSC website on 9 April 2009.

Full assessment: The team were nominated on 23 April 2009 and confirmed on 2 July 2009. No comment or objections were received about the composition of the team. A preliminary meeting was held with the MEP expert team, client and stakeholders on 16 June 2009 to consider the fishery and the assessment strategy. The revised assessment tree was posted on the MSC website on 13 October 2009 and confirmed after 30 days. The site visit and scoring meeting took place on 2-4 March 2010, in Bangor, North Wales. The peer reviewers were nominated by MEP on 2 June 2010 and approved after 10 days. The Public Comment Draft Report was returned after review by the client on XX and by the peer reviewers on XX. Peer reviewer comments were incorporated, and it was placed on the MSC website for stakeholder review on XX.

4.5 Stakeholder consultations

As well as making announcements and documents available via the MSC website, as required by the MSC assessment process, MEP twice made direct contact with key stakeholders, to ensure that they were aware that the assessment was taking place and that they had the opportunity to comment or object to any part of the process. This process of contact was conducted primarily by email, backed up by telephone when there was difficulty in making contact by email. The first set of contact letters was sent out during early May 2009 and announced the imminent start of the assessment. The second set was sent out in January 2010 and announced the details of the site visit. A preliminary meeting was also held in June 2009, to inform key stakeholders about the MSC process – minutes of this meeting are summarised in Annex 4. The stakeholders who participated in the SICA workshop and site visit are shown in Table 7.

Table 7 - Stakeholders and others who participated in the SICA workshop and site visit.

Name	Affiliation	Notes
James Wilson	Deep Dock Ltd. / BMP	BMP - client
Kim Mould	Myti Mussels Ltd. / BMP	BMP - client
Trevor Jones	Extramussel Ltd. / BMP	BMP - client
Roland Sharp	CCW	Menai Strait and Conwy Bay SAC
Robert Whiteley	Natural England	Morecambe Bay
Vickie Hickin	NWNWSFC (position transferring to WAG)	marine scientist

Virginia Prieto	NWNWSFC (position transferring to WAG)	marine scientist
Dr. Jim Andrews	independent	consultant to BMP
Dr. Andy Beaumont	Bangor University	expert in shellfish genetics, including mussels
Graham Rees	WAG	Fisheries (note – interviewed separately)
Stuart Evans	WAG	Fisheries (note – interviewed separately by phone)
Dr Jo Gascoigne	MEP	Assessment team Principle 1
Prof. Michel Kaiser	Bangor University / MEP	Assessment team Principle 2
Clive Askew	independent / MEP	Assessment team Principle 3
Max Goulden	MEP	observer / note-taker
Daniel Suddaby	MSC	observer

5. Scoring

5.1 Scoring methodology

Each PI is scored with reference to the three scoring guideposts (SGs) (see above). During the site visit and scoring meeting, each PI was discussed in the light of the information received from stakeholders during the site visit. The score and rationale put forward by each team member was considered and a joint score arrived at.

The PI scored using the RBF (1.1.1) were first scored using the SICA methodology, which is set out in detail in the FAM (1). Essentially, the stakeholders in the SICA workshop first score the temporal and spatial scale and intensity of the fishery, in order to focus ideas, before finally scoring the likely impact of the fishery on the element in question (i.e. the target stock for Principle 1) using a set of Scoring Guideposts defined by MSC (see Annex 2). These scores were discussed by the team but were not changed from those arrived at by the stakeholders. PI 1.1.1 was then scored again using the PSA, which is also described in detail in the FAM. This analysis considers the productivity and susceptibility of the entire stock to all fishing activity, rather than focuses just on the fishery in question (see Annex 2). In the event, both these scores came out the same, and this was obviously the final score given for this PI.

Scores between 60 and 80 or between 80 and 100 were arrived at by a semi-quantitative method. For example, if the fishery achieves all the components of SG 80, but only some of the components in SG 100, the fishery would have been scored as shown in Table 8.

Table 8 - Example of how the team decided on a score between 80 and 100 (the same principle would apply to a score between 60 and 80, as well as to SG with different numbers of elements). The table assumes that all the components of SG 80 are met.

Number of components in SG 100 achieved by the fishery, out of four	Score	Number of components in SG 100 achieved by the fishery, out of five	Score
0	80	0	80
1	85	1	80
2	90	2	85
3	95	3	90
4	100	4	95
		5	100

5.2 Weighting

The FAM sets out how the score of each PI should be weighted. The weighting ensures that overall scores for each Principle are equally important in the overall score. Within each Principle, each component is weighted equally. Within each component, each PI is weighted equally. The aggregate score for each Principle, and the overall score, is thus a weighted average of the scores for each PI.

Scores and weightings for this fishery are obviously complicated by the addition of extra PIs into Principle 1, as outlined above. These PIs were added into Principle 1 Component Outcome (extra PI 1.1.4 – Genetic Outcome) and Principle 1 Component Management (extra PIs 1.2.5 and 1.2.6 – Genetic Management and Genetic Information). It was agreed with MSC that these PIs should have equal weight within their component with the other PIs, leading to a reduced overall contribution of each PI in the component to the overall component score, but an equal contribution of each component to the overall Principle score.

The standard weightings as set out in the FAM apply to Principles 2 and 3, where there are no additional PIs. The weightings for each PI and component are given in Table 9.

Table 9 – Weightings for each PI, including the additional PIs, for this fishery.

Principle	Component	Weight of Component in Principle	PI number	PI	Weight of PI in Component	Weight of PI in Principle
One	Outcome	0.5	1.1.1	Stock status: outcome	0.333	0.167
			1.1.2	Reference points*	0.333	0.167
			1.1.3	Stock rebuilding	not	0

	Management	0.5			scored	
			1.1.4	Genetic outcome	0.333	0.167
			1.2.1	Harvest strategy	0.167	0.083
			1.2.2	Harvest control rules and tools	0.167	0.083
			1.2.3	Information and monitoring	0.167	0.083
			1.2.4	Assessment of stock status*	0.167	0.083
			1.2.5	Genetic management	0.167	0.083
Two	Retained spp.	0.2	1.2.6	Genetic information	0.167	0.083
			2.1.1	Outcome	0.333	0.067
			2.1.2	Management	0.333	0.067
	Bycatch	0.2	2.1.3	Information	0.333	0.067
			2.2.1	Outcome	0.333	0.067
			2.2.2	Management	0.333	0.067
	ETP species	0.2	2.2.3	Information	0.333	0.067
			2.3.1	Outcome	0.333	0.067
			2.3.2	Management	0.333	0.067
	Habitats	0.2	2.3.3	Information	0.333	0.067
			2.4.1	Outcome	0.333	0.067
			2.4.2	Management	0.333	0.067
	Ecosystems	0.2	2.4.3	Information	0.333	0.067
			2.5.1	Outcome	0.333	0.067
			2.5.2	Management	0.333	0.067
			2.5.3	Information	0.333	0.067
Three	Governance and policy	0.5	3.1.1	Legal / customary framework	0.25	0.125
			3.1.2	Consultation, roles and responsibilities	0.25	0.125
			3.1.3	Long-term objectives	0.25	0.125
			3.1.4	Incentives for sustainable fishing	0.25	0.125
	Fishery-specific management system	0.5	3.2.1	Fishery-specific objectives	0.2	0.1
			3.2.2	Decision-making	0.2	0.1

				processes		
			3.2.3	Compliance and enforcement	0.2	0.1
			3.2.4	Research plan	0.2	0.1
			3.2.5	Management performance evaluation	0.2	0.1

* Given a default score of 80

6. Assessment results

This section summarises the results of the assessment of the north Menai Strait mussel fishery. The full assessment tree with scores and rationales for each PI is in Annex 1 of this report. The SICA Table for the PI scored using the RBF is given in Annex 2.

6.1 Overall results

The scores for each Principle (calculated as described above) are shown in Table 10.

Table 10 - Scores for each Principle for the northern Menai Strait mussel fishery assessment.

Principle	Aggregate score
Principle 1	85
Principle 2	87.7
Principle 3	85.75

6.2 Principle 1

The scores for each PI, and the aggregate score for each component for Principle 1 are shown in Table 11.

Table 11 - Scores for each PI, and aggregate scores for each component for Principle 1 for the north Menai Strait mussel fishery.

Component	PI	Score
<i>Outcome</i>	<i>Average outcome score</i>	86.7
	Stock status	99.9
	Reference points	80
	Stock rebuilding	n/a
	Genetic outcome	80
<i>Harvest strategy (management)</i>	<i>Average harvest strategy score</i>	83.3
	Harvest strategy	85
	Harvest control rules and tools	80
	Information/monitoring	80
	Assessment of stock status	80
	Genetic management	90
	Genetic information	85

6.3 Principle 2

The scores for each PI, and the aggregate score for each component for Principle 2 are shown in Table 12.

Table 12 - Scores for each PI, and aggregate scores for each component for Principle 2 for the northern Menai Strait mussel fishery.

Component	PI	Score
<i>Retained species</i>	<i>Average retained spp. score</i>	100
	Outcome	100
	Management	100
	Information	100
<i>By-catch</i>	<i>Average bycatch score</i>	73.3
	Outcome	80
	Management	80
	Information	60
<i>ETP species</i>	<i>Average ETP spp. score</i>	83.3
	Outcome	90
	Management	80
	Information	80
<i>Habitat</i>	<i>Average habitat score</i>	91.7

	Outcome	95
	Management	100
	Information	80
<i>Ecosystem</i>	<i>Average ecosystem score</i>	<i>90</i>
	Outcome	80
	Management	100
	Information	90

6.4 Principle 3

The scores for each PI, and the aggregate score for each component for Principle 3 are shown in Table 13.

Table 13 - Scores for each PI, and aggregate scores for each component for Principle 3 for the north Menai Strait mussel fishery.

Component	PI	Score
<i>Governance and policy</i>	<i>Average governance and policy score</i>	<i>87.5</i>
	Legal and/or customary framework	90
	Consultation, roles and responsibilities	90
	Long term objectives	80
	Incentives for sustainable fishing	90
<i>Fishery-specific management system</i>	<i>Average fishery-specific management system score</i>	<i>84</i>
	Fishery-specific objectives	80
	Decision-making process	90
	Compliance and enforcement	90
	Research plan	70
	Monitoring and management performance evaluation	90

7. Draft Certification Recommendation

7.1 Recommendation

The fishery is recommended for certification under the MSC programme, having met the following criteria:

- Each Principle has an aggregate score higher than 80;
- No individual PI has a score below 60

7.2 Conditions

Two PIs have a score below 80 and therefore two conditions are imposed on the fishery, as follows:

Condition 1 – PI 2.2.3 – By-catch species information

The team concluded in order to meet SG 80, there was a need for more quantitative information on catches of the most significant by-catch species (green crab and starfish) either to conclude that they are not ‘main’ by-catch species (constituting more than 5% of the catch) or else to support a partial management strategy should that become necessary.

The fishery needs to collect quantitative or semi-quantitative data on starfish and green crab by-catch at each of the three sites, to show either i) that they typically constitute less than 5% of the catch (i.e. should be downgraded from main to minor by-catch species); or ii) so that the impact of the fishery on local population levels can be better understood and tracked over time.

Condition 2 – PI 3.2.4 – Research

The team noted that while BMP has an excellent record of supporting and participating in scientific research, there is no formal research plan as such, as required under SG 80 for this PI, although the team notes that the formulation of a formal research plan is an objective of the fishery (22).

The fishery should develop a formal, strategic research plan.

The Client Action Plan for meeting these conditions is set out in Section 9 below.

7.3 Recommendations

A number of recommendations have been made by the team (in several cases proposed by the peer reviewers). These recommendations do not have the same binding status as conditions, because they apply to a PI which was given a score of 80 or more. The fishery is therefore deemed to be meeting the appropriate standard for MSC certification without these recommendations being implemented, and is thus not required to take any action. However, if straightforward to implement, the proposed changes would improve the fishery still further. They are listed here for convenience.

8. Chain of custody

8.1 Vessels in the Unit of Certification

A complete list of vessels involved in the fishery is given in Table 1 above. The Unit of Certification has been defined to include all the mussels landed by members of BMP Ltd.

8.2 Points of landing

All the mussels covered by the Unit of Certification are landed for final sale at Port Penrhyn (Bangor, North Wales).

8.3 Processing on board

There is no processing on board

8.4 Traceability within the fishery

All mussels produced by BMP are eligible for sale as MSC. Upon landing by one of the registered vessels involved in the fishery (See Table 1) the product is placed into one ton bulk bags and unloaded on to the quay side at Port Penrhyn (Bangor, North Wales). All product remains here until it is collected by approved third party transportation (usually 22 one-ton bags are transported at one time. No other product is transported with the certified mussels ensuring physical and temporal separation is maintained.

Due to rules relating to the movement of live mussels, all product is accompanied with a Movement Document which sets out details relating to the date fished, vessels involved and quantity present. This is key to maintaining traceability and means that the members of BMP Ltd. have readily available records of the dates and amount of MSC product that they may sell at any given time.

BMP Ltd. members will also issue an invoice to the client stating the quantity of product and showing that it is MSC (the fishery certificate will also be present on the outgoing invoices).

8.5 Seed mussel collection sites

The Unit of Certification covers mussels grown from seed taken from either of two sites: Morecambe Bay and Caernarfon Bar. In recent years, seed for the fishery has only come from these sites, but in the past, seed has been taken from other areas. The Code of Good Practice agreed with CCW (to avoid risk of non-native introductions) (14) restricts the mussel fishermen to collecting seed from these sites. Thus if seed were taken from other sites and grown on the north Menai Strait mussel lays, these mussels would not be eligible for the MSC label, since they are not included in the Unit of Certification and are

not covered by this assessment. Verifying the source of seed mussels will be an important component of the annual surveillance audits. There is no reason, in principle, why other sources of seed could not be included in future assessments; obviously the impacts and risks of these activities would then have to form part of the assessment.

8.6 Chain of custody risk assessment for BMP Ltd.

In order to assess any possible risks associated with the start of the chain of custody MEP has conducted a risk assessment based on the following findings;

- 1. Risk of mixing of MSC and non-MSC product before landing – Low to Medium**
All mussels produced by members of BMP Ltd/ (provided they do not take seed from non-assessed areas) will be covered by this certification – thus there is no need to separate mussels during collecting, production or harvesting. Some risk to the chain of custody through risk that seed will be taken from sites not included in the Unit of Certification.
- 2. Risk of mixing of MSC and non-MSC product during processing – Low**
No processing is undertaken by BMP Ltd. members.
- 3. Risk of mixing of MSC and non-MSC product after landing – Low**
All mussels produced by BMP Ltd. members would be certified and no non-MSC mussels will be stored or sold at Penrhyn (Bangor, North Wales).
- 4. Risk of incorrect labeling of MSC and non-MSC product at sale – Low**
All mussels produced by BMP Ltd. members are certified and all product will be accompanied by a Movement Document (allowing traceability to be maintained) and an invoice that will show the product as MSC (along with the fishery certification code).

Overall, MEP concluded that there is a low risk of problems with the chain of custody arising due to the activities of BMP Ltd. members. The main risk to the chain of custody at the level of the fishery (i.e. as considered here) is considered to be the risk that seed will be taken from sites not included in the Unit of Certification – this is a key issue for each annual surveillance.

MEP concludes that Chain of Custody for product originating from the fishery shall be required at the point of sale and receipt by the client of certified product from BMP Ltd.

8.7 Target eligibility date

The target eligibility date for this fishery has been set at 1 April 2010.

9. Client Action Plan

Menai Strait Mussel Fishery MSC Assessment Client Action Plan

Bangor Mussel Producers Ltd welcomes the outcome of the MSC assessment of the Menai Strait Mussel Fishery. We undertake to implement this Action Plan in response to the two conditions raised by the assessment team.

Condition 1 – PI 2.2.3 – By-catch [Discarded] species information

The assessment report states that:-

The team concluded in order to meet SG 80, there was a need for more quantitative information on catches of the most significant by-catch species (green crab and starfish) either to conclude that they are not 'main' by-catch species (constituting more than 5% of the catch) or else to support a partial management strategy should that become necessary.

The fishery needs to collect quantitative or semi-quantitative data on starfish and green crab by-catch at each of the three sites, to show either i) that they typically constitute less than 5% of the catch (i.e. should be downgraded from main to minor by-catch species); or ii) so that the impact of the fishery on local population levels can be better understood and tracked over time.

Action Plan

We will commission research and record information on catch composition at each of the three sites in the unit of certification (on the lays in the Menai Strait, in Morecambe Bay and Caernarfon Bar), so that the quantity of non-target species caught and discarded in the fishery can be estimated. This will enable us to identify appropriate management measures and implement them, if necessary, to reduce discarding from the fishery.

Our timescale for action will be:-

Year 1

Action

June – July 2010:

- Identify information requirements and develop monitoring procedures.

August 2010 onwards:

- Implement monitoring procedures; record data.

March 2011:

- Analyse data & produce report on levels of discarding from fishery.

- Identify potential management measures, if necessary, for reducing discarding levels of main species.

Year 2 & Ongoing

- Agree and implement management measures identified as necessary to reduce discarding in the Year 1 report.
- Continue monitoring at a level appropriate to the level of risk identified in the Year 1 report to confirm the extent and nature of discarding from the fishery.
- Adapt management and monitoring approach in response to new information.

Condition 2 – PI 3.2.4 – Research

The assessment report states that:-

The team noted that while BMP has an excellent record of supporting and participating in scientific research, there is no formal research plan as such, as required under SG 80 for this PI, although the team notes that the formulation of a formal research plan is an objective of the fishery (22).

<i>The fishery should develop a formal, strategic research plan.</i>
--

Action Plan

We are pleased that the assessment team has highlighted that we had already identified the need for a research plan and have made a formal commitment to put one in place.

We recognise that our work on this will need to meet the SG80 requirements identified by the MSC, which are to provide:-

- a strategic approach to research
- reliable and timely information to guide management
- results that are disseminated to interested parties in a timely fashion

Our timescale for action to achieve these goals will be:-

Year 1

Sept - March 2010:

- Identify good practice from existing certified fisheries
- Agree information requirements with managers of the

Menai Strait, Caernarfon Bar and Morecambe Bay fisheries

- Prepare strategic research plan identifying key research issues
- Agree priorities for research

March 2011 onwards:

- Publish research plan & circulate to interested parties
- Commence implementation of plan
- Commence dissemination of research results to interested parties.

Year 2

March 2011:

- Keep research issues and priorities under review
- Continue implementation of plan
- Continue dissemination of results to interested parties.

Bangor Mussel Producers Ltd

June 2010

Annex 1 – Assessment tree

Principle 1

A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.

1.1 Outcome

1.1.1 Stock status

The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing

SG 60: It is likely that the stock is above the point where recruitment would be impaired.

SG 80: It is highly likely that the stock is above the point where recruitment would be impaired.

The stock is at or fluctuating around its target reference point

SG 100: There is a high degree of certainty that the stock is above the point where recruitment would be impaired.

There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.

Score from SICA – 100

Score from PSA – 99.9

Overall score – 99.9

Rationale

1. Peculiarities of the fishery

This fishery takes seed mussels from two specific areas – two ‘skears’ (cobble patches) in Morecambe Bay (South America skear and Falklands skear) and from Caernarfon Bar, just outside the southern entrance to the Menai Strait (see Figure 1 of main report for a map). These two sites are ecologically different because the Morecambe Bay skears are

in the low intertidal, while Caernarfon Bar is in the subtidal. However, they are both in high energy sites (because of strong tidal currents) with very mobile benthic habitats – in particular a tendency for sand waves to be moved through the area by storms, leading to temporary loss of suitable mussel habitat or smothering of mussels. This commonly happens in autumn and winter. In addition, in Caernarfon Bar where seed settles in the subtidal, starfish and crab predation on the small mussels is very significant. These factors ensure that it is relatively rare for seed which settles in one spring or summer to survive through to the following year (28). The newly settled mussels may spawn to some extent in year 0, but in general their contribution to the overall population is considered to be low in most years (this is sometimes called a ‘sink’ site). Recruitment of mussels to all these sites is sporadic and may not occur at all in some years – in which case the fishery has to survive without any input of seed for that year. As far as the team could discover, there is no specific information on the adult population(s) that provide source of recruitment to these areas.

This fishery harvests these seed mussels (subject to certain rules – see below) and relays them in the Menai Strait where they are grown for roughly two years before final harvest. In the Menai Strait they spawn. This means that overall the fishery probably has a positive impact on the overall mussel population – in any case, it does not have a net negative impact like most fisheries.

This means that the main concern in the management of the fishery is not the status of the stock, but rather the status of recruitment on to the seed sites, and more specifically the sharing of the resource between the fishery and the other elements of the ecosystem (noting that the seed resource is only naturally present in the ecosystem sporadically and in highly variable amounts - 28).

The rather unusual nature of this fishery has necessitated some interpretation by the team of some of the performance indicators below – for example in reference to stock status. Management and monitoring of stock status is not particularly relevant for this fishery; rather, managing and monitoring of recruitment on to the seed sites is the critical factor. Where some ‘interpretation’ of the PIs has been required, this is noted in the rationale. MEP welcomes all comments on the interpretation of the standard as well as on the scores and rationales.

2. Risk-based framework

This PI was scored using the risk-based framework (RBF) – for full details of how it works, see the FAM (1) and for a brief summary description see Section 4 of the main report. A SICA workshop was held in Bangor on 2 March 2010 – a list of participants is given in Section 4 of the main report above.

3. Results of the SICA

The full SICA Table with scores and rationales is given in Annex 2. The rationale is summarised here.

The most significant combination of activity-component-subcomponent for this PI was considered to be the impact of seed mussel fishing on mussel population size. There was unanimous agreement from the stakeholders that this impact was negligible, leading to a

SICA score of 1, which converts to an MSC score of 100. This was for the following reasons:

- *M. edulis* is abundant and ubiquitous around European shores (and beyond) – the entire UK stock is probably one population (3) although to be conservative the group considered that the Irish Sea was the appropriate geographical boundary for the population;
- The footprint of the fishery is very small relative to the population size and habitat distribution of mussels in the Irish Sea (this is quantified in Annex 2);
- The fishery operates on ephemeral seed beds (28) and relays mussels which go on to grow and spawn - so does not lead to a net loss to the population or to reproductive output.

The team fully agreed with this assessment by stakeholders.

4. PSA

If the RBF is used for PI 1.1.1, a PSA is normally required, notwithstanding the results of the SICA. For this fishery, the PSA was carried out to reflect the seed fishery element only (since it is not appropriate for the cultivation element). The team had scope, if necessary, to adapt the PSA score so that the final score reflected issues around the cultivation element of the fishery as well as the seed fishing element. In the event, however, this was not necessary (see below).

5. Results of the PSA

The full set of scores and rationales for the PSA is given in Annex 2 below. Mussels were considered by their life history attributes to have high productivity. Their susceptibility to fishing pressure scored in general low, because i) mussels are not fished, or are very lightly fished, over most of their range – all seed and handgathering fisheries account for a miniscule proportion of the standing stock; ii) mussels are not fished in their most important habitat (the rocky intertidal), except for a trivial amount of handgathering; and iii) post-capture mortality in this fishery is low, because the mussels are relaid.

This led to an overall score for the PSA of 99.91 (rounded to 100) – the same score as the SICA, and the final score for this PI.

1.1.2 Reference points

Limit and target reference points are appropriate for the stock.
--

SG 60: Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.

SG 80: Reference points are appropriate for the stock and can be estimated.

The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.

The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.

For low trophic level species, the target reference point takes into account the ecological role of the stock.

SG 100: Reference points are appropriate for the stock and can be estimated.

The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues.

The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.

Score: 80

Rationale

When Principle 1 is scored using the RBF, this PI is given a default score of 80.

1.1.3 Stock rebuilding

Where the stock is depleted, there is evidence of stock rebuilding
--

NOT REQUIRED TO BE SCORED IN THIS CASE

1.1.4 Genetic outcome

The fishery has negligible discernable impact on the genetic structure of the population
--

SG 60: Possible detectable change in genetic structure but minimal impact at population level. Any change in frequency of genotypes, effective population size or number of spawning units up to 5%.

SG 80: No detectable change in genetic structure. Unlikely to be detectable against background variability for this population.

SG 100: No interactions leading to impacts on genetic structure.

Score: 80

Rationale

This PI was discussed during the SICA workshop, but was scored by the team on the basis of scientific advice received from an expert in mussel genetics as well as from published scientific papers, although the scores and opinions expressed in the SICA workshop were taken into account.

As regards mussel genetics, there are two separate issues:

1. Mixing and hybridisation of *Mytilus edulis* and *M. galloprovincialis* (and to a lesser extent *M. trossulus*);
2. Possibility of sub-population structure within *M. edulis*.

In the UK, the main mussel species present is *M. edulis*. However, *M. galloprovincialis* has been migrating up the Atlantic coast of Europe (assumed to be a natural process) and has been known to be present in the SW of England since the 1950s, and is also found around the west coast of Ireland and Scotland (4). With *M. edulis*, it occurs naturally in a geographic mosaic of the species and of hybrids between them, which are fertile (4). *M. galloprovincialis* and *M. edulis* (and hybrids) are very difficult to distinguish except genetically – however a DNA marker exists which can act as a ‘signature’ for the presence of *M. galloprovincialis* in the system (29). In the Irish Sea, this marker has never been found (Dr. Andy Beaumont, Bangor University, pers. comm. – see Annex 4) and it is assumed that the oceanographic fronts that border the Irish Sea to the north and south have prevented the natural dispersal of *M. galloprovincialis* into the Irish Sea. *M. trossulus* (the Baltic mussel) has only recently appeared in the UK – in Loch Etive in Scotland (5).

As regards population structure of *M. edulis*, it appears likely that there is a single well-mixed population in the Irish Sea – i.e. there is not considered likely to be any spatial genetic structure within the Irish Sea (3, Dr. Andy Beaumont, Bangor University, pers. comm.).

In terms of stakeholder discussion on this issue, there was general agreement that the mussels in question were *M. edulis* not *M. galloprovincialis*. Stakeholders also felt that based on i) the larval duration of *M. edulis* (~2-4 weeks), ii) the strong tides and currents in the Irish Sea and iii) the apparent ubiquity of mussel larvae in the water column (i.e. any suitable substrate will be settled by mussels fairly rapidly) it was reasonable to assume that the Irish Sea mussel population is panmictic, even without the direct genetic information provided by Dr. Beaumont.

Overall, since this fishery operates only in the eastern Irish Sea, the team considered on the basis of the above information that this fishery would not be likely to result in any detectable change to genetic structure – i.e. SG 80 is met. However, since ‘interactions’ (i.e. with activities such as seed fishing and mussel farming) exist which in principle might cause change to genetic structure in the future, the team considered that no part of SG 100 was met, leading to a score of 80.

1.2 Harvest strategy (management)

1.2.1 Harvest strategy

There is a robust and precautionary harvest strategy in place

SG 60: The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.

The harvest strategy is likely to work based on prior experience or plausible argument.

Monitoring is in place that is expected to determine whether the harvest strategy is working.

SG 80: The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.

The harvest strategy may not have been fully tested but monitoring is in place and evidence exists that it is achieving its objectives.

SG 100: The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.

The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.

The harvest strategy is periodically reviewed and improved as necessary.

Score: 85

Rationale

The harvest strategy relates to the harvest of seed mussels from Morecambe Bay and Caernarfon Bar. The harvest of adult mussels from the Menai Strait is not considered here since these mussels are relayed from elsewhere. As noted in the rationale for PI 1.1.1 above, it is the level of recruitment in the seed collecting areas that is important for this fishery, rather than the state of the stock as a whole.

In Morecambe Bay, the spatfall is surveyed in spring by the mussel growers, NWSFC and Natural England. The biomass of seed mussels is estimated and NWSFC prepare an assessment of likely significance which is agreed by Natural England. In the past, there have at times been a TAC agreed – i.e. the amount of seed that the mussel growers can take, based on the amount available, the growth rate and an amount to be left for birds and other predators. In recent years, however, this has not been considered to be necessary. If spatfall is low, the mussel growers may not be permitted to take any seed, unless further spatfall occurs later in the season.

In Caernarfon Bar, the regulatory framework for management is essentially the same, except that CCW approve the assessment of likely significance rather than Natural England. In practice, there is less concern over seed harvesting from Caernarfon Bar than

from Morecambe Bay for two reasons: i) the spatfall is subtidal, and this means that predation from crabs and starfish makes it unlikely that it will survive for long; and ii) there are no species of conservation concern (such as eider ducks in Morecambe Bay) for which the seed mussels might be important. Nonetheless, the mussel growers survey spatfall on Caernarfon Bar, and CCW may participate in these surveys should they wish to.

For SG 80, the team considered that the harvest strategy is responsive – not to the state of the stock but rather to the state of recruitment on to the seed mussel beds. As noted above, the team considered that this is a more appropriate proxy measure of the impact of the fishery than stock biomass in this context, particularly considering that the fishery causes no net depletion of the stock. The elements of the harvest strategy (the mussel growers, the regulatory agencies) work together to achieve management objectives. While there are not explicitly defined reference points, there could be a TAC of seed imposed if necessary, so that enough seed is left for critical ecological requirements. The team considered that this constituted a proxy reference point in this context. There is good monitoring of spatfall, and the system appears to be achieving its objectives (i.e. the status of the SACs / SPAs is not being affected by the fishery).

For SG 100, the team considered that the harvest strategy was well designed to achieve stock management objectives, but that it has not been fully evaluated (in a quantitative way), nor is it systematically reviewed and updated, although the move from management by the Sea Fisheries Committee to the Welsh Assembly Govt. has lead to a one-off review process. Overall, the team considered that one part of SG 100 was met, leading to a score of 85.

1.2.2 Harvest control rules and tools

There are well defined and effective harvest control rules in place

SG 60: Generally understood harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.

There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.

SG 80: Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.

The selection of the harvest control rules takes into account the main uncertainties.

Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.

SG 100: Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.

The design of the harvest control rules take into account a wide range of uncertainties.

Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.

Score 80

Rationale

This fishery has no net impact on the stock size. The objectives of the seed harvest control rules are therefore to ensure that the available seed is shared between the fishery and other components of the ecosystem, where relevant.

For both seed collection areas, the harvest control rule is essentially that an assessment of likely impact is carried out by NWSFC (Morecambe Bay) or WAG (Caernarfon Bar) and approved by the relevant statutory conservation agency (Natural England or CCW). In Morecambe Bay in the past, a TAC for the amount of seed taken by the fishery has been set, following a survey by the industry and the management agencies, and enforced by daily catch information submitted by the mussel fishermen to NWSFC. For the last few years, it has not been considered necessary to set a TAC, and NWSFC have raised questions about the usefulness of this management tool for seed mussel beds, given that it is very difficult to estimate the biomass accurately, and that it changes very rapidly as the mussels grow (Bob Houghton, NWSFC, pers. comm.). Nonetheless, the powers are in place for a TAC to be set at both sites, although at Caernarfon Bar the management agencies have never thought that setting a TAC is necessary. The logic behind this is explained in the rationales for PIs 1.1.1 (given in full in the SICA table in Annex 2) and 1.2.1 above.

The team considered that the harvest control rules are well defined and consistent with the harvest strategy. The exploitation rate can if necessary be reduced according to the amount of seed available, although it not usually considered necessary to do this. The team considered that the main uncertainty in the system was the extent to which predators rely on the seed beds – particularly eider ducks in Morecambe Bay which are protected and where the breeding population is declining (8, Robert Whitely, Natural England, pers. comm. – see Annex 4). This can if necessary be taken into account in the harvest control rule for Morecambe Bay. The system appears to be appropriate and effective, and the team considered it to be precautionary. Thus SG 80 is met. However the team felt that the harvest control rules are basically ad hoc, and while they appear to be working they are not based on a sophisticated design or a quantitative understanding of ecological relationships. Thus SG 100 is not met.

1.2.3 Information / monitoring

Relevant information is collected to support the harvest strategy

SG 60: Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.

Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule

SG 80: Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.

Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.

There is good information on all other fishery removals from the stock.

SG 100: A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available.

All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.

Score 80

Rationale

Since the fishery does not affect the overall size of the stock, which is in any case extremely abundant and widespread, the team did not consider that information directly about stock size is relevant to this fishery. The key relevant information for this fishery is on i) annual recruitment (spatfall) at each of the seed collection sites; and ii) seed removals by the fishery. This information is collected each year at the relevant scale and level of precision required to estimate the biomass on the seed beds, although extensive surveys are precluded by i) difficult access to South America skear at low water springs, and ii) the fact that the Caernarfon Bar seed beds are subtidal, making data collection more difficult. There are no other fisheries removals from the two seed collection sites – they are not accessible to hand-gatherers.

The team considered on this basis that SG 80 was met. However they considered that a ‘comprehensive’ range of information to manage the fishery would involve more ecological and environmental information than is currently available, and the team did not consider that there was a ‘high degree of certainty’ about the system, particularly in view of the potential impact of climate change, so SG 100 is not met.

1.2.4 Assessment of stock status

There is an adequate assessment of the stock status

SG 60: The assessment estimates stock status relative to reference points.

The assessment identifies major sources of uncertainty.

SG 80: The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points.

The assessment takes uncertainty into account.

The stock assessment is subject to peer review.

SG 100: The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.

The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.

The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.

The assessment has been internally and externally peer reviewed.

Score 80

Rationale

When Principle 1 is scored using the RBF, this PI is given a default score of 80.

1.2.5 Genetic management

There is a strategy in place for managing translocations such that the fishery does not pose a risk of serious or irreversible harm to the genetic diversity of the population
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SG 60: There are measures in place, if necessary, which are expected to maintain the genetic diversity of the population at levels compatible with PI 1.1.4. The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).

SG 80: There is a partial strategy in place, if necessary, which is expected to maintain the genetic diversity of the population at levels compatible with PI 1.1.4. There is some objective basis for confidence that the partial strategy will work, based on some information directly about the population involved.

SG 100: There is a strategy in place to maintain the genetic diversity of the population at levels compatible with PI 1.1.4, based on in-depth knowledge of the genetic structure of the population. The strategy is being fully implemented

Score 90

Rationale

The fishery has a genetic strategy which has as objective to avoid an accidental introduction of *M. galloprovincialis* to the Menai Strait (23). A sample from each seed site will be tested each year by a lab at the School of Ocean Sciences, Bangor University, to see whether the DNA marker for *M. galloprovincialis* is present, and a reference site (Aberffraw on the west coast of Anglesey) will also be tested – this site is considered likely to be one of the first to show signs of *M. galloprovincialis* should it arrive naturally in the Irish Sea (Dr. Andy Beaumont, Bangor University, pers. comm.). Seed containing *M. galloprovincialis* will only be put in the Strait if the reference site suggests that the species has moved into the Irish Sea by natural processes.

Given this strategy, and based on the facts (outlined in PI 1.1.4 above) that *M. trossulus* is confined in the UK to a small area (distant from and unconnected to this fishery - 5) and that *M. edulis* is genetically homogeneous around the UK (3), the team considered that this strategy was objectively likely to work – thus SG 80 is met. The team considered that SG 100 was partly met – a strategy is in place and knowledge of the genetic structure of the population can be regarded as ‘in-depth’ relative to most marine species. However, the policy is new, and it is not yet possible to say whether it has been fully implemented. The overall score was thus 90.

1.2.6 Genetic information

Information on the genetic structure of the population is adequate to determine the risk posed by the fishery, if any

SG60: Qualitative or inferential information is available on the level of genetic structure within the population. Information is adequate to broadly understand the likely impact of the fishery. Information is adequate to support measures to manage genetic diversity, if necessary.

SG 80: Qualitative / inferential information and some quantitative or direct information is available on the genetic structure of the population. Information is sufficient to estimate the likely impact of the fishery. Information is adequate to support a partial strategy to manage main genetic impacts of the fishery on the stock.

SG 100: The genetic structure of the population is understood in detail. Information is sufficient to estimate the impact of the fishery with a high degree of certainty. Information is adequate to support a comprehensive strategy to manage genetic impacts, and evaluate with a high degree of certainty whether a strategy is achieving its objective.

Score 85

2090R04D

Rationale

As outlined above, information is available on the genetic structure of the population, which is adequate to support a strategy to manage potential genetic impacts. SG 80 is thus met. For SG 100, the team considered that the genetic structure is understood ‘in detail’ (e.g. see 3,4,5,29), but that given the potential for natural change and migration of populations, requirements for ‘a high degree of certainty’ in the prediction and management of potential genetic impacts is not met – giving an overall score of 85.

Principle 2

Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.

2.1 Retained species

2.1.1 Outcome status

The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species.

SG 60: Main retained species are likely to be within biologically based limits or if outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.

If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.

SG 80: Main retained species are highly likely to be within biologically based limits, or if outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.

SG 100: There is a high degree of certainty that retained species are within biologically based limits.

Target reference points are defined and retained species are at or fluctuating around their target reference points.

Score 100

Rationale

Under Principle 2, the assessment considered ecosystem-level impacts of both seed collection and of mussel relaying, husbandry and harvesting. Thus three sites are considered: i) Morecambe Bay; ii) Caernarfon Bar and iii) the Menai Strait. The sites and activities are considered separately where necessary.

The MSC standard makes a distinction between ‘retained’ species and ‘by-catch’ species. Retained species are those which are caught alongside the target species and which are retained and sold, or which have a market value. By-catch species are those which have no value and are rejected.

When seed is collected from both Morecambe Bay and Caernarfon Bar it is usually relatively clean, but can contain green crabs (both sites) and starfish and whelks (Caernarfon Bar), as well as the occasional flatfish (both sites) and catshark (Caernarfon Bar). These species are relaid with the mussels, except that the flatfish are occasionally retained for personal consumption by the fishermen. The same issues apply when fully grown mussels are removed from the Menai Strait for sale, except that in this case, none of the animals will survive as they are transported over long distances and removed by hand during a shore-based sorting process. On this basis, the team considered that none of these species constituted 'retained species'. (By-catch is considered below.)

A separate fishery (outwith the current assessment) occurs in the Menai Strait for green crabs, which was started by the mussel industry as a predator control measure. The industry now uses other methods (husbandry techniques) to reduce green crab and other sources of predation on mussels, but the green crab fishery continues because the crabs can be sold to France for use in some processed seafood products. The team debated whether this fishery should be included as an activity associated with the mussel fishery; however the team noted i) in years where the price for green crabs is low, the fishery does not take place; and ii) the fishery is open to any licensed fishermen to enter or leave at any time. On this basis, the team considered that this activity was separate, and did not include it in the assessment. Furthermore, recent (unpublished) evidence suggests that crab population structure has not changed between 1990 and the present day (30).

Thus overall there are no retained species, main or otherwise, in this fishery. This leads to a default score of 100 for this PI.

2.1.2 Management strategy

There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.

SG 60: There are measures in place that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.

The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).

SG 80: There is a partial strategy in place that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.

There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.

There is some evidence that the partial strategy is being implemented successfully.

SG 100: There is a strategy in place for managing retained species.

The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports high confidence that the strategy will work.

There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is some evidence that the strategy is achieving its overall objective.

Score 100

Rationale

As outlined above, there are no retained species in this fishery, leading to a default score of 100.

2.1.3 Information / monitoring

Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
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SG 60: Qualitative information is available on the amount of main retained species taken by the fishery. Information is adequate to qualitatively assess outcome status with respect to biologically based limits.

Information is adequate to support measures to manage main retained species

SG 80: Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.

Information is sufficient to estimate outcome status with respect to biologically based limits.

Information is adequate to support a partial strategy to manage main retained species.

Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).

SG 100: Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.

Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.

Information is adequate to support a comprehensive strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.

Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species

Score 100

Rationale

As outlined above, there are no retained species in this fishery, leading to a default score of 100.

2.2 By-catch

2.2.1 Outcome status

The fishery does not pose a risk of serious or irreversible harm to the by-catch species or species groups and does not hinder recovery of depleted by-catch species or species groups.

SG 60: Main by-catch species are likely to be within biologically based limits, or if outside such limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.

If the status is poorly known there are measures or practices in place that are expected result in the fishery not causing the by-catch species to be outside biologically based limits or hindering recovery

SG 80: Main by-catch species are highly likely to be within biologically based limits or if outside such limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding

SG 100: There is a high degree of certainty that by-catch species are within biologically based limits

Score 80

Rationale

1. Definition of 'by-catch'

As noted above, 'by-catch' species are those caught with the target species that have no commercial value in the context in which they are captured and are discarded. SGs 60 and 80 refer to 'main' by-catch' species – this is defined as species constituting more than 5% of the catch or those which are particularly vulnerable.

2. Sources of data

Bycatch data from the fishery is mainly qualitative or semi-quantitative ('a few buckets'). There is no requirement to report bycatch along with mussel seed or harvest data. However, at various times researchers (including members of the assessment team) have been onboard the mussel boats during seed harvesting, or have visited or surveyed the seed mussel beds (31).

Unfortunately, there appears to be very little regular, formal monitoring of macrobenthic species such as crabs, starfish and whelks in the Irish Sea, although a great deal of work has been done in various different areas and times – notably in the vicinity of research institutes such as the School of Ocean Sciences (Menai Bridge), Port Erin Marine Lab (Isle of Man) and the MAFF lab at Conwy (now closed). In particular, there has been a lot of research focused on the mussel beds in the Menai Strait, (much of it sponsored by the mussel fishery), some of which considers green crabs and starfish (e.g. 32,33,34,35,36) – this is considered in the relevant sections below.

3. 'Main' by-catch species

Generally (with some exceptions), the term 'main' by-catch species as used in SGs 60 and 80 above is only applied to species that constitute more than 5% of the catch. This fishery is very 'clean', with few by-catch species and low numbers of individuals, both in terms of the seed mussel catch and in terms of the mussels that are moved around on the lays and those which are finally harvested (pers. obs. of the assessment team). However, quantitative data on the weight of different species in the catch is lacking. On this basis and to be precautionary, the team decided to define the species most likely to be important (green crabs *Carcinus maenas* and starfish *Asterias rubens*) as 'main' by-catch species, although they recognise that they probably only constitute more than 5% of the catch under relatively rare circumstances. Green crabs are a potential bycatch of seed mussels from both sites as well as of harvested mussels from the Menai Strait, while starfish are not caught at South America skear, which is intertidal.

Both green crabs and starfish are ubiquitous throughout the Irish Sea, as well as more locally in Liverpool Bay with densities of up to 1 m⁻² in the Menai Strait (36). The spatial area directly affected by the harvesting process for seed mussels is 4-5 orders of magnitude smaller than the ICES statistical area that encompasses the areas in question (see table of approximate areas in Annex 2). Thus the spatial footprint of the fishery is extremely small. Consequently, given the relative infrequency of harvesting in a single year (measured in some tens of days at most), the proportion of the population of any of the by-catch species removed through the seed harvesting activity will be negligible. This argument applies equally to the harvesting of naturally settled mussel seed on the Caernarfon Bar and South America Skear and to the relaying and harvesting that occurs on the on-growing beds in the Menai Strait.

Green crabs: When green crab are removed along with mussel seed they are re-deposited alive in the Menai Strait; hence there is no net loss from the ICES subarea VIIa population. Only when the mussels are harvested from the Menai Strait does crab mortality occur as they are transported together with the mussels to The Netherlands where they are sorted from the catch and destroyed.

Considerable recent research has been carried out on green crab populations in the Menai Strait, their likely impact on mussel beds and vice versa (e.g. 34,37). This research shows that green crabs are present at high density on the mussel beds in summer, although largely absent or inactive in winter (34, Helen Beadman unpublished data, quoted in 38). During the site visit, one stakeholder reported that from his previous experience collecting soft (moulting) crabs for bait (and from talking to other bait fishermen) the

population of crabs in the Strait may have declined over the last twenty years or so – anecdotally, the ‘CPUE’ of bait fishermen has declined significantly over this period (34). There was considerable debate over this point between stakeholders, and the consensus was that this was not likely to be due to the mussel fishery, which was more likely to have played a role in increasing the population by providing additional food. The decline could be due to a directed fishery for green crabs which exists in the Strait, or increased numbers of predatory birds attracted to the intertidal mussel beds, or an environmental factors such as a reduction in pollution leading to lower overall productivity of the system – or some other unknown issue. A recent study which included historical data suggests that population composition and size structure has not altered significantly over the last 20 years (30).

Starfish are harvested along with mussels from Caernarfon Bar and the Menai Strait, but not from South America skear (which is intertidal). They do not survive relaying in the Strait because it takes place in the intertidal. Work on starfish in Conwy Bay has shown that they are apparently quite mobile and can aggregate in enormous numbers to feed on suitable prey (such as seed mussel beds) – this phenomenon is known as swarming (35). Surveys in Caernarfon Bay have observed starfish at very high densities in this area, even though mussels were not present in significant numbers at the time (Jo Gascoigne pers. obs., 31). Video and time lapse photography on the subtidal mussel beds in the Strait also showed starfish present in fairly high densities on these beds (33).

4. Minor by-catch species

The team also considered some additional minor by-catch species as listed below:

- Sharks: Although catsharks, *Scyliorhinus canicula*, are caught occasionally, these are returned alive. Even when caught in heavier fishing gear such as a 4-m beam trawl, the mortality of this species is only 1% (39). This high survivorship may in part explain the ubiquitous nature of catsharks throughout the Irish Sea. This conclusion holds true for all phases of the mussel fishery cycle.
- Flatfish: According to ICES current advice, the Irish Sea plaice is within safe biological limits with a quota of 1627 tonnes in 2010 (40). The catch of plaice by-catch is measured in a few boxes in this fishery. Small fish are returned and the survivorship of plaice from similar gear is about 40% (39). Dab are not a managed species, however dab are recognised to have increased their population size as a result of the removal of competitor species or predators (e.g. cod) (41). As for plaice, the quantity of fish taken as by-catch is trivial measured in terms of a few boxes; nevertheless, the survivorship of these individuals will be low (39). Although sole stocks in the Irish Sea are at depleted levels (42), this fishery is not considered to take sole as a by-catch. Sole are specialist polychaete feeders and hence are unlikely to be found feeding on mussel seed beds. Furthermore they are nocturnal feeders whereas the mussel seed fishery occurs during daylight hours (43). Hence there is considered to be only a minimal chance of an interaction between this species and the fishery. This conclusion holds true for all phases of the mussel fishery cycle.
- Whelks are known to be vulnerable to local fishing pressure. However, whelks taken as by-catch in this fishery are trivial relative to the Welsh directed fishery which is

currently 4131 tonnes in the Irish Sea with around 1700 tonnes taken from Anglesey (44). Whelks are taken with the mussel seed from Caernarfon Bar, but not South America skear. They are transferred direct to the Menai Strait, but they probably will not survive because relaying takes place initially in the intertidal. No whelks are reported to be taken during mussel harvesting. As for the fish, only a few baskets of whelks are taken as by-catch amounting to perhaps 50 kg. Nonetheless, the fishery might pose a risk of very localised depletion of whelks on Caernarfon Bar – one or two stakeholders raised this issue, although they did not express major concern.

- Mullet are abundant in the Menai Strait and graze on the mussel beds where the patches of bare, organic-rich sediment supports a thick diatom mat. The team considered that the probability of negative interactions between the fishery and mullet was highly unlikely. They are not caught in mussel dredges. The presence of mussel mud in the Strait may enhance the population, although this is pure speculation.

5. Conclusions

The team was happy from their own experience, a review of the data and the input of stakeholders to say that starfish and crabs ('main' bycatch species) are abundant and ubiquitous, and that this fishery was likely to be having a negligible impact on populations, which appear from existing data to be in a healthy state. Thus SG 80 is met. However, the team could not argue that there is a 'high degree of certainty' about all the bycatch species, as required for SG 100. This, plus the slight question mark over the potential for local depletion of whelks meant that a higher score could not be given.

6. Recommendation

Peer reviewer 1 expressed some concern over the issue of localised depletion of whelks on Caernarfon Bar, as did one or two stakeholders (although not as a serious issue). The team was happy that relative to directed fisheries in the area this impact was negligible. Nonetheless, it would be preferable for whelks fished up with seed to be returned to the sea at the fishing site if this is straightforward to do.

2.2.2 Management strategy

There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations.

SG 60: There are measures in place, if necessary, which are expected to maintain main bycatch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.

The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).

SG 80: There is a partial strategy in place, if necessary, for managing bycatch that is expected to maintain main bycatch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.

There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or the species involved.

There is some evidence that the partial strategy is being implemented successfully.

SG 100: There is a strategy in place for managing and minimising bycatch.

The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports high confidence that the strategy will work.

There is some evidence that the strategy is achieving its objective.

There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring.

Score 80

Rationale

As outlined above, ‘main’ by-catch species are green crabs and starfish. The team noted i) that both species are very abundant in the Irish Sea; ii) the footprint of the fishery is very small relative to the extent of crab and starfish populations and habitats; and iii) that in the case of crabs post-fishing survival is good. The team therefore considered that an explicit strategy to manage by-catch was not necessary. Similar considerations applied to the other considered by-catch species that were taken far less frequently. SG 80 was therefore met. SG 100 requires a strategy regardless of whether or not it is considered to be necessary, so this is not met.

2.2.3 Information / monitoring

Information on the nature and amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch
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SG 60: Qualitative information is available on the amount of main bycatch species affected by the fishery.

Information is adequate to broadly understand outcome status with respect to biologically based limits.

Information is adequate to support measures to manage bycatch

SG 80: Qualitative information and some quantitative information are available on the amount of main bycatch species affected by the fishery.

Information is sufficient to estimate outcome status with respect to biologically based limits.

Information is adequate to support a partial strategy to manage main bycatch species.

Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).

SG 100: Accurate and verifiable information is available on the amount of all bycatch and the consequences for the status of affected populations.

Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.

Information is adequate to support a comprehensive strategy to manage bycatch, and evaluate with a high degree of certainty whether a strategy is achieving its objective.

Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.

Score 60

Rationale

As noted above, starfish and green crabs were identified by the team as ‘main’ by-catch species due to a lack of quantitative data on the proportion of the catch they constitute.

The fishery affects directly only a small proportion of the seabed in ICES VIIa. The by-catch species will not be uniformly distributed across this area. Green crabs will be confined to inshore waters and estuaries where they are known to be common. In these areas they attain high densities (34,35,37), however there are no systematic monitoring programmes for green crab (although there is considerable information about the population in some areas – see for example 34). Despite some concerns about a possible decline, not related to the mussel fishery (34), a recent unpublished study demonstrated that there has been no change in the population structure or sex composition over a 20 year period. This would indicate that the population is stable and does not appear to show any of the classic signs of population decline in response to fishing or other factors (30).

Starfish are likewise ubiquitous in the Irish Sea (45), but as with green crab their populations are not systematically monitored. An analysis of starfish biomass data obtained as part of a trawl impact study in the Irish Sea (39,46) demonstrated that biomass sampled between October 1993, April 1994 and October 1994, remained relatively constant at c. 40-50 kg per ha. This estimate is highly conservative as the 4 m beam trawl has a low catch efficiency for this species given the large meshes used on the net (80 mm diamond mesh) and the catchability of starfish. This study site occurred approximately 8 – 10 nm off the coast of North Wales in mixed sediments typical of Liverpool Bay. Given such a high background biomass of starfish, even the removal of the entire biomass of starfish on the mussel seed beds in Morecambe Bay and Caernarfon Bar will have negligible effect on the population as a whole. Surveys on Caernarfon Bar

in 2005 likewise showed a very high biomass of starfish in the area at certain times (31, Jo Gascoigne pers. obs.). Furthermore, both crab and starfish remain alive when relocated to the on-growing beds, hence they continue to contribute their reproductive output to the regional population.

As a result of the information above it is possible to infer qualitative information regarding the by-catch and the probability of population level impacts, as well as on the status of the population as a whole, at least in the areas in question. It is reasonable to conclude given background densities of the by-catch species in question that a management for these species is not required. Consequently SG 60 is met.

As there is no directly available contemporary quantitative information regarding background population density or the amount of by-catch removed SG 80 is not met.

Condition

The fishery needs to collect quantitative or semi-quantitative data on starfish and green crab by-catch at each of the three sites, to show either i) that they typically constitute less than 5% of the catch (i.e. should be downgraded from main to minor by-catch species); or ii) so that the impact of the fishery on local population levels can be better understood.

2.3 ETP species

2.3.1 Outcome status

The fishery meets national and international requirements for protection of ETP species. The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species.

SG 60: Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.

Known direct effects are unlikely to create unacceptable impacts to ETP species

SG 80: The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.

Direct effects are highly unlikely to create unacceptable impacts to ETP species.

Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts

SG 100: There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.

There is a high degree of confidence that there are no significant detrimental effects (direct and indirect) of the fishery on ETP species

Score 90

Rationale

The ETP species of interest in relation to the mussel fishery are the eider duck (in Morecambe Bay) and the oystercatcher population at Traeth Lafan Special Protection Area (SPA) adjacent to the Menai Strait (6,7,8,9).

Both eider duck and oystercatcher feed on mussels, in the case of the former by diving to the seabed and in the case of the latter by wading at low water or when beds are exposed (13,47). As a result, only eider duck are likely to be affected by the removal of seed mussels from the natural beds in Morecambe Bay or Caernarfon Bar, since they are in the very low intertidal or the subtidal. However, there are no eider duck at Caernarfon Bar and the statutory agency responsible for Morecambe Bay (Natural England) confirmed at the stakeholder workshop that there are no concerns with respect to the mussel harvesting practices for the Morecambe Bay overwintering population. In addition, adequate provision is made for the birds prior to any licenses to fish being made available (see section below). Natural England did report a decline in the breeding population but they hypothesise that this is primarily related to the prevalence of predators (fox) and a decline in the seagull colony that provides additional protection from predators. The decline was not suspected to be linked to any of the fishing activities (Robert Whitely, Natural England, pers. comm. – see Annex 4).

Oystercatcher populations have been shown to benefit from the provision of abundant additional food sources (re-laid mussels) in the Menai Strait and the current numbers of birds in the Traeth Lafan SPA are considered to be elevated by these activities (13). It is possible to model precisely the decline in population numbers should the extent of the mussel on-growing activities decline, or changes in husbandry practices occur (48). In addition, other birds species that use the intertidal area under mussel cultivation showed no negative responses to the cultivation practices (13).

It is demonstrable that the fishery either has no effect or a positive effect on oystercatchers, and it is considered by conservation experts that monitor eider duck populations that the fishery has no impact under its current management regime, hence it is considered that SG80 is met for both species. There is a high degree of certainty for oystercatcher populations that there are no negative impacts, however there is less certainty for eider duck because they have not been studied with similar intensity. This gives an overall score of 90.

2.3.2 Management strategy

<p>The fishery has in place precautionary management strategies designed to: - meet national and international requirements; - ensure the fishery does not pose a risk of serious or irreversible harm to ETP species; - ensure the fishery does not hinder recovery of ETP species; and - minimise mortality of ETP species.</p>

SG 60: There are measures in place that minimise mortality, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.

The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).

SG 80: There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, that is designed to be highly likely to achieve national and international requirements for the protection of ETP species.

There is an objective basis for confidence that the strategy will work, based on some information directly about the fishery and/or the species involved.

There is evidence that the strategy is being implemented successfully.

SG 100: There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, that is designed to achieve above national and international requirements for the protection of ETP species.

The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work.

There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is evidence that the strategy is achieving its objective.

Score 80

Rationale

As noted above, oystercatchers are not adversely affected by the mussel cultivation and harvesting cycle. Eider duck are a priority species in Morecambe Bay where the management strategy considers the food requirements of the ducks prior to any decision to issue licenses to fish for mussels (as part of the assessment of likely significant effect, which is approved by Natural England). There have been no known breaches of this management regime by any party associated with the fishery. SG 80 is therefore met; however SG100 is not met as there is no quantitative analysis that measures the performance of the management measures in relation to eider duck. Changes in eider duck breeding population have been recorded but this is not considered linked to the fishery.

2.3.3 Information / monitoring

Relevant information is collected to support the management of fishery impacts on ETP species, including: - information for the development of the management strategy; - information to assess the effectiveness of the management strategy; and - information to determine the outcome status of ETP species.

SG 60: Information is adequate to broadly understand the impact of the fishery on ETP species.

Information is adequate to support measures to manage the impacts on ETP species.

Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.

SG 80: Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species, and if so, to measure trends and support a full strategy to manage impacts.

Sufficient data are available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.

SG 100: Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.

Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.

Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.

Score 80

Rationale

The mussel fishery has overall positive effects on the oystercatcher population (13,48) that is monitored as part of the statutory requirements to ascertain the status of the Traeth Lafan SPA (9). This is done by CCW on an annual basis. Natural England is about to commence a more formal study on eider ducks in Morecambe Bay (Robert Whitely, Natural England, pers. comm.). Thus, while there is considered no threat to their status from the mussel fishery, the information available to ascertain their status will improve in the near future. NWSFC is responsible for regular assessment of the status of the mussel beds in Morecambe Bay and this information is used to ascertain the amount of mussels available for eider duck and other birds and consequently how many remain for the fishery.

As a result the criteria for SG80 are met, but due to the uncertainty surrounding the decline in eider duck breeding populations the criteria for SG100 are not met, but may be met at some point in the future when better information becomes available.

2.4 Habitat

2.4.1 Outcome status

The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function.
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SG 60: The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.

SG 80: The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.

SG 100: There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.

Score 95

Rationale

At both a regional and bioregional level, the areas subject to harvesting in this fishery have a very small footprint (see SICA analysis for P1 – Annex 2). Consequently any adverse impact associated with the harvesting would affect only a very limited proportion of the seabed that would be considered negligible when compared with any other form of towed bottom fishing gear. Both Caernarfon Bar and South America skear in Morecambe Bay are exposed glacial cobble deposits that occur in shallow water. As such, they are exposed to frequent erosion from wave action during high winds. Such habitats are typified by opportunistic species such as barnacles and tube worms and have low diversity (49). Wave erosion leads to the transport of mobile sand that can cover these lags or skears (cobble areas) periodically leading to smothering of the assemblage and death. This is a natural process. As the sand is winnowed away by tidal currents, the glacial lag becomes exposed and is then recolonised by opportunistic species and mussel seed.

Both the habitat and the characteristic species are thus considered likely to be resilient to direct physical disturbance by the mussel dredges. The impact of fishing gears on different habitats and under different environmental regimes is well understood (50,51). The mussel dredges used in all fishing operations are traditional Dutch mussel dredges. These are relatively light. They have no tooth bar and the harvesting is undertaken when the mussels have accumulated mussel-mud and are raised slightly from the underlying substratum. Hence the ‘fabric’ of the seabed is not directly impacted by the fishery. The fishery occurs over a short period of time, once the mussels have been removed there is a recovery period of a year before the next harvesting which is adequate for the ephemeral species associated with the glacial lag seabed to recover. As a result of the considerations above, for this component of the fishery SG100 is considered an appropriate score.

In the Menai Strait, the mussels are relaid onto areas of mud substratum. The mussels embed and thereby form patterns that are partly influenced by the hydrodynamics of the local environment (38,52). The mussels change the hydrographic regime directly flowing across the seabed and increase the rate of deposition of particles to the seabed. In addition the mussels generate faeces and pseudofaeces that are high in organic content. This increased amount of organic material makes the sediment associated with the mussel bed anoxic due to the fine nature of the particles and high organic content. Accordingly, the diversity of the community within the area of the mussel beds declines directly with an increasing density of mussels. However, the natural community found in adjacent areas to the mussel beds has low diversity and is composed primarily of small polychaetes such as cirratulids that are typical of organically enriched muds. Furthermore, the impact on

natural community diversity is confined directly to the footprint of the mussel lays and there is no evidence of any effects propagating beyond the lays (53). Given the life-history characteristics and low diversity of the natural community, removal of the mussels would result in restoration of a natural system within ~ one year. Furthermore, at a regional level the footprint of the fishery amounts to a small proportion of the seabed (see SICA Table, Annex 2).

For the reasons above, although the ecological impacts are negligible when considered at larger scales, locally they are detectable, but within the confines of a restricted area of the seabed that is tightly restricted by a formal lease. Consequently a SG score of 90 is more appropriate than SG100 for this element. This leads to an overall score of 95.

2.4.2 Management strategy

There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types.

SG 60: There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.

The measures are considered to work, based on plausible argument (e.g general experience, theory or comparison with similar fisheries/habitats).

SG 80: There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.

There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or habitats involved.

There is some evidence that the partial strategy is being implemented successfully.

SG 100: There is a strategy in place for managing the impact of the fishery on habitat types.

The strategy is mainly based on information directly about the fishery and/or habitats involved, and testing supports high confidence that the strategy will work.

There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is some evidence that the strategy is achieving its objective.

Score 100

Rationale

The fishery is spatially restricted for both seed mussels and during the on-growing phase. The former is restricted by the limits of the habitat while the latter is restricted by a formal lease. Working beyond the limits of the lease is not possible. The lease specifically requires the fishers to maintain the bed in a manner that is conducive for the purposes of the fishery. Degradation of the habitat would therefore contravene the conditions of the lease.

The fishery occurs in proximity to, or within, areas of the sea or intertidal zone that are managed for conservation purposes. Therefore there is a high degree of scrutiny and appropriate assessment of these activities to ensure they do not compromise the conservation objectives of the areas in question.

The team considered that since the fishery conducts all its operations within SACs, which have been designated for habitat attributes, and which are managed under management plans which focus on habitats, a 'strategy' for habitats is in place as far as this fishery was concerned, even if this strategy was not put in place by the fishery itself. This, together with the small footprint of the fishery and the resilience of the habitats and associated species that are affected by the fishery, lead to an SG100 score.

2.4.3 Information / monitoring

Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types.

SG 60: There is a basic understanding of the types and distribution of main habitats in the area of the fishery.

Information is adequate to broadly understand the main impacts of gear use on the main habitats, including spatial extent of interaction.

SG 80: The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery.

Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent, timing and location of use of the fishing gear.

Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).

SG 100: The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.

Changes in habitat distributions over time are measured.

The physical impacts of the gear on the habitat types have been quantified fully.

Score 80

Rationale

The habitats affected by the fishery are well described and quantified. Accordingly we understand much about their potential vulnerability to fishing disturbance. Similar habitats (Cardigan Bay) have been shown to be resilient to much more severe forms of fishing such as scallop dredging, hence the mussel fishery is highly unlikely to have any

impact on the habitats in question (49). The spatial extent of the fishery is limited by the extent of the habitat and occurs only within the confines of this area. The timing and amount of fishing is strictly limited and defined by a fixed quota with appropriate enforcement and management controls. Accordingly SG80 is met due to these considerations. SG100 is not met because the precise effects associated with the specific fishing gear used in this fishery have not been defined formally, even though this gear is considered much lighter than any of those documented to date for which we have a good understanding of their impacts (50).

2.5 Ecosystem

2.5.1 Outcome status

The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function.

SG 60: The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.

SG 80: The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.

SG 100: There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.

Score 80

Rationale

We have broken our consideration of the wider ecosystem effects into a consideration of 1) predators of mussels, 2) issues of system carrying capacity, 3) risks associated with the introduction of non-native species.

1. Mussel predators

A full consideration of predators of mussels are given in the sections above (i.e. green crabs and starfish under by-catch and birds under ETP species). As the seed mussels are considered ephemeral, the spatial extent of the fishery is limited, mussels are wide-spread throughout the Irish Sea, and the food supply of mussels is enhanced in the Menai Strait, the overall effects on predators are considered negligible and in some cases positive (oystercatchers in the Menai Strait, see rationale for PI 2.3.1).

2. Carrying capacity

The relaying of high densities of mussels in the Menai Strait has the potential to lead to competition with other organisms that compete for similar food resources (i.e. phytoplankton, suspended particulate matter and dissolved organic matter). Previous

studies have demonstrated that mussels in the Menai Strait deplete the chlorophyll *a* in the water column (33,54). The mussels are self-regulated through self-thinning (38) such that over-stocking the mussels is counter-productive and there is little sense in the industry achieving such a status. To date there are no indications that any potentially competing organisms have been affected by the feeding activities of the mussel biomass in the Menai Strait. The latter is likely due to the fact that the incoming tide ingresses from the Caernarfon end of the Menai Strait, and hence the water depleted by the mussels is unlikely to affect communities to the south west of the mussel lays. Furthermore these communities are dominated by sponges and hydroids that feed on dissolved organic matter and particulate material that is enhanced by the sewage outfall adjacent to these communities.

3. Introduced species

Introduced species are a risk with any fishery that involves the movement of live organisms from one location to another. The fishery has a Code of Good Practice (14) that is designed to deal with this issue to the extent that is practical – adherence to this code is a requirement of the individual lease agreements. The fishers are themselves very concerned about the potential introduction of *Diademnon* - a sea squirt (tunicate) that has been found in Holyhead harbour, relatively nearby. There is concern that would greatly reduce the value of the fishery if it were introduced into the Menai Strait. Thus there is a strong incentive for the industry to avoid accidentally introduced non-native species. A past occurrence of the introduction of *Crepidula fornicata* was managed by smothering the introduced animals with a large volume of mussels that killed the non-natives in-situ. The final species of concern is Chinese mitten crab (*Eriocheir sinensis*) which is present in Morecambe Bay during winter – however it is not present during the period when seed mussel is harvested (Kate Smith, CCW, pers. comm.) so no action by the fishery is required, although the situation is kept under review by Natural England and CCW.

4. Conclusions

The team concluded that there is sufficient quantitative information to assess that there is little risk of ecosystem impacts associated with the fishery, and where they occur suitable mitigation measures are in place to limit their effect. For this reason SG80 is met. Some knowledge gaps are present (e.g. use by fish predators of mussel seed beds, and a quantified understanding of competition with other species for DOM and SPM), hence a score of SG100 is not appropriate.

2.5.2 Management strategy

There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function.

SG 60: There are measures in place, if necessary, that take into account potential impacts of the fishery on key elements of the ecosystem.

The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems).

SG 80: There is a partial strategy in place, if necessary, that takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.

The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems).

There is some evidence that the measures comprising the partial strategy are being implemented successfully.

SG 100: There is a strategy that consists of a plan, containing measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place.

The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem. This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.

The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved.

There is evidence that the measures are being implemented successfully.

Score 100

Rationale

For the seed collection component of the fishery, the activity is spatially restricted and impacts only a minimal part of the regional marine area. The seed harvesting activity is undertaken after considering the needs of other ecosystem components (e.g. eider duck). For non-native species, a code of practice is in place (14) and there is regular communication with Natural England and CCW. Appropriate assessments can be required for seed mussel harvesting and will be required for the renewal of the Several Order lease. The protected areas are surveyed regularly by the statutory conservation agencies in regard to their key features. The team considered that this comprised a 'strategy' to avoid ecosystem impacts of the fishery, which is being implemented successfully and is avoiding significant ecosystem impacts.

Having said that, it is clear that the footprint of the on-growing site (in the Menai Strait) is altered from its natural state, although the natural state is depauperate in terms of species richness (53). Nevertheless, while cultivation is in operation the system will remain in an altered state, however this state is reversible upon the cessation of the mussel on-growing activities. This may not be the case for the ecosystem impacts of many other fisheries.

The policy documents of BMP Ltd. (22) and of the Menai Strait Fishery Order Management Association (24) recognise these various ecosystem issues and set out clear objectives to manage them (see under fishery-specific objectives PI 3.2.1 below for more details). The team considered that overall this constituted a 'plan' based on well-

understood functional relationships (e.g. 13,28,31,32,33,34,35,36,37,38,39,48,52,53,54,55). The plan appears to be being implemented without difficulty. The team therefore considered that SG 100 was met.

2.5.3 Information / monitoring

There is adequate knowledge of the impacts of the fishery on the ecosystem.
Information is adequate to identify the key elements of the ecosystem (e.g. trophic structure and function, community composition, productivity pattern and biodiversity).

SG 60: Information is adequate to identify the key elements of the ecosystem (e.g. trophic structure and function, community composition, productivity pattern and biodiversity).

Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.

SG 80: Information is adequate to broadly understand the key elements of the ecosystem.

Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but may not have been investigated in detail.

The main functions of the Components (i.e. target, by-catch, retained and ETP species and habitats) in the ecosystem are known.

Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.

Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).

SG 100: Information is adequate to broadly understand the key elements of the ecosystem.

Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated.

The impacts of the fishery on target, by-catch, retained, ETP and habitats are identified and the main functions of these Components in the ecosystem are understood.

Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.

Information is sufficient to support the development of strategies to manage ecosystem impacts.

Score 90

Rationale

This is a data-rich fishery in terms of wider ecosystem effects. Information is available on:

- seed mussels and predators (e.g. 28,31,56)
- phytoplankton / carrying capacity (e.g. 33,54)
- oystercatchers (13,48)
- eiders (monitoring by Natural England, detailed study underway)
- benthic infauna diversity and habitat effects (e.g. 49,50,53).

This body of evidence provides an appropriate framework from which to manage the SACs and SPAs by taking into account the effects of the mussel fishery.

The information on the effects of the fishery on green crab and eider duck requires improvement (as noted above), but is not considered a major issue of concern – however SG100 is thus not quite met, leading to an overall score of 90.

Principle 3

The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable

3.1 Governance and policy

3.1.1 Legal and/or customary framework

The management system exists within an appropriate and effective legal and/or customary framework which ensures that it: - Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; - Observes the legal rights created explicitly or by custom of people dependent on fishing for food or livelihood; and - Incorporates an appropriate dispute resolution framework.

SG 60: The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2.

The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.

Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.

The management system has a mechanism to generally respects the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.

SG 80: The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2.

The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery.

The management system or fishery is attempting to comply in a timely fashion with binding judicial decisions arising from any legal challenges.

The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.

SG 100: The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2.

The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective.

The management system or fishery acts proactively to avoid legal disputes or rapidly implements binding judicial decisions arising from legal challenges.

The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.

Score 90

Rationale

1. Summary of legal framework

Fishery Order: The mussel fishery in the Menai Strait operates under the Menai Strait Oyster and Mussel Fishery Order 1962 (the 1962 Order - 11) which was made by the UK Government under the Sea Fisheries Act 1888 (the 1888 Act). The 1888 Act was consolidated and superseded by the Sea Fisheries (Shellfish) Act 1967 (the 1967 Act - 10). The 1962 Order granted the right of fishery for mussels and oysters in the northern end of the Menai Strait to the North Western & North Wales Sea Fisheries Committee (NW&NWSFC – now NWSFC), termed the ‘Grantee’ of the Order. As Grantee, NW&NWSFC was able to lease areas of the Menai Strait to private companies for the purposes of shellfish cultivation; and to issue licences to fishermen who wished to gather any wild mussels in the Order area. These arrangements were put in place for a period of 60 years, and will expire in 2022 (11).

Following devolution, these arrangements have changed, and the Grantee of the 1962 Order is now the newly-formed Menai Strait Fishery Order Management Association, which is made up of a representative of the lease holders, the licence holders, the two local authorities (Gwynedd and Anglesey); the Environment Agency, the Countryside Council for Wales and Bangor University (24). The ‘Grantor’ of the order is now WAG, who have oversight of the management of the fishery and are ultimately accountable to the Welsh Fisheries Minister.

At the time of the most recent renewal of the leases (2009), the Menai Strait and Conwy Bay SAC and the Traeth Lafan SPA were already in existence. Consequently, the renewal process necessitated consideration of the EU Habitats and Birds Directives. Management conditions were laid down to ensure that the leases would have no significant effect on the conservation objectives and features of the European Sites (6,7,8,9). Any departure from the conditions would require a full appropriate assessment of the activity.

Seed fishery: In Morecambe Bay (an SAC and an SPA) the regulation of the seed mussel fishery remains under the jurisdiction of NWSFC. They participate in annual stock assessment of the mussel 'set' and determine the quantity which may be moved for relaying. Mussel seed removal is subject to a 'test of likely significant effect', which can trigger an Appropriate Assessment, if Natural England considers that it is required. It is also subject to NWSFC byelaws (25) which set out permit requirements and gear restrictions, and enable NWSFC to close the fishery if they deem it necessary (subject to consultation). The seed fishing operation on Caernarfon Bar is adjacent to the Menai Strait and Conwy Bay SAC, and hence the same regime applies, under the jurisdiction of WAG and with CCW as the statutory conservation agency providing oversight.

Water quality legislation: A direct result of the existence of this molluscan fishery was its classification as a European Shellfish Water under the Shellfish Waters Directive. In the UK, the directive is implemented by the EC Shellfish Waters Directive (2006/113/EEC) and the Surface Waters (Shellfish) Directions 1997, administered by the Environment Agency. The Menai Strait (West) and Menai Strait (East) are separately designated and monitored by the Environment Agency.

This affords a degree of protection to the water quality of the area, which currently includes a faecal coliform standard for shellfish growing in the area. This is distinct from the hygiene regulations which apply to harvested shellfish. The Shellfish Waters Directive is set to be rescinded in 2013 and replaced by powers under the Water Framework Directive, which does not include any microbiological standard for shellfish. However, it must provide at least the same level of protection to shellfish waters as the Shellfish Waters Directive.

2. Dispute resolution

The creation of the Menai Strait Fishery Order Management Association (as the grantee for the Fishery Order) (24) maintains the mechanism previously provided by the NW&NWSFC for avoidance of internal disputes between the individual companies operating in the fishery, or between the fishermen and the various statutory bodies in Wales (CCW, the local authorities). In addition, the Fishery Order covers the issue of dispute resolution by appointing the Shellfish Association of Great Britain as sole arbiter in the case of disputes arising as a consequence of the Order (19).

The fishery has a long history free of serious disputes. The long duration of the leases is a major consideration which prevents contentious situations arising. However, the complexity of the operation (three sites with differing management regimes) does mean that there is not a single unified mechanism for dispute resolution.

3. Binding judicial decisions

The only example which has occurred (not strictly judicial, but could have become so without rapid response) was the discovery of slipper limpets, accidentally transferred with seed mussels from a site no longer used for seed supply by this fishery. The precautions taken to avoid another occurrence have now been formalized in a Code of Good Practice (14) and in the February 2010 Policy Document of Bangor Mussel Producers Ltd) (22). Procedures were developed by the fishery for follow-up surveys to

ensure that eradication is thorough (14). This code of practice was on the latest renewal of the leases (Sept. 2009) formalised as a condition of the leases, so is legally binding on the mussel farming companies.

4. Legal rights of other mussel fishermen

The legal rights of other mussel fishermen (hand gatherers) in the Menai Strait are formally represented in the overall management of this fishery through their presence as members of the Menai Strait Fishery Order Management Association (on a equal basis with the mussel farming companies - 24). In Morecambe Bay they are represented via NWSFC.

5. Conclusions

On the above basis, the team considered that SG 80 was met. The legal framework meets Welsh, UK and European standards, incorporates both formal and informal mechanisms for dispute resolution which have been shown to be effective, and respects the legal rights of other mussel fishermen, as well as other stakeholders more generally (for example via the representation of local authorities in the organisation acting as Fishery Order grantee - 24). For SG 100, the team considered that the system does 'formally commit' to the rights of other fishermen, but that it is not clear that the dispute resolution system is completely transparent, as required. For this reason, SG 100 was not met in full, with the overall score being 90.

6. Recommendation

Notwithstanding the conclusion above, the team concurs with Peer Reviewer 1 that the legal and administrative framework for this fishery is rather complicated, and not always easy to understand. Peer Reviewer 1 recommends, and the team agrees, that it would be useful for the fishery to compile a single summary document setting out various statutes, policies, objectives, protocols and codes into a single Management Structure or Plan, for use in audits and future assessments. This document would serve two purposes: i) as Peer Reviewer notes, it would facilitate comparison of this fishery with other fisheries in the MSC programme and ii) it would smooth any transition in CB or assessment team members in the future.

3.1.2 Consultation, roles and responsibilities

The management system has effective consultation processes that are open to interested and affected parties. The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties.

SG 60: Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood.

The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.

SG 80: Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.

The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.

The consultation process provides opportunity for all interested and affected parties to be involved

SG 100: Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.

The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.

The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.

Score 90

Rationale

The organisations involved in the management of the fishery, and their roles and responsibilities, are set out in full in Table 4 of the main report. Their functions are explicitly defined and broadly well-understood, although given the recent change in responsibilities in Wales (transfer of responsibilities from the former Sea Fisheries Committee, now NWSFC, to WAG) it is clear that there will be some issues around the edges that will become better defined as time goes on.

The management of the fishery is both formally and informally consultative. On a formal level, the grantee of the Fishery Order represents all the main stakeholders in the Menai Strait (24, see Table 4), and extensive annual consultation is required between the fishery, NWSFC / WAG and Natural England / CCW before seed fishing licences are granted. On an informal level, relations are excellent between the fishery and the various statutory bodies (although WAG is a relative newcomer) – with, for example, the fishery playing an important role in sponsoring and participating in research to address questions of concern to CCW or Natural England in the various protected areas (e.g. 13,28,30,31,32,33,34,36,37,38,48,52,53,54,55,56).

On this basis, the team concluded that SG 80 is met. For SG 100, the team concluded that the management system does facilitate the effective engagement of stakeholders, and does provide some measure of explanation as to how information and input is used to take decisions (mainly via the system of informal contacts and good relations) but that given the recent upheavals with the Welsh component of the management system, it is likely that some (more minor) areas of responsibility and interaction probably remain to be fully defined. This gives an overall score of 90.

3.1.3 Long term objectives

The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach

SG 60: Long-term objectives to guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are implicit within management policy.

SG 80: Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within management policy.

SG 100: Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy

Score 80

Rationale

Unlike purely wild fisheries, there is a particular time horizon in the form of the 60 year duration of the Mussel Fishery Order 1962 (11). Over the coming 12 years, there will be an additional pressure on the operators to ensure that they can demonstrate both productive use of the leased lays, and responsible environmental management. Long-term objectives to this end are set out in several contexts: i) by the fishery itself (22,24); ii) by the terms of the Fishery Order and the various associated legislation (10,11,19); iii) by WAG in a Welsh policy context (20,21) and iv) as part of the management of the various protected areas (6,7,8,9). The objectives set out by the fishery as part of the leasing arrangements are considered under ‘fishery-species objectives’ (PI 3.2.1) below, while the broader objectives are considered here.

1. Long-term objectives in UK legislation

The main management objectives set out in the UK legislation underpinning the Fishery Order (e.g. the 1967 Shellfish Act) is that the areas under lease should remain in use for shellfish cultivation. It is clear from the legislation that a failure by a lease holder to cultivate the site could result in the rescinding of his/her lease (10). The legislation is not, however, prescriptive as to how cultivation is carried out – this is left to the terms of individual leases and to the lease-holders.

2. Welsh Fisheries Strategy

The Wales Fishery Strategy (a long-term vision for managing and developing Welsh fisheries) includes specific mention of mussel farming and sets out several objectives for the industry: e.g. i) the development of sea-bed aquaculture in Wales must conform to European legislation relating to European Marine Sites; and ii) ensure their shellfish have full traceability and comply with national and EU food hygiene and public health standards (20). Encouragement towards MSC certification also included as an objective in the socio-economic section of the strategy.

The aquaculture implementation plan (part of the strategy) (21) proposes four stakeholder groups, including one for aquaculture (where this type of fishery is included). That group will produce its own Implementation Plan on a format included in the strategy document (Table 9 p. 50).

3. Protected areas

As has already been made clear, the fishery must operate in the context of various protected areas (Morecambe Bay and Menai Strait and Conwy Bay SACs, Morecambe Bay and Traeth Lafan SPAs). These protected areas have objectives, in the sense that they must be maintained with key habitats and species having the same status or better as when the areas were designated (6,7,8,9). The management of these protected areas underpins many of the activities undertaken by this fishery.

4. Conclusions

In summary, the fishery operates under a series of long-term objectives, from different sources with different outlooks, but forming together a coherent framework which ensures that the fishery has security of tenure on the mussel lays as long as it i) continues to keep the site under shellfish cultivation, and ii) achieves this without prejudicing the ecological values of the site. This framework certainly underpins long-term fisheries management decision-making.

On this basis, the team concluded that SG 80 is met. However, it was not clear to the team whether these objectives can be said to be ‘required by’ management policy, as required by SG 100. The team is satisfied that the fishery operates in the framework of a series of long-term political, economic and environmental policy objectives, but could not give a score of more than 80 according to the SGs as set out above.

3.1.4 Incentives for sustainable fishing

The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing

SG 60: The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.

SG 80: The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that negative incentives do not arise

SG 100: The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure that they do not contribute to unsustainable fishing practices.

Score 90

Rationale

The major incentive to manage the fishery sustainably is the long duration of the Fishery Order and the regular renewal conditions for the leases (10,11). Any negative trends which could be ascribed to poor practice would be subject to review prior to renewal of leases, with a serious sanction of non-renewal as a deterrent.

The fishery operates entirely within protected areas, so again is subject to close oversight by statutory conservation agencies, with in the case of the seed mussel fishery a regular, annual review of activities in the form of the annual spat survey and permissions for seed removal from Morecambe Bay and Caernarfon Bar. The fishery does not obtain any subsidies.

Overall, the team considered that issues of sustainability are regularly considered in the management context – they are in fact central to the management of the fishery. Thus the management system ‘ensures’ that negative incentives do not arise. However it is not clear that there is formal ‘regular review’ explicitly on this topic – although in general the fishery management system is subject to a great deal of internal and external review (see PI 3.2.5 below). Thus not all of SG 100 is met, leading to a score of 90.

3.2 Fishery-specific management system

3.2.1 Fishery-specific objectives

The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC’s Principles 1 and 2.

SG 60: Objectives, which are broadly consistent with achieving the outcomes expressed by MSC’s Principles 1 and 2, are implicit within the fishery’s management system.

SG 80: Short and long term objectives, which are consistent with achieving the outcomes expressed by MSC’s Principles 1 and 2, are explicit within the fishery’s management system.

SG 100: Well defined and measurable short and long term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC’s Principles 1 and 2, are explicit within the fishery’s management system

Score 80

Rationale

1. Long-term context

As an enhanced fishery operation with a high capital investment in dedicated mussel dredging vessels, which could not easily be used for any other purpose, and with long-term leases for the mussel lays (next up for renewal in 2016), the management of this fishery is clearly based on a long-term view. The terms of leases themselves oblige the

operators to maintain their beds in a productive state (10,19), as well as to follow the various byelaws associated with the seed fishery (25), and a Code of Good Practice for seed mussel movements (14). Failure to do so can result in the leases being rescinded. The Policy Document of Bangor Mussel Producers Ltd (22) makes it explicit that the over-arching management objective is the long-term success of the fishery within its environmental and legislative context.

2. Fishery-specific objectives – general points

In this context, a series of specific objectives have been developed, which will act as the objectives for the industry itself (i.e. of BMP Ltd.) (22), and have also been proposed as the objectives of the body that acts as the grantee of the Fishery Order (Menai Strait Fishery Order Management Association) (24). This is important because this latter body includes not just the industry but also other key stakeholders, including other mussel fishermen, CCW, local authorities, scientists etc. (see Table 4 in the main report). This body may therefore be expected to provide oversight on the actions and management of the fishery within the Strait.

In general these objectives, plus the more general long-term objectives set out in 3.1.2 above, are designed to ensure that the MSC standard is met (in fact, they are based around the MSC standard). They are set out in summary here and in more detail in references 22 and 24.

3. Fishery-specific objectives - summary

BMP Ltd. will where necessary work with others to meet the following objectives:

1. Seed mussel stocks

- Ensure that seed mussel fishing activities are compatible with stock status at a regional and local level;
- Ensure that levels of exploitation take account of the ecological role of the stock;
- Provide information at the level of detail and frequency of monitoring required to inform the seed mussel harvest strategy;
- Assist with annual stock assessments in the seed mussel fishery prior to any harvesting taking place.

2. Retained species

- Monitor levels of retention of non-target species in the fishery;
- Develop new management measures, where necessary, to ensure that the fishery does not pose a risk of serious or irreversible harm to any retained non-target species;
- Investigate the effectiveness of any new management measures introduced to minimise the retention of non-target species.

3. Discarded species

- Monitor levels of discarding of non-target species in the fishery;
- Develop new management measures, where necessary, to ensure that the fishery does not pose a risk of serious or irreversible harm to any discarded non-target species;
- Investigate the effectiveness of any new management measures introduced to minimise the discarding of non-target species.

4. Endangered, Threatened & Protected species

- Ensure that fishery does not pose a risk of serious or irreversible harm to ETP species;
- Work with fishery regulators and nature conservation agencies to implement the formal management strategy designed to deliver precautionary management of ETP species;
- Encourage and support research and monitoring work to determine the status of ETP species in our area of operations where possible;
- Collaborate with partners to investigate the relationship between the fishery and ETP species where possible.

5. Habitats

- Ensure that fishery does not pose a risk of serious or irreversible harm to marine habitats;
- Work with fishery regulators and nature conservation agencies to implement the formal management strategy designed to deliver precautionary management of marine habitats;
- Encourage and support research and monitoring work to determine the status of marine habitats in our area of operations where possible;
- Collaborate with partners to investigate the relationship between the fishery and marine habitats species where possible.

6. Ecosystems

- Ensure that the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function;
- Encourage research to improve understanding of the interaction between the fishery and key elements of relevant ecosystems;
- Encourage the introduction of new management measures, where necessary.

7. Genetics

- Ensure that any seed mussels introduced to the Menai Strait that are gathered from wild stocks are likely to be compatible with the genetic structure of the local wild population;

- Work with partners to confirm that current practices are compatible with the genetic status of the mussel population in the fishery area;
- Introduce new management measures, where necessary, to maintain the genetic structure of the population.

8. Management

- Support moves to modernise and update the fisheries management regime in Wales and England;
- Observe all statutory requirements arising from fisheries and environmental legislation to ensure a high level of compliance with regulations;
- Support and encourage research into the fishery that will inform and develop the management of the fishery.

9. Research Strategy

It will be appropriate to develop a research strategy that identifies and prioritises research requirements for the fishery. Issues that could be addressed in this strategy could include:-

- Seed mussel harvesting – interactions between seed mussels and other species (especially birds);
- Non-native species risk analysis – investigating the relative risks arising from and faced by the mussel industry from non-native species (particularly the colonial ascidian *Didemnum vexillum*)
- Dissemination of information – making the results of research available to interested parties.

4. Conclusions

It is clear that there are objectives explicit in the management system, as required by SG 80. They are thorough, in the sense that they cover all (or at least most) of the various elements in the MSC standard. They are also measurable in many cases. However, the team were concerned that they are not specific in the sense of identifying specific issues relevant to each seed collection site: e.g. issues such as the lack of control over seed exploitation at Caernarfon Bar and actions to be taken in the event of a recruitment failure at both seed sites over a long period. As the team noted, it is easy to write a lot of objectives, but the fishery nonetheless has a few unresolved issues which are not covered in the list above. For that reason, the team did not award a score higher than 80.

3.2.2 Decision-making processes

The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives

SG 60: There are informal decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.

Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions

SG 80: There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.

Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.

Decision-making processes use the precautionary approach and are based on best available information.

Explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.

SG 100: There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.

Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.

Decision-making processes use the precautionary approach and are based on best available information.

Formal reporting to all interested stakeholders describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.

Score 90

Rationale

It is clear that there are established decision-making processes in this fishery – for example there is an established process for allowing seed exploitation under permit (assessment of likely significant effect, approval by statutory conservation agency, permitting by NWSFC or WAG), as well as for more long-term issues such as renewing the Several Order leases – these are described above. The team concluded that these processes can respond to serious and important issues – an example being the response to the accidental introduction of *Crepidula* (described in the rationale to PI 2.5.1) – the

Crepidula was destroyed by the fishery; a Code of Good Practice was negotiated with CCW (14) to ensure no repeat, and this code now forms an element of the conditions of the Several Order lease. This incident also shows that the various organisations and stakeholders work efficiently together to respond to issues which arise.

The decision-making system also takes the best available information into account – in fact, it has proved to be pro-active at gathering information to improve management (e.g. 28,31,32,33,34 etc.etc). Explanations of decisions are provided – examples would be reports on assessments of seed biomass, as well as the appropriate assessment carried out for the renewal of the lease in 2009 (17). The appropriate assessments are also available, as is almost all of the various research associated with the management of the fishery.

Thus SG 80 is clearly met. As regards SG 100, the team considered that the system did not necessarily respond to all issues (examples might be changes in infaunal diversity or chlorophyll concentrations in the Menai Strait). However, the requirement for formal reporting (as opposed to informal ‘explanations’) is met, leading to an overall score of 90.

3.2.3 Compliance and enforcement

Monitoring, control and surveillance mechanisms ensure the fishery’s management measures are enforced and complied with.
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SG 60: Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective.

Sanctions to deal with non-compliance exist and there is some evidence that they are applied.

Fishers are generally thought to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery

SG 80: A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.

Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.

Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.

There is no evidence of systematic non-compliance

SG 100: A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.

Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.

There is a high degree of confidence that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.

There is no evidence of systematic non-compliance.

Score 90

Rationale

The requirement for compliance and enforcement mainly applies to the two seed gathering operations. It is the responsibility of NWSFC in England and WAG in Wales. For Morecambe Bay, compliance is well established, with daily catch reported to NWSFC. At Caernarfon Bar requirements are less stringent because there has never been any TAC for this fishery: this reflects the fact that this is well recognised as being a regular but ephemeral mussel seed bed too exposed to allow the mussels to survive to maturity if left *in situ*, and without requirements for other protected species to be taken into account.

Under normal conditions, the combined seed resource from Caernarfon Bar and Morecambe Bay provide sufficient stock for all the Menai lays, so there is no pressure on the operators to seek stock elsewhere. In the past, the Sea Fisheries Committee (now NWSFC) has immediately been aware from the annual survey if spatfall is inadequate for the year's restocking and the additional pressure that would put on the operators to acquire additional seed. Under the new system, NWSFC is no longer responsible for any actions at Caernarfon Bar while WAG is not involved in management at Morecambe Bay, so it is not clear that the management agencies would necessarily be aware of problems with seed supply, although it seems likely that at the very least through informal channels they would be (for example, the key staff at WAG formerly worked for the Sea Fisheries Committee, making ongoing interaction much easier).

Overall, however, the team considered that the monitoring system for seed gathering is adequate (the seed-gathering vessels have GPS plotters and one has VMS). There is also daily reporting of seed landings to either NWSFC or WAG (depending on site) and annual reporting of production to WAG and DEFRA. It is highly unlikely that it would be possible for any of the mussel companies to breach the general byelaws relating to seed mussel collection (e.g. fishing for seed without a permit, during periods when the seed bed is closed or with an inappropriate dredge) without NWSFC or WAG finding out – and it is highly improbable that this has ever happened. However, compliance with the seed gathering restrictions such as the TAC at Morecambe Bay (i.e. accurate reporting of landings) is mainly down to self-policing and peer pressure. Whilst stakeholders have reported that they are 'not concerned' about compliance within this fishery, that could change if successive years of poor spatfall occur. More formal reporting (e.g. a requirement for VMS with regular position reporting to NWSFC and WAG) could potentially be introduced. The ultimate sanction for a breach of the regulations is the loss of lease on the relaying bed – which would obviously spell the end for the mussel company in question.

The team considered that SG 100 was partly met: following all the main stakeholders they had a ‘high degree of confidence’ that the fishermen were complying with the regulations, but did not necessarily regard the system as ‘comprehensive’. This led to an overall score of 90.

The team noted some possible risk if the fishery finds itself in a situation where no seed is available for a long period of time – although we note that this is a hypothetical situation. However, the team wished to flag up this point as a consideration for the ongoing surveillance of this fishery under the MSC process.

3.2.4 Research plan

The fishery has a research plan that addresses the information needs of management
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SG 60: Research is undertaken, as required, to achieve the objectives consistent with MSC’s Principles 1 and 2.

Research results are available to interested parties.

SG 80: A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC’s Principles 1 and 2.

Research results are disseminated to all interested parties in a timely fashion.

SG 100: A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC’s Principles 1 and 2.

Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available.

Score 70

Rationale

There is a good history of research part-funded by the operators – this has in general been being fully reported and published in peer review journals or in student theses (or both). The Wales Fishery Strategy (42) notes that ‘the industry operates in areas where there is an increasing obligation for conservation objectives to be met and is rising to that challenge through engaging in appropriate research.’ This research has covered over the years most of the key Principle 1 and 2 objectives associated with the fishery: including the impact of the lays on the Menai Strait ecosystem, the ecological role of ephemeral seed mussel beds, the role of predation on the mussel beds, impacts of the lays on birds etc. (as previously outlined). There is not, however, a formal on-going strategy-based research plan as such. This means that SG 80 is not met in full, giving an overall score of 70 (although the team did note that it is somewhat ironic that what is certainly one of the

most supportive and participatory fisheries in the UK when it comes to scientific research should get a relatively low score for this PI).

Condition

The fishery should develop a formal, strategic research plan. This is already noted as an objective by BMP in their company policy document (22). The team considered that the BMP Ltd. members have sufficient expertise, and are best placed, to identify research priorities without input from them. However, the team and peer reviewers identified the issue of source and sustainability of seed supply as one which may merit attention.

3.2.5 Monitoring and management performance evaluation

There is a system for monitoring and evaluating the performance of the fishery-specific management system against its objectives. There is effective and timely review of the fishery-specific management system.

SG 60: The fishery has in place mechanisms to evaluate some parts of the management system and is subject to occasional internal review.

SG 80: The fishery has in place mechanisms to evaluate key parts of the management system and is subject to regular internal and occasional external review.

SG 100: The fishery has in place mechanisms to evaluate all parts of the management system and is subject to regular internal and external review.

Score 90

Rationale

As noted above, since the transfer of controls within Wales to WAG on 1st April 2010, there are actually two separate management systems. In England, the Association of Sea Fisheries Committees (of which NWSFC is a member) holds regular meetings and conducts an annual review of shellfish management. In addition, the role and status of the SFCs was extensively reviewed and changed as a result of the development of the Marine Bill (57). The Welsh system is new, and therefore was de facto subject to comprehensive review in the process of putting it in place. It is expected that there will be some review of performance over the next few years, as adjustments are made to make sure that it works efficiently. WAG proposes a structure that would be subject to regular review by stakeholders (26) although it is not clear whether this has been finalised

As well as this general review of institutional bodies and arrangements, the fisheries management system also incorporates internal and external review of management policy and actions. The management of the seed mussel resource in Morecambe Bay and Caernarfon Bar is subject to regular external review by Natural England or CCW, as part of their oversight of the protected areas. For example, they consider the issue annually as part of the process of granting permits for seed mussel collection. They may also consider specific issues in more detail – e.g. Natural England is studying the management system

for the seed fishery in Morecambe Bay as part of wider research into the causes of decline on the eider duck population. The management of the Menai Strait is also subject to regular internal and external review. The Menai Strait Fishery Order Management Association includes a range of external stakeholders as well as the industry – this includes local authorities, CCW, scientists and other fishermen, and one of their roles is to provide oversight into the management of the lays (see Table 4 of the main report). CCW also provides periodic external review – for example in regard to the renewal of the leases (58,59).

The team considered that this process constituted ‘regular internal and external review’, as required by SG 100, although all parts of the management system might not be reviewed both internally and externally on a regular basis (i.e. in some cases some types of review might be better be described as ‘periodic’). On this basis, the team felt that a score of 90 was justified.

Annex 2: SICA and PSA Tables with scores and justifications

1. Principle 1 (target species) SICA table, scores and rationales

Performance Indicator	Risk-causing activity	Spatial scale of activity	Temporal scale of activity	Intensity of activity	Relevant sub-components	Consequence score	MSC Score
1.1.1 Stock status outcome	Fishing for mussel seed	1 – fishing in very small area relative to stock	3 – a few weeks per year	2 – activity detectable only locally for part of year	Population size	1	100
1.1.1 Stock status outcome	Prospecting for seed	1 – as above	3 – a few days per year	2 – localised and only a few days per year	Population size	1	100

Rationales

1.1.1 – Stock status outcome

The stock of mussels (*Mytilus edulis*) on which the fishery operates is considered (on the basis of genetic evidence, larval duration and oceanographic information) to be panmictic across the whole Irish Sea (3). It may, however, be more precautionary to assume that the eastern Irish Sea (i.e. north Wales, northwest England, eastern Isle of Man) is a separate stock or sub-stock to the western Irish Sea. Within this area, mussels are very widely distributed, being ubiquitous in the rocky intertidal (and in some cases on hard sand or cobble) – such mussel habitat being also very widespread in the area.

By contrast, the fishery takes place in two very small constrained areas. The main source of seed in most years is ‘South America skear’ (so-called due to its shape) in Morecambe Bay, which is a discrete cobble area of just a few hectares in the low intertidal on which seed mussel settles in some years at high density in spring or summer, before being washed away by autumn or winter storms, or suffering high mortality rates due to overcrowding. The other seed area is Caernarfon Bar – a sandy-cobble area at and just outside the southern end of the Menai Strait. The area in

which seed may settle is larger and less well defined than South America skear, but still does not exceed a few square kilometres at most. In this area, seed settles in the subtidal and is usually lost to predation rather than physical processes. In neither area are adult mussels abundant (pers. obs.), suggesting that most of the seed is lost in any given year. The relevant areas are estimated (to the nearest order of magnitude) in the table below.

Location	Estimated area (km ²)	% of Irish Sea covered by this location (order of magnitude)
ICES Subarea VIIa (Irish Sea)	49940	100
Menai Strait mussel lays	5.1	0.01
South America skear (Morecambe Bay)	0.25	0.001
Caernarfon Bay seed collection area	2	0.01

The seed mussel may spawn *in situ* in its first summer, but the quantity of gametes put out by these age 0+ mussels is probably low relatively to age 1+ and older. The seed is brought back to the Menai Strait and relaid, where it will spawn as normal in spring and autumn until it is harvested.

In summary:

- The fishery takes place in a very limited area relative to the population;
- The fishery takes place on mussels which are usually lost to the population after only one summer;
- The mussels are relaid in the same population area, where they will spawn as normal for 2-2.5 years until harvest.

Taking these key points into consideration, the stakeholders were all in agreement that that the fishery had no impact on the mussel population, unless it were a very small to negligible positive impact. The score was therefore 100.

As regards prospecting for seed, this occurs mainly using remote sensing equipment (e.g. RoxAnn bottom imaging equipment), or by visiting the Morecambe Bay skear on a low spring tide by boat or helicopter. If seed mussels are sampled, only a few bucketfuls are taken. Stakeholders were thus in agreement that this activity had a negligible impact on the stock.

2. PSA Tables, scores and rationales for the target species

2.1 Productivity

Productivity considers and scores seven attributes of the life history of the species (*Mytilus edulis*) and uses these scores to generate an aggregate score (the arithmetic mean of the seven scores). The scoring table for productivity is provided by MSC (see FAM) and is given in Table 1 below.

Table 1. Scoring table for productivity in the PSA (see FAM)

	Low productivity / high risk – score 3	Medium productivity / medium risk – score 2	High productivity / high risk – score 1
Average age at maturity	> 15 years	5-15 years	< 5 years
Average maximum age	> 25 years	10-25 years	< 10 years
Fecundity	< 100 eggs / year	100-20,000 eggs / year	> 20,000 eggs / year
Average maximum size	> 300 cm	100-300 cm	< 100 cm
Average size at maturity	> 200 cm	40-200 cm	< 40 cm
Reproductive strategy	live bearer	demersal egg layer	broadcast spawner
Trophic level	> 3.25	2.75-3.25	< 2.75

The scores for mussels for productivity are given in Table 2.

Table 2. Values for each attribute for mussel, with corresponding scores and overall productivity score.

	Value	Score
Average age at maturity	A low level of spawning in the first year (0+), full spawning by the second year (1+)	1
Average maximum age	Depends on habitat, probably never more than ~8 years	1
Fecundity	Annual output of order of 10^9 eggs per female	1
Average maximum size	Around 6-7 cm shell length	1
Average size at maturity	Variable – probably around 1-3 cm shell length	1

Reproductive strategy	Broadcast spawner	1
Trophic level	Main food source is phytoplankton in most environments, may also consume bacteria, small heterotrophic organisms and also takes up dissolved organic matter. Trophic level not far above 2.	1
Overall score	Arithmetic mean of scores	1.00

2. Susceptibility

Scoring criteria

Susceptibility scores four attributes of the fishery in relation to the population in question (*Mytilus edulis*, Irish Sea), and generates an aggregate score by calculating the geometric mean of these scores. The scoring table for three of these four attributes is provided by MSC (see FAM). The final attribute (selectivity) is not defined by MSC for this particular gear type, and therefore had to be defined by the team.

The team proposed to divide the selectivity of mussel dredges into three categories as follows:

1. Low risk score for selectivity for the species: Dredges which are made of a larger mesh size than the body size of the species in question, i.e. where the species can pass directly through;
2. Medium risk score for selectivity for the species: Dredges where only large adult individuals are caught, or dredges that work only in specific habitats which are not the main habitat of the species in question;
3. High risk score for selectivity for the species: Dredges which can operate over most of the habitat and catch a wide range of size classes.

Table 3 shows the scoring table for susceptibility, incorporating the above criteria for scoring selectivity.

Table 3. Scoring table for susceptibility in the PSA (from the FAM), with selectivity criteria as designed by the team.

	Low susceptibility / low risk – score 1	Medium susceptibility / medium risk – score 2	High susceptibility / high risk – score 3
Availability – overlap of geographic range of species with fishery	Overlap < 10%	Overlap 10-30%	Overlap >30%

Encounterability – overlap of habitat and/or depth range with fishery	Low overlap with fishing gear (strong depth or habitat refuge from fishing)	Medium overlap with fishing gear (small depth or habitat refuge from fishing)	High overlap with fishing gear (little or no depth of habitat refuge from fishing)
Selectivity (see discussion above)	Animal can swim / fall directly out of dredge through mesh.	Only largest individuals captured	Majority of animals captured
Post-capture mortality	Evidence of post-release survival	Released alive	Retained or discarded dead

Scoring selectivity

Based on the criteria outlined above, the team decided that selectivity should score 3 (low selectivity – high risk) in this case. The mussel dredges used in this fishery (and in other mussel seed dredge fisheries) catch all sizes of individuals, helped by the fact that mussel seed is often found roped together by byssus threads.

Scores for susceptibility

The scores for susceptibility, with the overall score, is given in Table 5.

Table 5. Scores for susceptibility and overall score (geometric mean).

	Value	Score
Availability	The species is not fished, or fished in a very trivial fashion by handgathering, over most of its range	1
Encounterability	The species cannot be fished by dredge in its main habitat (rocky intertidal); much of this habitat is also inaccessible to handgathering.	1
Selectivity	Dredges can catch individuals of all sizes, down to the very smallest	3
Post-capture mortality	Little or no post-capture mortality – mussels are relaid.	1
Overall score	Geometric mean of scores	1.05

3. Overall PSA score

The overall PSA score is calculated as the root mean square of the productivity and the susceptibility scores (i.e. $\sqrt{(1.00^2 + 1.05^2)} = \mathbf{1.45}$). The MSC score is computed by a formula derived from a linear regression model: $-11.956(\text{PSA})^2 + 32.28(\text{PSA}) + 78.259$. This works out at **99.91**. This is the score that is given for PI 1.1.1 (rounded to the nearest whole number – i.e. 100).

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Annex 4. Summary of stakeholder submissions during the information-gathering phase

1. Written submissions prior to site visit

The team received one written submission of substance prior to the site visit, from Natural England, as follows:

‘... Couple of issues

Crepidula – as far as I know this is not an issue in the NW, except for an accidental introduction to the Menai area 2 or 3 years ago (not from Morecambe Bay I should add). I believe this was acted upon v quickly and they did not establish.

*Removal of seed & size mussel [and cockles] from Morecambe Bay has been identified (in response to a DEFRA request) as an activity that potential conflicts with the favourable status of some of the designated features of the European Marine Site (most notably Eider duck). **Please note, this is a only a potential issue at this stage.***

NE are therefore hoping to be able to let a contract to undertake two shellfish resource modelling exercises in Morecambe Bay. First in the pipeline was to look at cockle stocks and food availability for Oystercatcher – and use this information to underpin sustainable management of the public cockle fishery.

The second of these projects (which is a little further behind at present and does not yet have a financial allocation) was to look at mussel stocks and requirements of Eider in Morecambe Bay – again so that mussel removal is sustainable and does not damage the Morecambe Bay Eider population which is in decline. ...’

2. Verbal submissions prior to site visit

A preliminary meeting was held with key stakeholders on 16 June 2009. A summary of the issues raised by stakeholders at the meeting is given below:

A. Invasive non-native species (raised by CCW)

The risk of the fishery introducing invasive non-native species to the Menai Strait along with seed mussels is an important concern for this assessment. The two species of most concern are i) the gastropod *Crepidula fornicata* and ii) the Chinese mitten crab *Eriocheir sinensis*. There is no explicit provision for the discussion of this issue in either the FAM or the RBF. The meeting discussed how this issue could be incorporated into the assessment.

B. Forthcoming changes to management structure for this fishery

If the Marine Bill goes through Parliament before the next general election, then the responsibility for the management of this fishery inside Wales will shift from the Sea Fisheries Committee (NW&NWSFC) to the Welsh Assembly Government (WAG) in April 2010 (although the seed collection from Morecombe Bay will still be managed via NW&NWSFC, or its successor). This raises several issues about management structure (e.g. can WAG be both grantor and grantee of the several order?) as well as about the scientific support to management which has up till now been provided by NW&NWSFC.

It is difficult to make decisions about this issue at the present time, because the final outcome is still unclear. However, it was agreed that Jo Gascoigne should make contact with Stuart Evans from WAG fisheries and keep him (and any other relevant individuals from WAG) informed of the progress of the assessment and opportunities for WAG to become involved.

C. Green crab fishery

There is a fishery for green crabs on the mussel lays in the Menai Strait, which is not directly associated with the mussel fishery but is run by a member of BMTA (the organisation under assessment). There was discussion as to whether this fishery should be part of the assessment or not. The team will take a decision on this question during the information-gathering phase of the assessment.

3. Issues raised during the site visit

The site visit took the form of a day-long meeting with stakeholders (details of attendees are given in the main body of the report). Part of this meeting was taken up with a SICA workshop, the results of which are summarised in Annex 2. The remainder covered more general discussion of key issues.

The key issues raised by stakeholders were as follows (in the order in which they were discussed, rather than any order of priority):

1. Non-native invasive species – of particular concern was the potential for the introduction of *Diademnon*, an invasive tunicate currently present in Holyhead harbour. The industry indicated that they were aware of the issue and taking steps to avoid it. Recreational vessels were considered to be the main risk.
2. Eider ducks in Morecambe Bay – the breeding population is in decline, although it is not clear why. Eider ducks are a ‘feature’ of the SPA so are taken into account during the annual process of giving permission for seed fishing in Morecambe Bay. Stakeholder were satisfied that the fishery was not a cause of the decline.
3. Green crabs in the Menai Strait – one stakeholders (CCW) reported some anecdotal evidence of a national decline in green crab numbers. Whether or not the green crab fishery should be included in the assessment (e.g. as a retained species) was discussed, and it was agreed that it is a separate activity.
4. Sabellaria in Morecambe Bay - it was concluded that the fishery was not a threat. *Sabellaria* is a feature of the SAC, so is also considered annually in relation to seed fishing.

5. Terns on Foulney Island – same conclusions as above.
6. Enforcement of Code of Good Practice for non-native species – pointed out that enforcement is by self-enforcement / peer pressure, however also agreed that the industry has a track record in dealing with problems. Also, beds are surveyed by an independent contractor, and samples provided to Dutch government to ensure that non-natives not introduced into Oosterscheldt.
7. VMS – one vessel has VMS but the other one does not.
8. Mytilus galloprovincialis – reported that no evidence of ‘gallo’ in the Irish Sea, but routine sampling proposed to monitor situation.
9. By-catch in seed and adult mussels – list given of the following species: starfish, green crabs, plaice, dab, sole, dogfish (catsharks) and whelks. It was questioned whether plaice are a BAP species (they are not).

4. MEP assessment team response to these issues

From this list, six general issues arise which are of concern (or interest) to stakeholders. The MEP response to each of these issues is summarised below.

1. Non-native species: The risk of introducing non-native species into the Menai Strait is a big concern of this fishery – probably the major concern. This issue is dealt with extensively under Principle 2 Component 5 – fishery ecosystem impacts. CCW noted that now that the Code of Good Practice has been formalised into the Several Order lease, they are happy about how the issues is being dealt with.

2. Morecambe Bay eider ducks: Eider ducks are the main species identified under Principle 2 Component 3 – ETP species interactions. The team was satisfied i) that the fishery is not a cause of the decline in the breeding population; and ii) that the process of oversight for seed mussel fishing in Morecambe Bay is precautionary and takes eider ducks into account. For more details see rationale to PI 2.3.1 above.

3. Other ETP species in Morecambe Bay: The team was satisfied that there are no other interactions between the fishery and ETP species in Morecambe Bay, and that the process for ensuring that this continues is adequate.

4. Green crabs: MEP decided that the green crab fishery in the Strait is a separate activity to the mussel fishery, and that it should not be included as part of the assessment. A detailed rationale for this is given in the main body of the report.

5. Enforcement: MEP was satisfied that reporting requirements for seed (daily), plus independent surveys of the mussel beds for non-native species, plus peer pressure, were sufficient to enforce the Code of Good Practice, given that key stakeholders (CCW) also appeared to be happy with the situation.

6. Genetic issues: MEP considered that the Genetic Code of Good Practice (produced by the industry between the preliminary meeting and the site visit) was sufficient to address this issue.

Annex 5. Peer reviewer reports

Peer Review of Northern Menai Strait mussel (*Mytilus edulis*) fishery for MacAlister, Elliott and Partners

Peer Reviewer 1

Overall assessment

I have read the Public Comment Draft Report thoroughly, and have taken care to satisfy myself about some assumptions and scoring issues of particular concern in a shellfishery based on the collection of seed mussel from locations within or adjacent to statutory protected areas in North Wales and Morecambe Bay, and its subsequent relaying, on-growing and harvesting in leased areas of the seabed removed from the public right of fishery in the Menai Straits. The Report provides a good background description of the fishery, the legal and management framework, and the scoring methodology used, and given that the fishery has required an innovative approach to some aspects of the assessment process, I feel that for the most part this has been achieved successfully and convincingly, and that the assessment team have done a good job. For the three MSC Principles the team has generally made a well-reasoned evaluation of the status and governance of the fishery, and the degree of risk that it poses to the mussel stock, habitat and ecosystem, with due consideration to the locations of the two components of the fishery. The Report is appropriately structured, clearly written, and in most cases the rationale supporting the scores is clear, informative, and sufficient. The references cited in the text all appear in the reference list. Looking at this fishery from the standpoint of the more usual common property fishery, I commend the client for having taken the initiative to develop its policy document and shape it, at least in a general way, towards the required MSC principles.

As set out below I do have a number of edits, comments and questions for accuracy and clarification. Some of these are small points, but several are more substantive and are emphasised in bold (e.g. questions about the scoring for several PIs; about whether it is right to score PIs 2.1.1 -2.1.3; the whelk by-catch; and a number of PIs where there is a familiar difficulty over deciding between ‘measures and outcomes’ as opposed to a formally agreed ‘system under the precautionary approach’). Overall, I am nevertheless satisfied that almost all of the attributes required to achieve a Pass at the MSC standard can be found somewhere (if somewhat fortuitously in some cases) within the web of statutes, responsibilities, policy documents, protocols and codes of practice that apply to the fishers and the new grantees. I am also satisfied that, irrespective of my comments on one or two scores, the outcome of these attributes on the defined fishery and stock justifies the conclusion that the fishery achieves a Pass, subject to the stated Conditions, Recommendations, and Client Action plan.

I note, however, that the dispersion of the various attributes among several statutory and management bodies and processes is rather convoluted. I see scope for the assessment team to consider making an extra Recommendation to compile a single overarching

document that lists and arranges the various statutes, policies, objectives, protocols and codes into a single evergreen Management Structure/Plan under the precautionary approach and MSC Principles, and that can be carried forward into future audits. This would establish the coherent framework that is at present more implicit than explicit, and would make it easier for outsiders to compare the attributes of this fishery with other fisheries of the same or different type elsewhere.

A recommendation to this effect has been added under PI 3.1.1.

Edits, comments and questions

Note – where comments refer to text improvements, edits and typos, corrections have been made throughout as proposed by the reviewer. Thus where there is no response under a comment, assume that the correction has been made.

These are in page order for your convenience. The more substantive points are in bold.

Page 6, para 2, line 5, edit: replace ‘collection’ by ‘collect’

Page 7, last line, edit: ‘Seed taken *from* these..’

Page 11, Section 2.1: I accept that this definition of the stock is suitably precautionary for the assessment of this fishery

Page 11, para 2.2.1 I would prefer the key SACs and SPAs in Figure 1 to be labelled.

Page 13, Table 2: Of the 6445 tonnes of seed harvested in 2008/9, 50 tonnes are not accounted for by the next two columns.

The figures are not perfect since weights are usually estimated. In terms of percentages, however, this error is relatively small (~0.8%).

Page 14, para 2, line 7, edit: replace ‘occasionally’ by ‘occasional’, and in last line, suggest indicate what a ‘small quantity’ is.

Page 15, Table 3, edit: The genus for dunlin and knot is *Calidris*, and for common eider is *Somateria*

Page 17, Table 4. Reference 61 should be 60.

Page 21, 4th bullet: suggest say why MLS is 45mm, is it mean size of maturity?

As noted by the other peer reviewer, this is for adult mussel hand-gathering fisheries and probably just adds confusion here – it has been removed.

Page 23, section 4.2.1, line 9, edit: ‘where if the RBF *is used* the PSA score..’

Page 24, regarding low, medium and high selectivity. I think that in fisheries circles the low and high terms are, paradoxically, reversed i.e. a gear that catches a wide range of sizes and ages is considered to be not very selective, and a gear that only retains the largest individuals is very selective, because the word selective refers to positive conservation attribute. But it doesn’t affect your outcomes and isn’t worth changing.

It's a good point though – it should be low, medium and high risk scores for selectivity. We have changed it for clarity.

Page 24/25. I am content with the adoption of the additional PI's.

Page 30, section 4.5, line 4, edit: replace 'objective' by 'object'

Page 32, section 5.2, line 6, edit: replace 'is' by 'are'

Page 33, top two components, small point but the final weighting for 'outcome' has been rounded, but for 'management' it is not rounded. Trivial, but inconsistent.

Page 45. It may be worth commenting on whether there is any information about the likely source of the settlement on these skears (based on previous work by Peter Dare ?)

This point was also made by the other peer reviewer, and clearly merits more emphasis that we originally gave it. As far as we know, there is no published information on the likely source (in terms of the reproductive output) for this settlement – this is of course not an easy question to tackle, involving as it does tracking larvae whose behaviour in the planktonic stage is imperfectly known. As noted in the previous peer review, this issue might be an important one for research, although priorities have been left to the industry to define.

Page 46, section 5, line 4, edit: replace 'accounting' by 'account'

Page 48, para 2, line 8, edit: 'In *the* Irish Sea..'

Page 48, last para. Shouldn't these interactions be described briefly?

Good point. Actually, I'm not sure that 'interactions' is the appropriate word here – activities would be more appropriate probably. The relevant activities would be, of course, seed mussel fishing, mussel relaying and harvesting. However the wording of these new PIs was agreed with MSC and we can't really change it now.

Page 49. Para 2 of *Rationale*. It would help to comment briefly on the method of estimating seed mussel biomass, and whether in meeting the needs of the birds the TAC is determined by a quantitative rule, a rule of thumb, or an ad hoc expert judgement.

As a result of both the peer reviews, the MEP team enquired more closely into how the TAC system for seed mussel fishing is managed in Morecambe Bay. In the past, a TAC was set for the fishery on a fairly regular basis (whenever there was sufficient seed for a fishery to go ahead). In 2006 for the first time this was not done, because the judgment of NWSFC (approved by Natural England) was the such a large spatfall had occurred that the fishery could remove all the biomass it required to fill the lays and still leave the majority of seed biomass on the bed. Bob Houghton at NWSFC reported that under those circumstances it was extremely difficult to estimate the biomass of seed on the bed with any precision, so any TAC set would be, as the reviewer notes here, basically ad hoc. Since 2006, there has apparently been very little settlement on South America skear, and/or any settlement was rapidly lost to bad weather, so that the question of setting a TAC has not arisen.

As regards how the TAC was set, it is unfortunate that since the days in which a TAC was regularly set, both the Chief Executive and the Chief Scientific Officer of NWSFC has changed, as has the key player at Natural England. There appears to be little institutional memory of how it was done in the past, but the team assumes that it was on the basis of ad hoc expert judgment rather than any hard and fast rule. The team had the impression that the fishery was moving away from TACs as a standard management method, with the current chief scientist noting that it was hard to set a precise TAC given that i) it is very hard to estimate the biomass on the bed; and ii) the biomass on the bed changes rapidly as the mussels grow and/or as they are washed away, so that the estimated biomass at the time any surveys are carried out may not have much relation to reality even 2 weeks later.

On the basis of this new, more detailed information, the team reviewed the PIs that had been scored on the basis that a TAC would be set as a matter of course (notably PI 1.2.2 – harvest control rules and tools). The team was happy that the score of 80, previously given, was still appropriate, however the rationale has been revised to present the situation more accurately.

Page 50, para 2, line 9. Suggest ‘constituted a *proxy* reference point..’

Page 51, *Rationale for PI 1.2.2*, para 3. I agree that the TAC appears to be ad hoc, and that because it appears to be working in the particular context of this fishery it is probably unfair to score less than 80, but in a different fishery context I think that this could be a borderline case. **I suggest a comment that this is an area of uncertainty that should be addressed in the research plan**

For detailed discussion of the TAC issue, see above. The team is grateful to the peer reviewers for obliging them to clarify this issue. As regards the research plan, the team has been happy to leave the details of prioritising research areas to the members of BMP Ltd., given their long track record in commissioning and supporting research. However, we have noted in the rationale for research (PI 3.2.4) that the issue of sources and sustainability of seed supply has been identified as an important one.

Page 52, *Rationale for PI 1.2.3*, para 2. Ditto. Scope for this in the research plan.

True – although you can argue that the team has been strict here in scoring this PI at 80, since relatively more ecological information exists for this fishery than for many others with MSC certification; this was due to the sensitive areas in which the fishery operates. In any case, it is clear that the fishery has up till now been very pro-active in supporting ecological studies, as the rationale for PI 2.5.3 makes clear. From this track record, the team had confidence that the industry would do a good job of developing a list of priority research (and acting on this list) and that ecological issues would not be neglected.

Page 53. Last para, line 2, ‘a sample’. This is very unspecific. I would hope that there is a protocol similar to that used in disease monitoring, viz, ‘a minimum of X mussels will be sampled to give a Y% chance of detecting a Z% prevalence of M. gallo.’.

There is of course an appropriate sampling protocol to follow. This is not set out in the Genetic Strategy document provided by the team and quoted here. The industry (and the assessment team) had confidence that the genetics lab at the School of Ocean Sciences, Bangor University, who have been entrusted to do this work, would carry out sampling appropriately.

Page 54, para 2. The Rationale states that there is a strategy, and that it scores 90, but it is not clear that it is fully implemented! Unless there is further clarification on implementation, does this go beyond the words for an 80 score?

It is true that the strategy is new, and was introduced largely in response to concern from MSC over this issue. However, our information from Dr. Beaumont is that recent work has confirmed that no gallo is present in the Irish Sea – the sampling protocol and site were chosen so that they would provide a time series with work which has already been done in Dr. Beaumont's lab. Therefore in that sense the strategy is already implemented, albeit not for the purposes required by the fishery. On that basis, the team was happy with the score.

Page 56. Retained species 2.1: I see the reason for relegating the nominally retained species to the status of by-catch, in which case is it right to give default scores of 100 to 2.1.1, 2.1.2, 2.1.3, which gives undue weight to PIs which are in effect scored again under by-catch. I would have thought it more appropriate to assign these three as Not Applicable. The weighted mean score for Prin 2 would then fall from 87.7 to 84.6, but still a clear pass. Perhaps this is for MSC to clarify.

We queried this in the scoring process. The logic from MSC is that a fishery can by this means be rewarded for not having any retained species or any by-catch, which makes sense.

Page 60. Section 4, Flatfish, line 3. What is the authority for the statement that the undersized flatfish are returned to the sea ?

I think we should not have used the term 'undersized' here, since this implies some kind of measuring process, with comparison against some kind of legal requirement. In fact, the process is more that they are released unless they are of a size to be worth eating! 'Undersized' has been changed to 'small'.

Page 61. Whelk by-catch. This is a left a bit loose. Although there are no statutory limitations on whelk fishing beyond an EU and some SFC minimum sizes, and the quantities here are very small, there is wider biological concern about local depletion of whelks. **It would be precautionary, and not very time consuming given the amounts involved, to develop a protocol to return the whelk by-catch to sea at the site of their capture.**

To impose a condition on the fishery, the score must be below 80, and the team did not feel that this was justified. However, a recommendation has been added.

Page 68, line 7, re the term 'lags'. I was not familiar with this use of the word: suggest defining it higher up in line 3 by putting in brackets after 'glacial cobble deposits'.

Page 69. Frankly, I am in doubt whether the positive attributes cited here for the two fisheries are a defined strategy, or whether they are, more simply, measures in place that achieve the desired outcome, but I accept that at the end of the day it is fairly clear that the risk to the species and habitats is low.

It is true that the definition of what constitutes a ‘strategy’ (and a ‘partial strategy’) is not always straightforward. In this case, the team felt that the fact that the fishery conducts all its operations within SACs, which have been designated for habitat attributes, and which therefore are managed under management plans which focus on habitats, meant that a ‘strategy’ was in place as far as this fishery was concerned, even if it had not been put in place by the fishery itself. The rationale has been edited to make this logic more clear.

Page 82 to 87, re PIs 3.1.2. to 3.2.2. The last paragraph in my overall assessment applies to this block, i.e. the rationales for scoring these PIs would benefit greatly from a compiled management strategy/plan, showing that there is a ‘strategy’ and ‘system’ that cites the precautionary approach, meets the MSC principles, and compliance criteria.

As noted above, a recommendation to this effect has been added to the rationale for PI 3.1.1.

Page 88/89. Various different mechanisms are certainly in place, as described. I am not sure that they necessarily represent a ‘system’, but I accept that in practice the outcome represents substantive compliance in comparison to most fisheries.

Enforcement is by necessity a bit disjointed in the fishery (as is the whole management structure) because it is taking place in two separate jurisdictions. The team was, however, happy that all the key issues were addressed by the enforcement system and that compliance was not an issue – hence the score above 80.

Page 93. Rationales. Para 1, penultimate line, ‘ubiquitous on in’

Page 95. Table 2. The word lobster needs to be changed to mussel.

Page 96. My earlier comment on low, medium and high selectivity applies here also.

END.

**Peer Review of Northern Menai Strait mussel (*Mytilus edulis*) fishery for
MacAlister, Elliott and Partners**

Peer Reviewer 2

The Northern Menai Strait mussel (*Mytilus edulis*) fishery is not large but it is, in many ways, quite complex and does not fit easily into the MSC assessment model for sustainable fisheries. In addition to the usual problems of applying the MSC assessment methodology to a spatially structured immobile shellfish population, this is an ‘enhanced’

fishery, where seed mussels are dredged from two separate locations and relaid on the seabed to grow on for two years at a third location. Management of the fishery is complicated by the fact that the two seed mussel collecting grounds (Morecambe Bay in England and Caernarfon Bar in North Wales) are situated in different fisheries jurisdictions, and both lie entirely within or adjacent to two statutory protected areas (Morecambe Bay SAC and SPA in England and Menai Strait and Colwy Bay SAC and Traeth Lafan SPA in Wales), administered by Natural England and the Countryside Council for Wales respectively, which adds additional management obligations.

With fishing operations in three locations, all the different legislative bodies and four companies participating it is a complex fishery. The fishery appears to be well established and fairly stable but few details of the history of the fishery are given and only nine years of seed and adult mussel harvesting data are included in the report. This is unfortunate since the fishery is highly dependent on regular recruitment and it would have been beneficial to assess how stable the fishery is likely to be in the future with just these two sources of seed.

The team agrees with this comment - concern about the potential risk of lack of seed supply in the future was certainly expressed by team members during the assessment process, and the issue is flagged up as an important issue for surveillance. However, it is not clear to us that a longer time series of seed and production information would really shed much light on this issue, because the fishery has changed significantly over the few decades of its existence. Notably, the fishery in the past was able to use more diverse sources of seed to offset any recruitment failure in Morecambe Bay and at Caernarfon Bar – including Conwy Bay, South Wales and southern England. For the last few years, these sites have been off-limits to the fishery, minimising the risk of non-native introductions into the Strait but obviously increasing the risk of problems with seed supply. For this reason, data on the amount of seed fished in the past is not a good indication of the future supply situation.

However, the ecology of the Menai Straights in general and of the mussel populations and their fishery in particular has been the subject of considerable study. The assessors are therefore to be congratulated on the production of an excellent and very thorough report that has clearly summarised a complex fishery. The descriptions of the seed and relaying fisheries and the management systems are very clear and summarise a good, long, list of literature cited. I believe the information on which the assessments are based is accurate, comprehensive and up-to-date and that the appropriate stakeholders have been consulted.

This information has been appropriately and rigorously applied in scoring the fishery to the MSC Principles and Criteria. The decision by the team to use the Risk-Based Framework (RBF) for Principle 1 (1.1.1) is, I believe, entirely justified. While the RBF was originally developed to enable data-deficient fisheries to undergo MSC assessment, this methodology is rapidly becoming the method of choice for bivalve fisheries, even those with good data available, because it is rarely appropriate or cost efficient to carry out stock assessments and set reference points for these fisheries using traditional methods. Furthermore, fecund, fast growing, early maturing bivalves inevitably score

highly in the PSA. The selectivity categories proposed by the assessment team for the mussel dredges are sensible and appropriate for this gear but due to the clumping behaviour all sizes of mussels are retained, resulting in a high susceptibility score for this attribute. For most fisheries increased susceptibility/increased risk would be considered to be a detrimental characteristic but it seems to me that for a re-laying/on-growing fishery in a closed area, clearing the grounds entirely of mussels before relaying may actually be a beneficial way of operating. However, despite this one high score, the overall susceptibility score was low and it did not affect the outcome.

The main issue arising from the 'enhanced' fishery that is not covered by the standard MSC assessment tree is the question of the genetic impacts on the wild stock of translocating large quantities of mussels from Morecambe Bay or Caernarfon Bay into the Menai Straights. The assessment team decided to deal with this quite sensibly by the addition of three additional PI's not normally in the FAM. In the event, the translocations were deemed to not currently be any problem but I consider that the inclusion of these additional PI's has been beneficial in this assessment as it has flagged up the potential problems and need for further study and it will also be a useful precedent for future 'enhanced' fisheries going for MSC accreditation.

While one can always argue about the exact scores awarded in any subjective marking scheme, particularly in such a complex and data rich fishery, I believe the scores awarded are fair and reasonable, and the rationales that accompany each score are very clear and cogently argued. Overall, I think that some of the scores are, if anything, slightly on the low side of what I might have awarded and are certainly not over-marked compared with other MSC assessments I have seen. I therefore concur with the recommendation that the fishery is certified according to the MSC Principles and Criteria for Sustainable Fisheries.

The two conditions to be applied are suitable and achievable, and will enhance the sustainable management of the fishery in future years. I note that the second condition, the requirement for a formal strategic research plan, is already in hand with a draft Action Plan included in the report (p.42). This lays out a sensible timetable and appropriate topics for further study but makes no mention of the provision of funding which needs to be part of the strategic planning process.

BMPA Ltd. members undertake to provide funding as required to ensure that the Action Plan is fulfilled.

Such is the quality of this assessment that there is very little, if anything, in it with which I would disagree and many of my comments below are very minor. The report is also presented to a high standard and there are very few errors, but a few photographs or diagrams would have improved the readability and comprehension.

The only area of the report where I think the science is a little weak is the consideration given to recruitment. In several places in the report (e.g. p 47, 49) it seems to imply that because mussels are abundant and ubiquitous in the north Irish Sea, the larval duration in the plankton is 2-4 weeks and there is genetic evidence of panmixia, recruitment to the seed collection sites comes from larvae originating throughout the north Irish Sea. I do not believe that this is so. For bivalve populations where there is historical evidence of abundant larval settlement in the same, restricted, locations over a long period of time, it

is generally the case that the larvae tend to arise from specific source populations and there are particular topographic and hydrographic features that entrain the planktonic larvae and retain them over the settlement sites. This is not to say that the settling larvae all or always come from the same source population – the system is obviously very ‘leaky’ – but for most years it is probably predominately one or a few populations that provide most of the settlement. This does not lead to genetic differentiation for a panmictic population can be maintained with only a low level of interchange between populations. Given the great reliance of this fishery on seed mussel settlement in very few locations, and some history of recruitment failure at these sites, I think that the question of the provenance of larvae setting at the Morecambe Bay ‘skears’ and Caerarvon Bar should not be dismissed so lightly and should at least be flagged as a topic for further study.

This point is noted, and some edits have been made to the text of the rationale for PI 1.1.1 to reflect the comments above. We have also added a comment in the rationale for the ‘research’ PI (3.2.4) noting that while the industry is free to set its own research priorities, this issue, and more generally the issue of sustainability of seed supply, was considered by the team (and this reviewer) to be a potential priority.

Some minor points:

Page 13 MFA – not in list of Acronyms

Table 1 – an additional column giving details of the size or capacity of the vessels would be helpful to the reader.

P17 – reference 61 not in reference list, or should it be 60?

P21 – In the list of byelaws the first three refer to seed mussels. In the fourth ‘size of 45 mm’ is either an error or it refers only to the adult mussel fishery. This should be clarified.

All these added or sorted out as noted by the reviewer.

p.50 There seems to be a bit of a flaw in the logic here. On page 50 it is stated that the fishery ‘does not impact the stock when harvested’ but on p47 and elsewhere it is argued that the seed fishery ‘does not lead to a net loss to the population or reproductive output’ because the seed are relaid elsewhere. This is rather contradictory – you cannot have it both ways!

Presumably our logic was the while the adult mussels in the Strait are obviously removed from the population after a certain point: i) this point is after they have spawned several times; and ii) they would not ‘naturally’ be there are all to contribute to the spawning stock. In that sense their harvest does not lead to a net loss relative to what would be present if the fishery did not exist. However we agree that it is not particularly clear and the argument on page 50 has been somewhat edited.

p.73. Where do the Chinese mitten crabs go during this period?

Up rivers into fresh water. We gather they are known to be present in the Dee and the Duddon (see http://www.marlin.ac.uk/marine_alien/species.asp?SpID=19), but are not completely sure about the various estuaries in between.

P88 & elsewhere. No detail is given of how the TAC for seed is calculated so I cannot judge if it is precautionary.

For a response to this question, please see the long comment under the same point made by Peer Reviewer 1.

P96 Table 2 legion – replace ‘lobster’ with ‘mussel’ ?

P97 numbering 4,5,6 – should these be 1,2,3?

These typos corrected.

END

Annex 6. Stakeholder comments on PCDR

to be added

Annex 7. Acronyms

ASI	Accreditation Services International
BMP / BMP Ltd.	Bangor Mussel Producers Ltd.
CB	Certification Body
CCW	Countryside Council for Wales
DEFRA	Department for Environment, Food and Rural Affairs
ETP	Endangered, threatened and protected
FAM	Fisheries Assessment Methodology
MEP	MacAlister Elliott and Partners Ltd.
MFA	Marine Fisheries Agency – now the Marine Management Organisation
MSC	Marine Stewardship Council
NWSFC	North West Sea Fisheries Committee
NW&NWSFC	North Western and North Wales Sea Fisheries Committee
PCDR	Public Comment Draft Report
PI	Performance Indicator
PSA	Productivity Susceptibility Analysis
RBF	Risk-Based Framework
SAC	Special Area of Conservation
SG	Scoring Guidepost
SICA	Scale Intensity Consequence Analysis
SPA	Special Protected Areas
TAC	Total Allowable Catch
WAG	Welsh Assembly Government