Title:	Impact Assessment (IA)
Chichester Harbour European Marine Site (Specified Areas) Prohibition of Fishing Method byelaw	**Date:** October 2013
	Stage: Development
	Source of intervention: Domestic
IA No:	**Type of measure:** Secondary legislation
Lead department or agency: Sussex Inshore Fisheries and Conservation Authority (IFCA)	**Contact for enquiries**: Erin Pettifer, Sussex Inshore Fisheries and Conservation Marine Protected Area Officer, e.pettifer@sussex-ifca.gov.uk, Tim Dapling, Sussex Chief Fisheries and Conservation Officer, t.dapling@sussex-ifca.gov.uk, 01273 454 407
Other departments or agencies: MMO, Natural England	

Summary: Intervention and Options

What is the problem under consideration? Why is government intervention necessary?

Government has revised the approach to the management of fishing activities within English European Marine Sites (EMS) to bring commercial fisheries management in line with other activities and ensure compliance with EU Habitats and Birds Directives to protect habitats and species for which sites were designated.

Natural England, on behalf of Defra, developed a generic matrix which sets out potential effects of fishing activities on EMS designated features and helps IFCAs and MMO identify and prioritise risks at the site level. Eelgrass beds within Chichester Harbour were identified as a red risk sensitive feature in the matrix and Sussex IFCA must implement management measures to protect this as a priority.

It is the expectation of government that appropriate management measures will need to be regulatory in nature. The focus of this IA is the proposed Sussex IFCA 'Chichester Harbour European Marine Site (Specified Areas) Prohibition of Fishing Method' byelaw. This would apply to the area of the harbour east of Emsworth Channel which falls within the Sussex IFCA District.

What are the policy objectives and the intended effects?

- To implement the government's revised approach to fisheries within EMS
- To protect habitats and species for which EMS were designated, specifically sensitive eelgrass beds within Chichester Harbour, from both current and possible future increases in damaging fishing activities
- To fulfil IFCAs duties under Sections 153 and 154 of the MCAA 2009, to manage the sustainable exploitation of sea fisheries resources and further the conservation objectives of EMS respectively
- To fulfil the IFCAs legal requirement under Article 6.2 of the Habitats Directive, to take appropriate conservation measures to avoid damaging activities in EMS

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

- Option 1: Do Nothing
- Option 2: IFCA eelgrass protection byelaw
- Option 3: Full site prohibition – IFCA byelaw
- Option 4: Voluntary agreement

The preferred option is 2. Under government's revised approach to the management of fisheries within EMSs, there is a requirement to implement regulatory management measures to protect red high risk features as a priority. Guidance indicates that 'regulatory' in this instance refers to the byelaw making powers of the IFCA and MMO. As such options 1 and 4 were rejected. Full site closure, Option 3, was considered too conservative and could not be justified.

Will the policy be reviewed? The effectiveness of the byelaw will be reviewed. **If applicable, set review date:** 6 yearly cycle, based on NE EMS condition assessment period. In addition, Sussex IFCA will seek to support partners with interim eelgrass beds condition surveys where able, to inform management. **What is the basis for this review?** Duty to review **If applicable, set sunset clause date:**	
Are there arrangements in place that will allow a systematic collection of monitoring information for future policy review?	Yes – 6 yearly EMS condition assessment by NE

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Chairman: _____ Date: 8/10/13

Tony Delahunty, Sussex IFCA Chairman

Summary: Analysis & Evidence Policy Option 2

Description: FULL ECONOMIC ASSESSMENT

Price Base Year N/A	**PV Base Year** N/A	**Time Period Years** N/A	**Net Benefit (Present Value (PV)) (£m)**		
			Low: Optional	**High:** Optional	**Best Estimate:** N/A

COSTS (£m)	**Total Transition** (Constant Price) Years		**Average Annual** (excl. Transition)	**Total Cost** (Present Value)
Low	Optional	1	Optional	Optional
High	Optional		Optional	Optional
Best Estimate	£0		£0	£10,000

Description and scale of key monetised costs by 'main affected groups'

Costs incurred by Sussex IFCA in terms of staff time, legal advice and advertising costs associated with making the proposed byelaw are estimated at £10,000.

Sussex IFCA does not anticipate any loss of known commercial fishing ground or associated commercial fishing industry costs as a result of the proposed byelaw. Sussex IFCA activity data indicates no towed (demersal) and dredge (towed and other) interaction with the mapped eelgrass beds.

Sussex IFCA holds limited data on hand working and bait collection activity. Available evidence suggests limited interaction with the mapped eelgrass beds in the harbour. Intelligence from Chichester Harbour Conservancy indicates the only known interaction between fishing activity and mapped eelgrass areas east of Emsworth Channel occurs on the beds at Pilsey Sands, close to Oar Rithe, where hand gathering of clams occurs. IFCO observations and information reports indicate clams are being illegally commercially collected on Thorney Island, primarily along the west side and up to Oar Rithe. Costs to illegal operators cannot, and would not, be considered within this IA. There is no known interaction between these activity types and the other three mapped beds east of Emsworth Channel.

If recreational hand gathering and bait digging does occur within the mapped eelgrass areas it would only be prohibited from a small section of the foreshore (0.85km^2) under the proposed byelaw and persons can relocate to more accessible areas close by.

An assessment of potential monetised costs and benefits is not possible so these have been described in a qualitative manner within the evidence base under Section 6.0.

Other key non-monetised costs by 'main affected groups'

No wider impacts of the proposed byelaw are anticipated.

BENEFITS (£m)	**Total Transition** (Constant Price) Years		**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	Optional		Optional	Optional
High	Optional		Optional	Optional
Best Estimate	-		-	**-**

Description and scale of key monetised benefits by 'main affected groups'

Environmental and fisheries benefits are difficult to quantify, therefore a qualitative description of benefits is provided within the evidence base.

It is considered that the potential environmental benefits of introducing the proposed byelaw outweigh the possible administrative and enforcement burden.

Other key non-monetised benefits by 'main affected groups'

The proposed byelaw will facilitate the protection of an internationally important habitat which is a key component sub-feature/attribute for the designation of the Solent Maritime European Marine Site. Eelgrass beds are also a declining habitat, included on the OSPAR List of Threatened and/or Declining Species and Habitats (declining in Region II – North Sea and Region III – Celtic Sea, and threatened in Region V – Wider Atlantic).

Protecting eelgrass beds from known damaging gear types will also help support sustainable fisheries in the district. Eelgrass beds are important nursery and spawning areas for a variety of commercial fish and shellfish species and provide a sheltered home for many other animals.

As well as promoting biodiversity, eelgrass beds store carbon, cycle nutrients, support numerous industries (e.g. fishing and tourism) and help reduce coastal erosion as their roots catch and trap sediments. Eelgrass/algae beds value is estimated as $19,004 ha-1yr-1 globally – some three times more than coral reefs.

Conservation of eelgrass beds within Chichester Harbour will contribute to the delivery of Sussex IFCAs responsibility to ensure the sustainable management of inshore fisheries, balancing environmental, social and economic costs and benefits.

Key assumptions/sensitivities/risks **Discount rate (%)**

At present, based on existing information the assumption is that there is only interaction between the eelgrass beds and hand collection activity at the site near Oar Rithe. However, this could solely be due to knowledge gaps regarding the extent of hand gathering and bait collection activity and interaction could be more widespread.

A key assumption of intervention under the revised approach is that it will prevent possible fisheries resources exploitation in a sensitive habitat.

As the site straddles the boundaries between two IFCAs there is the risk that different management measures could be proposed making compliance confusing for stakeholders.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			**In scope of**	**Measure qualifies as**
Costs: N/A	**Benefits:** N/A	**Net:** N/A	No	In/Out/Zero net costs

Evidence Base (for summary sheets)

1.0 Problem under consideration
2.0 Rationale for intervention
3.0 Policy objective
4.0 Rationale and evidence
5.0 Description of options considered
6.0 Cost benefit analysis
7.0 Risks and assumptions
8.0 Summary and preferred option

Annexes
References

Evidence base attached report

1.0 Problem under consideration

1.1 Revised approach to fisheries within European Marine Sites (EMS)

The Department for Environment, Food and Rural Affairs (Defra) have revised the UK approach to the management of commercial fisheries within EMS[1]. The objective is to ensure that management of all existing and potential commercial fishing activity complies with our obligations under the European Union (EU) Habitats and Birds Directives (no. 92/43/EEC and 2009/147/EC respectively) and is in line with the regulation of other marine industries and activities. In particular, these legal obligations fall under Article 6 of the Habitats Directive[2], to protect the habitats and species for which sites have been designated.

Under this revised approach, all existing and potential commercial fishing activities that can legally be carried out in EMS under a general fishing licence require an assessment to ensure they are compatible with our obligations to protect sites under the EU Directives. The Inshore Fisheries and Conservation Authorities (IFCA – 0-6nm) and Marine Management Organisation (MMO - 6-12nm) have legal obligations to ensure fishing activities which could adversely affect EMS are managed in a manner that secures compliance with the requirements of Article 6 of the Habitats Directive.

1.2 Generic risk matrix

Natural England, on behalf of Defra, developed a matrix type approach which shows, at a high generic level, gear types[3] and their effect on EMS designated features achieving their conservation objectives. This generic matrix[4] has provided IFCAs and other regulators with an indicator as to whether an activity requires management measures to be introduced to protect a feature without further site level assessment or whether a further assessment is necessary.

Within the generic matrix the broad vulnerability of EMS features to different gear types, based on existing information, was identified and these were categorised as "red", "amber", "green" or "blue" according to their sensitivity, as described in Table 1.

Utilising the generic matrix an evidence-based, risk-prioritised, phased approach has been adopted, assessing the level of risk that fishing activities present to the protected species and habitats in EMS. Government guidance stipulates that management action must first focus on sites that contain red risk features where evidence suggests there is significant threat that certain types of fishing activities could prevent a qualifying feature or sub-feature from achieving its conservation objectives.

1.3 Impact Assessment purpose

The purpose of this Impact Assessment (IA) is to assess the Sussex IFCA proposed byelaw to protect the red high risk features identified in the area of Chichester Harbour encompassed within Sussex IFCAs District. This harbour falls within two EMS - Solent Maritime Special Area of Conservation (SAC) and Langstone and Chichester Harbours Special Protection Area (SPA).

The rationale for taking fisheries management action is to ensure that red rated site features are protected, to contribute to achieving the conservation objectives for the site, by removing the risk associated with the specified fishing gears and activities categorised as red in the generic matrix.

Potential at risk Annex I features within the Solent Maritime SAC were identified utilising English Nature's Regulation 33 advice for this EMS:

- sandbanks which are slightly covered by sea water all the time
- mudflats and sandflats not covered by seawater at low tide

The associated high risk sub-features or attributes under the Solent

Maritime SAC are:

- subtidal eelgrass (*Zostera marina*) beds
- intertidal eelgrass (*Zostera* spp.) beds (structural component of intertidal muddy sand communities)

A conservation objective is a statement describing the desired ecological/geological state (the quality) of a feature for which a site is designated. The above features and component sub-features/attributes conservation objective is to maintain them in favourable condition. For subtidal and intertidal eelgrass beds, Regulation 33 advice details the measure of favourable condition for management and monitoring purposes as extent (during the peak growth period May-August) with a target for no decrease in extent from an established baseline, subject to natural change.

The following fishing activities have been identified by government as high risk and incompatible with the conservation objectives for eelgrass:

- Towed (demersal)
- Dredges (towed and other)
- Intertidal handwork (from vessel and land)
- Bait collection (digging with forks)

Table 1. Risk matrix classifications

Risk	Definition	Action by IFCAs
Red	Habitat features which are the most sensitive to the impact of certain fishing gear types. Activities are deemed incompatible with the conservation objectives for the site features (or sub-features) for which a EMS was designated	Under **Article 6.2** of the Habitats Directive, IFCA is required to implement regulatory management measures to protect red risk features by the **end of 2013** ideally, or by May 2014 at the latest
Amber	There is doubt as to whether certain fishing activities are likely to have a significant effect on achieving the conservation objectives for a site feature (or sub-feature)	Under **Article 6.3** of the Habitats Directive, IFCAs (from 0-6nm) or MMO (6-200nm) are required to conduct further detailed site-based assessment on the effect of such activities on sensitive features Based on that assessment, appropriate management action should be taken if needed by **end of 2016**, or sooner where activities pose a high risk to the site Management will not always leads to closures, mitigation measures may be introduced instead
Green	It is clear the achievement of conservation objectives for a site feature is highly unlikely to be affected by a type of fishing activity	No management action should be necessary, unless there is the potential for in combination effects. Under Article 6.3 a site level assessment needs to be conducted to assess this potential and management introduced by end of 2016 if needed
Blue	No feasible interaction between gear types and habitat features	No further assessment or management is needed

2.0 Rationale for intervention

2.1 Revised approach guidance

Under the government's revised approach, Sussex IFCA is required to implement management measures for any red risks identified within their district by December 2013 ideally, to protect those features from that fishing activity or activities which are known to be damaging – irrespective of feature condition, level of pressure or background environmental conditions.

It is the expectation of government that appropriate management measures will need to be regulatory in nature to ensure adequate protection is received[1]. Guidance indicates that 'regulatory' in this instance refers to the byelaw making powers of the IFCA and MMO.

2.2 Site specific matrices

The government's generic risk matrix was applied to the features, sub-features and attributes for all EMS within Sussex. The fishing activities and associated risk ratings (red, amber, green, blue) from the generic matrix were directly transferred to these site specific risk matrices and the known occurrence or absence of each activity type indicated (Annex I).

Through these site matrices eelgrass (*Zostera* spp.) beds in Chichester Harbour within the Solent Maritime SAC were identified as the only red high risk feature in the district and therefore of priority for management under the revised approach. Based on government advice, IFCA is required to implement regulatory management measures to protect red risks, thus the proposed eelgrass protection byelaw and associated Impact Assessment have been formulated.

Application of the generic matrix risk ratings to Langstone and Chichester Harbours SPA categorised eelgrass as amber risk as they are not a key feature for which the site was designated, with SPAs instead focusing on bird species. All eelgrass beds encompassed within the SPA in Chichester Harbour are also contained within the Solent Maritime SAC site and will

therefore be protected under proposed management measures introduced in 2013 for red risks.

3.0 Policy objective

The underlying policy objective of the proposed byelaw introduction is to ensure Sussex IFCAs obligations to protect red risk features under the government's revised approach to the management of commercial fisheries in EMS are met.

IFCAs also have a duty under the Marine and Coastal Access Act (MCAA) 2009 to manage the exploitation of both commercial and recreational sea fisheries resources in a sustainable way and to protect marine ecosystems from the impact of fishing in the 0-6nm limit off England. Their nationally agreed vision is to: *"lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry"*.

Under Section 155 of the MCAA IFCAs may make byelaws for their district to enforce their duties under Sections 153 and 154, to manage the sustainable exploitation of sea fisheries resources and further the conservation objectives of EMS respectively.

The proposed closure of eelgrass beds to specific damaging fishing activities is in line with both Sussex IFCAs duties outlined under MCAA and their legal requirement under Article 6.2 of the Habitats Directive, to take appropriate conservation measures to avoid damaging activities in EMS.

In addition, eelgrass beds are a UK Biodiversity Action Plan (BAP) priority habitat, identified as being the most threatened and requiring conservation action. Under the Natural Environment and Rural Communities Act 2006 all public authorities have an obligation to have regard for the conservation of biodiversity when carrying out their functions.

4.0 Rationale and evidence

4.1 IFCA evidence requirements

One of IFCAs success criteria is to make the best use of evidence to deliver their objectives. In order to sustainably manage sea fisheries resources, IFCAs need to gather evidence to inform decisions, evaluate options, propose management solutions and, where necessary, develop and agree byelaws. They also need to evaluate outcomes and review the effectiveness of any action taken.

4.2 Eelgrass extent evidence

Working with partners, IFCA has worked to identify gaps in knowledge on the red risk eelgrass feature extent within Chichester Harbour. Based on existing survey data from Hampshire and Isle of Wight Wildlife Trust (HIoWWT), an eelgrass location and extent map was produced for the harbour (Annex II).

Four intertidal beds have been identified in Sussex IFCAs district east of Emsworth Channel. The consensus from Natural England (NE) and local experts, namely Chichester Harbour Conservancy and HIoWWT, is that the mapped beds are the only ones present within the area, but as previous surveys were conducted between 2006-2009 re-survey of these beds to establish current extents would be beneficial. Sussex IFCA incorporated this into their summer 2013 research plan to inform their management, enabling the authority to be proportionate in their restriction of activities. In future years, Sussex IFCA will seek guidance from NE on the districts eelgrass beds condition, ascertained in their 6 yearly EMS condition assessments. In addition, Sussex IFCA will seek to support partners with interim eelgrass beds condition surveys where able, to inform management.

No subtidal eelgrass beds have been mapped within Chichester Harbour. Consensus from the above partners is that they are not present and due to heavy maintenance and oyster dredging in the channels are unlikely to

occur. Sussex IFCA reviewed all their survey data for the site and also found no evidence of subtidal eelgrass in the harbour.

NE has advised that subtidal eelgrass beds in Chichester Harbour are not cited within Regulation 33 advice for the Solent Maritime SAC and therefore IFCA can proceed on the basis that they are absent and management prescriptions need not be implemented. As such Sussex IFCA removed surveys to ascertain subtidal seagrass presence from their 2013 research plan. If new evidence comes to light in the future regarding subtidal eelgrass presence within the harbour, IFCA will be receptive to new information and can subsequently adjust where damaging activities are prohibited.

4.3 Current fishing activity and management

Sussex IFCA conducted a review of observed fishing activity in Chichester Harbour and constructed an activity map (Annex III). Fishing activity data has been collected by Sussex IFCA, and its predecessor the Sussex Sea Fisheries Committee, over the past 30 years.

The current level of activity for each method identified by Natural England as damaging to eelgrass beds and of red risk, together with existing management measures are summarised in Table 2 below:

Table 2 Current level and location of activities damaging to seagrass with current management

Gear type	Current level and location of activity	Current management
Towed (demersal)	Activity low. Only light otter trawls are currently known to operate in the harbour. This activity is demonstrably limited to the main channels (Annex III). No activity and feature interaction in the intertidal.	Only fishing instruments which are defined in the Sussex IFCA 'Fishing Instruments Byelaw'[5] may be used in fishing.
Dredges (towed and other)	Activity high. This activity is demonstrably limited to the main channels (Annex III). The fishery is not identified as interacting with the feature in the intertidal according to latest available information.	The only type of dredging allowed is oyster dredging (by virtue of the Sussex IFCA 'Fishing Instruments Byelaw'[5]) Further regulation of the oyster fishery is found in the 'Dredging for, fishing for and taking of oysters & clams and removal of cultch' byelaw[6]. This byelaw also establishes a season, which commences in November. Catch Per Unit Effort reaches minimum economic yield within 2-4 weeks of this season, for most (usually larger boats). The number of vessels fishing in Chichester for oysters has declined since designation of the EMS, with on average 5-15 vessels pursuing the fishery for the last 10 years. However in 2012 there was a peak in effort

Gear type	Current level and location of activity	Current management
		whereby 30+ fished in the Harbour on account of the high yields and a decline in the wider Solent oyster fishery. Although the main output from the fishery is associated with a short lived season, several smaller boats, by virtue of their lower overheads, can and do, pursue the fishery for longer periods. This fishery has been managed as part of the Solent European Marine Site Management Plan since the creation of that Single Scheme of Management.
Intertidal handwork and bait collection	Moderate activity. Solely in the intertidal. Limited feature interaction. Intelligence from Chichester Harbour Conservancy indicates the only known interaction between fishing activity and the mapped eelgrass areas east of Emsworth Channel in the Harbour occurs on the beds at Pilsey Sands, close to Oar Rithe, where hand gathering of clams occurs. This area would be accessed by boat, access is otherwise through the army camp at Thorney Island and is restricted to footpath without special permission (Sussex IFCA Chichester Harbour Eelgrass Case Management Running Sheet). IFCO observations and information reports from a	Only fishing instruments which are defined in the Sussex IFCA 'Fishing Instruments Byelaw'[5] may be used in fishing. Fishing by hand is not restricted, but fishing using other instruments is. Solent European Marine Site (SEMS) Code of Conduct Bait Collection[7].

Gear type	Current level and location of activity	Current management
	number of sources indicate clams are being illegally commercially collected on Thorney Island, primarily along the west side and up to Oar Rithe. There should be no collection of clams for human consumption within Chichester Harbour as there is no Food Standards Agency shellfish hygiene classification for these species. Illegal clam collection is an offence regulated by the Local Authority Environmental Health Officers. Sussex IFCA are also aware of intelligence indicating commercial bait digging and illegal commercial clam collection outside of the mapped eelgrass beds elsewhere within the Harbour, at Dell Quay and the latter activity also at East Head.	

4.4 Eelgrass impacts evidence

Eelgrass impacts evidence for red risk damaging activities outlined in Natural England's generic matrix audit[8] is summarised in Table 3. The level of certainty associated with the generic description of impact provided in the audit is included.

Based on revised approach advice, where a feature and gear combination is assigned red risk in the government's generic matrix, no further local evidence is required to justify management intervention. Evidence underpinning the need to implement management measures to restrict activities assessed as red risk over eelgrass areas is therefore based on generic impacts evidence provided in Natural England's matrix audit.

Evidence presented within Sections 4.2 and 4.3 indicate there is no current towed (demersal) and dredge (towed and other) interaction with the intertidal beds mapped. There are also no known subtidal eelgrass beds in the areas where these gears operate, or the harbour as a whole.

Available evidence on handworking and bait collection activity suggests limited interaction with the mapped intertidal eelgrass beds in the harbour. Intelligence from Chichester Harbour Conservancy indicates the only known interaction between fishing activity and mapped eelgrass areas east of Emsworth Channel in the Harbour occurs on the beds at Pilsey Sands, close to Oar Rithe, where hand gathering of clams occurs. IFCO observations and information reports from a number of sources indicate clams are being illegally commercially collected on Thorney Island, primarily along the west side and up to Oar Rithe.

Government has advised that management measures to protect sensitive red risk features must be introduced, irrespective of condition or level of pressure, and implemented through an IFCA byelaw (within 6nm). Risk refers to the sensitivity of the feature to different fishing types, and is not related to the level of that fishing activity at a site.

Table 3 Evidence for seagrass impacts from red risk fishing activity types

Potential hazard	Explanation for matrix red risk categorisation in audit	Potential impact and evidence indicated in matrix audit	Additional evidence of impact	Confidence in potential impact description in audit
Towed (demersal)	Although empirical evidence describes impact to *Posidonia* spp in the Mediterranean Sea, given the similarities between species it is reasonable to assume analogous impact to *Zostera* spp in the UK. This is supported by the evidence for dredging, which has a comparative impact to trawling and is for *Zostera* spp.	Trawling has major direct and indirect impacts on seagrass beds (Moore and Jennings 2000[9]); substrate is lost or destabilised, seagrasses are uprooted and damaged (Tudela 2004[10]) and sediment resuspension reduces light necessary for seagrass photosynthesis (Ardizzone et al 2000[11]). Recovery is variable and rapidity is dependent on extent of removal. Rates may be slow where adjacent seed sources and viable grass beds are present, but can be between 60-100 years where the removal of rhizomes has occurred (Gonzalez-Correa *et al* 2004[12] and Moore and Jennings 2000).	Towed (demersal) gear activity mapped in harbour (see Annex III and Table 2). Activity low and limited to the main channels. No activity and feature interaction in the intertidal. Cefas literature review[25] and NE angiosperm report[26] for additional evidence on impacts.	**High:** There is peer reviewed evidence from the Mediterranean Sea (*Posidonia* spp). Given the similar ecological requirements and sensitivities of this species and the evidence concerning impacts of towed demersal fishing gears, this evidence is considered to be highly relevant scientific information which directly supports the conclusions on categorisation of this activity/sub feature combination.

Potential hazard	Explanation for matrix red risk categorisation in audit	Potential impact and evidence indicated in matrix audit	Additional evidence of impact	Confidence in potential impact description in audit
Dredges (towed)	Empirical evidence for impacts of dredge fishing on seagrass is extensive. Recovery rates are extremely variable; however shorter rates reported under experimental conditions are not considered to be representative of commercial fishing activity and therefore have not been considered further in the assessment of risk.	Both scallop dredging and other shellfish dredges immediately reduce shoot density and biomass (Peterson *et al* 1987[13], Fonseca *et al* 1984[14], Neckles *et al* 2005[15] and De Jonge and de Jong 1992[16]) increase turbidity and have indirect consequences for trophic structures (Bishop *et a*l 2005[17]). Recovery is variable, demonstrated experimentally to range from months (at a non-commercial level of intensity) to many years, dependent on the extent of shoot damage (Cabaco *et al* 2005[18]) and the extent and intensity of damage. In summary, recovery rates have been considered analogous to those for biogenic (sponge and coral) habitats (Ruesink and Rowell 2005[19]).	Dredge (towed) activity mapped in harbour (see Annex III and Table 2). Only oyster dredging allowed in harbour. Activity high and limited to the main channels. The fishery is not identified as interacting with the seagrass features in the intertidal according to latest available information. Cefas literature review[25] and NE angiosperm report[26] for additional evidence on impacts.	**High:** There is peer reviewed, highly relevant scientific information to directly support the conclusion

Potential hazard	Explanation for matrix red risk categorisation in audit	Potential impact and evidence indicated in matrix audit	Additional evidence of impact	Confidence in potential impact description in audit
Dredges (other)	Evidence for this categorisation is largely taken from grey literature, with one empirical source assessing trampling in New Zealand and one assessing hand collection in Portugal. However, this limitation reflects the absence of peer-reviewed literature on this subject rather than a lack of confidence in the conclusion as a high risk category. This is because it is reasonable to identify the consequent impacts of suction dredging and propeller action as analogous to impacts identified from gears above. Therefore evidence	Suction dredging removes seagrass and causes siltation which may result in further indirect negative effects (Davidson and Hughes 1998[20]). Propeller wash or cutting also removes shoots and leaves to cause scars in seagrass (Short and Wyllie-Echeverria 1995[21]) which can increase bed fragmentation by reducing the integrity of the bed and increasing vulnerability to further erosion (Turner and Schwarz 2006[22]). Trampling (Eckrich and Holmquist 2000[23]) and hand-collection (Cabaco et al 2005[18]) has also been shown to have significant detrimental effects, including reducing shoot density and total biomass.	Dredge (other) activity mapped in harbour (see Annex III and Table 2). No suction dredging currently occurs. Cefas literature review[25] and NE angiosperm report[26] for additional evidence on impacts.	**Medium:** There is directly relevant scientific information to support the conclusion but it comes from 'grey literature' sources

Potential hazard	Explanation for matrix red risk categorisation in audit	Potential impact and evidence indicated in matrix audit	Additional evidence of impact	Confidence in potential impact description in audit
	from the grey literature is also supported by an expert consideration of sensitivity to the mechanical impacts exerted by the activities detailed in the potential impact and evidence column.			
Intertidal handwork and Bait collection	Evidence for this categorisation is available from a small number of international, primarily experimental, peer-reviewed studies. Although these studies concern impacts on non-UK species of seagrass they are considered relevant for the assessment of risk posed to seagrass	Seagrasses' are considered highly sensitive to physical disturbance, including that caused by trampling and digging (e.g. Davison and Hughes 1998[20], Skilleter *et al*. 2006[28], Tyler-Walters and Arnold, 2008[29]). An experimental study of the effects of trampling on *Thalassia testudinum* in Puerto Rico recorded significant decreases in seagrass cover and increases in sand cover. Heavier trampling (50 passes per month for four months) also resulted in reduced rhizome biomass of up to 72% and loss of standing crop of up to 81% (Eckrich and Holmquist 2000[23]). Clam harvesting, whereby intertidal	Local information on intertidal handwork and bait collection locations within the harbour was sought from Chichester Harbour Conservancy - low activity, solely in the intertidal and limited feature interaction. The use of rakes to harvest clams has been shown to	**Medium:** The conclusions are supported by relevant scientific information. However, the evidence-base is relatively limited and international in origin, although the study species and environments are considered analogous to UK seagrass habitat. Grey literature and

Potential hazard	Explanation for matrix red risk categorisation in audit	Potential impact and evidence indicated in matrix audit	Additional evidence of impact	Confidence in potential impact description in audit
	habitats in the UK. There is some variation in the level of impact detected within these studies and in the rates of recovery from impact; however the balance of available evidence still strongly suggests that seagrass has a high sensitivity to commercial intertidal handwork, bait digging and crab tiling and that recovery rates are generally slow. Expert judgement of the available evidence has concluded that the risk of significant impact is sufficient to require a precautionary categorisation of red	sediments dominated by *Zostera noltii* are dug up using a hand blade, in the Ria Formosa lagoon (Southern Portugal) was found to have an adverse effect on vegetative shoot density and total plant biomass, leading to increased fragmentation of the seagrass meadows. Both relatively low and relatively high levels of clam harvesting disturbance (intensity and frequency) resulted in negative effects on seagrass density (Alexandre *et al*. 2005[30], Cabaco *et al*. 2005[18]). An experimental analysis of the effects of recreational clam digging within *Zostera marina* beds in Newport USA resulted in significant reductions in above- and below-ground seagrass biomass (Boese, 2002[31]). The observed recovery rates of seagrasses from anthropogenic disturbance are variable, thought in part to be related to variation in intensity, frequency and extent of disturbance, although the recovery potential of seagrass is generally considered to be relatively poor (Mazick & Smyth, 2013[32]). The recovery potential of seagrass from 'foot-based' activities	significantly damage the seagrass (Petersen, 1983[24]). Cefas literature review[25] and NE angiosperm report[26] for additional evidence on impacts.	expert judgement have also informed the categorisation.

Potential hazard	Explanation for matrix red risk categorisation in audit	Potential impact and evidence indicated in matrix audit	Additional evidence of impact	Confidence in potential impact description in audit
	in the Matrix.	specifically is more uncertain due to the limited number of studies. In Eckrich and Holmquist's (2000)[23] experimental study of the effects of trampling, recovery was incomplete after seven months and reduced cover was still visually distinguishable at several study sites after 14 months, whilst recovery from the experimental removal of *Zostera marina* shoots took between 24 and 30 months (Boese *et al*., 2009[33]). Although recovery from the negative effects of a single experimental clam harvesting event on shoot density of *Z. noltii* meadows occurred within 1 month, recovery from the ongoing activity in the Ria Formosa lagoon was considered unlikely due to the intensity and frequency at which it actually occurs (Cabaco et al. 2005[18]).		

5.0 Description of options considered

5.1 Evidence-based decision making cycle

IFCAs must have a consistent approach to their decision making and be able to articulate clearly to stakeholders why they have chosen a certain approach. An evidence-based decision making cycle approach provides a common framework for decision making by IFCAs and has been adopted in the current management options consideration for EMS high risk features and activities.

The government's revised approach to fisheries within EMS defined the issue for consideration by IFCAs, namely to ensure that management of all existing and potential commercial fishing activity complies with our obligations under the EU Habitats and Birds Directives.

The generic and site risk matrices compiled clarify the priorities for action. Development and appraisal of management options for red risk eelgrass areas within Chichester Harbour formed the next stage of the decision making cycle, as outlined in sections 5.2 to 5.5 below.

5.2 Option 1: Do Nothing

The 'do nothing' Option 1 would allow fishing activities identified by government as incompatible with red risk eelgrass features to continue and potentially damage beds within Chichester Harbour, now or in the future. Guidance from government on the revised approach to fisheries management within EMS stipulates that management to protect red risks must be implemented by 2013, thus the option of doing nothing was disregarded. Inaction could also mean that Sussex IFCA fails to fulfil its duties under Article 6.2 of the Habitats Directive and Section 154 of the MCAA 2009 to protect and further the conservation objectives of EMS habitats and features.

5.3 Option 2: Sussex IFCA 'Chichester Harbour European Marine Site (Specified Areas) Prohibition of Fishing Method' Byelaw. Preferred option

In accordance with government advice and evidence provided through the revised approach, Sussex IFCA is required to introduce management measures to protect sensitive red risk features in EMS within 6nm, irrespective of condition or level of pressure, and to implement these through an IFCA byelaw by 2013.

Under Article 6.2 and based on revised approach advice, despite local recreational and commercial fishing activity information indicating limited current interaction with the known eelgrass areas in Chichester Harbour, a precautionary approach must be adopted and activities identified as damaging to this sensitive feature prohibited where beds occur, even if interaction is purely theoretical. Without management action, government advice is that it will not be possible to ensure long-term protection for these communities as there is no certainty that damaging fisheries will continue to be absent and not interact with the feature.

On this basis Option 2, the introduction of a local IFCA byelaw, is proposed for zoned management of towed (demersal) fishing, dredges (towed and other), intertidal handwork and bait collection to ensure avoidance of known eelgrass beds in Chichester Harbour and prevent the deterioration of this feature (Annex IV). This would apply to the section of Chichester Harbour within Sussex IFCAs district which follows the administrative boundary between Hampshire and West Sussex and encompasses the area of the harbour east of Emsworth Channel.

For management purposes, polygons have been drawn around known eelgrass areas over which identified damaging activities will be prohibited. These polygons were created using the following principles:

a) that the feature should be wholly contained within the polygon
b) that the area should use identifiable land or navigation marks where appropriate
c) that subject to a and b they cover the smallest area possible and that,
d) subject to a, b and c that the polygon should use the fewest points as possible.

It is essential that the areas delineated are realistically enforceable, using fixed features for ease of compliance. Table 4 outlines the polygon delineation point positions and boundary rationale for each eelgrass bed east of Emsworth Channel in Chichester Harbour. Positions were rounded to 2 decimal places rather than 3 to facilitate mapping in real life.

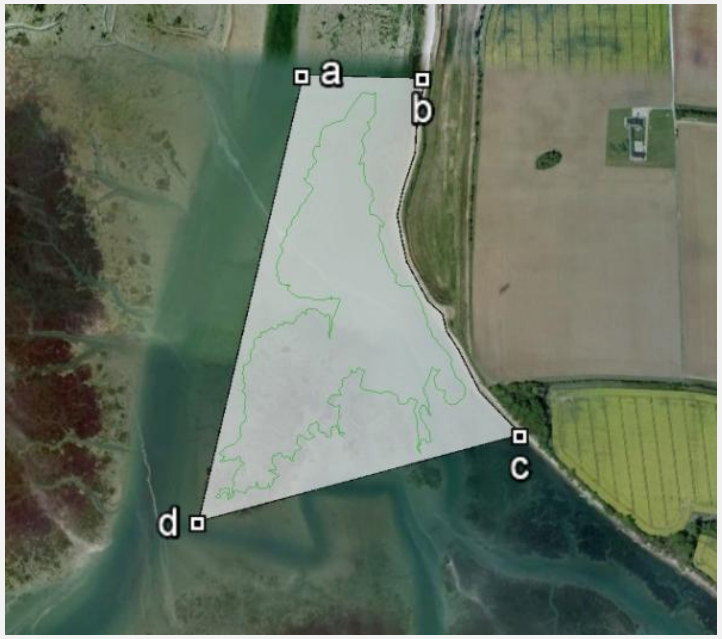
For those activities identified as red risk for eelgrass no additional evidence on habitat impacts needs to be obtained before byelaws are implemented.

Although government advice under the revised approach is solely for commercial fisheries, the proposed byelaw encompasses both recreational/commercial and permissive/unlicensed activities. For management purposes Sussex IFCA cannot distinguish between commercial and recreational hand gathering and bait collection activities. Managing activity type, regardless of whether it is commercial or recreational, also represents a common sense approach as the environmental impact is equivalent and NE conservation advice and management action will be the same for both.

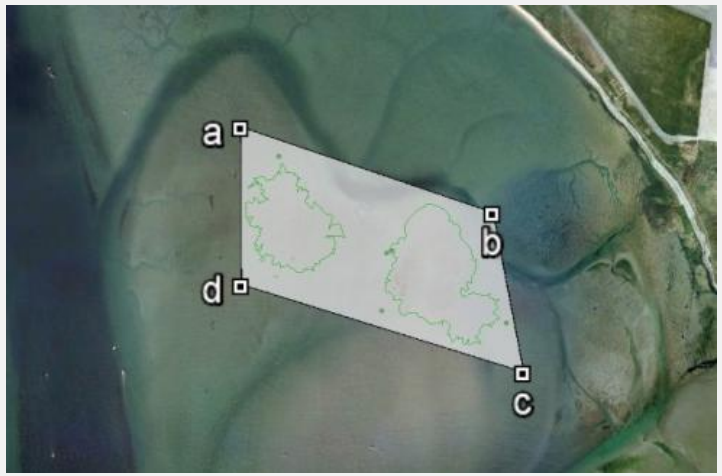
Option 2 is considered the most appropriate and proportionate management method to address risk to 'red' categorised features within the site whilst minimising effects on existing patterns of fishing activities in the area.

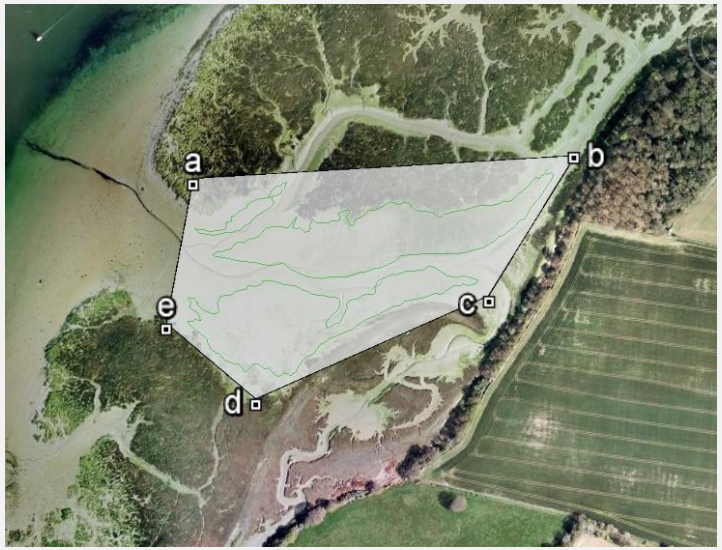
The proposed management utilises best available evidence. Sussex IFCA has worked to identify and address knowledge gaps, namely regarding the extent of the eelgrass feature. Survey programs with partners were conducted during summer 2013 to assess current intertidal bed extents and feature maps and management polygons were updated accordingly – see Table 4.

Table 4 Eelgrass beds management polygon delineation point positions and boundary rationale based on 2013 survey eelgrass bed extents

Eelgrass bed point	Latitude	Longitude	Management polygon map with 2013 eelgrass bed extent illustrated (northern edge at top)	Boundary rationale and area
Crake Bed				Area 0.175 km^2 Eastern edge: Landward extents follow MHWS line between points b and c. Straight lines between all other points. Western edge: Roughly bounded by Creek Rithe channel illustrated. Northern edge: Line from field boundary north of house as delineating feature. Southern edge: Line corresponds to midway point in tree line (approximately 80m from NW corner of tree line). SW edge bounded by saltmarsh.
a	50° 49.25'N	0° 53.67'W		
b	50° 49.25'N	0° 53.51'W		
c	50° 48.96'N	0° 53.37'W		
d	50° 48.88'N	0° 53.79'W		

Eelgrass bed point	Latitude	Longitude	Management polygon map with 2013 eelgrass bed extent illustrated (northern edge at top)	Boundary rationale and area
East Head				Area 0.381 km^2 Northern edge: Straight line between points a and b from the NE tip of East Head spit to the land lying to the east, where it corresponds with a field boundary. Byelaw applies to the area south of this line, delineated by a line adjoining points a and b following the MHWS line; marking the landward boundary of East Head Spit and land lying to the east.
a	50° 47.21'N	0° 54.50'W		
b	50° 47.21'N	0° 54.23'W		

Eelgrass bed point	Latitude	Longitude	Management polygon map with 2013 eelgrass bed extent illustrated (northern edge at top)	Boundary rationale and area
Oar Rithe				Area 0.226 km^2 Northern edge: Roughly corresponds with Oar Rithe creek illustrated. Western boundary: Line from western boundary roughly due south corresponds with SE tip of Hayling Island.
a	50° 48.55'N	0° 56.21'W		
b	50° 48.45'N	0° 55.70'W		
c	50° 48.25'N	0° 55.63'W		
d	50° 48.35'N	0° 56.20'W		

Eelgrass bed point	Latitude	Longitude	Management polygon map with 2013 eelgrass bed extent illustrated (northern edge at top)	Boundary rationale and area
Horse Pond				Area 0.064 km^2 Western edge of polygon contained just within entrance of the unnamed channel illustrated. Straight lines between points c, d, e and a roughly conform to saltmarsh boundary on northern and southern edges. Straight line between b and c eastern edge points, roughly following the landline.
a	50° 48.29'N	0° 53.29'W		
b	50° 48.31'N	0° 52.96'W		
c	50° 48.23'N	0° 53.03'W		
d	50° 48.17'N	0° 53.23'W		
e	50° 48.21'N	0° 53.31'W		

As part of their cyclical decision making approach Sussex IFCA will continue to evaluate and adapt proposed management. The current SNCB advice is that subtidal eelgrass is not known to occur within Chichester Harbour, however if new evidence of presence arises Sussex IFCA will expand activity restrictions to include these areas.

The evidence trail underpinning all management decisions will be accurately and thoroughly recorded within a Site Action Plan for eelgrass beds in Chichester Harbour, outlining available evidence (for activity levels, impacts and feature mapping) and information gaps, such as on feature extents, to inform future evidence gathering priorities.

5.4 Option 3: Full site prohibition – IFCA byelaw

Based on government advice under the revised approach, management of identified damaging activities is solely required over the sensitive feature, not throughout the whole EMS. Full site closure to red risk gear types within Chichester Harbour, the impacts of which are localised, is considered too conservative and cannot be justified. Thus, Option 3 has been rejected. Such a management measure would also not be in line with IFCAs duty to sustainably manage the inshore marine environment 'ensuring healthy seas, sustainable fisheries and a viable industry'.

5.5 Option 4: Voluntary agreement

Government advice under the revised approach indicates that voluntary measures cannot be used to manage red risk fishing activities identified as damaging to sensitive features within EMS. As such, Option 4 has been rejected.

6.0 Cost benefit analysis

6.1 Fisheries costs

The recommended byelaw would potentially remove access to fishing grounds and sea fisheries resources to both commercial and recreational fishermen utilising towed (demersal), dredges (towed and other), intertidal handwork and bait collection methods.

Sussex IFCA does not anticipate any loss of known commercial fishing ground as a result of the proposed byelaw or any commercial fishing industry costs associated with restricting the above fishing methods over known eelgrass beds within Chichester Harbour.

Evidence gathered from Sussex IFCA on the location of different fishing activities within the harbour, presented within Sections 4.2 and 4.3, indicates there is no towed (demersal) and dredge (towed and other) interaction with the intertidal beds mapped. There are also no known subtidal seagrass beds in the main channel areas where these gears operate, or the harbour as a whole. As such, no impact to operators of these gear types is anticipated.

Sussex IFCA holds limited data on hand working and bait collection activity. The available evidence from IFCO sightings data, information reports from the local community and intelligence sought from partners suggests moderate activity levels for these fishing methods and limited interaction with the mapped intertidal eelgrass beds east of Emsworth Channel in the harbour.

No economic data associated with hand gathering is held by Sussex IFCA as commercial hand gathering is not permitted. Sussex IFCA regulation under a Fishing Instruments byelaw[5] and the absence of a Food Standards Agency (FSA) classification for shellfish species other than oysters, both prohibit commercial hand working activity in the harbour. Legally, shellfish cannot be collected for human consumption without a hygiene classification from the FSA. As such, for the purpose of an assessment of cost to industry the assumption is made that hand gathering activity is not commercial within the harbour and no impact is anticipated. As outlined in Section 4.3, Sussex IFCA are however aware of intelligence indicating illegal commercial clam collection in the harbour, including around the mapped eelgrass bed near Oar Rithe. Costs to illegal operators cannot, and would not, be considered in this impact assessment.

Currently, Sussex IFCA does not hold any information on recreational hand gathering and bait collection activity on the mapped eelgrass beds although this is known to occur within the wider harbour. Intelligence from CHC indicates that the only known interaction between fishing activity and the mapped eelgrass areas east of Emsworth Channel is the clam collection outlined above.

Sussex IFCA knowledge of the area indicates that fishermen cannot easily access the known eelgrass beds within the harbour by foot. If any recreational hand gathering and bait collection activity does occur it would be able to relocate to more accessible areas locally within the harbour. These activities would also only be restricted from a limited portion of the harbour due to the geographically small area covered by the known mapped seagrass beds (Annex II) within the Sussex IFCA district east of Emsworth Channel. The mapped polygons encompassing each bed for management purposes cover a combined area of 0.85km^2.

When considering restricting bait digging and associated activities the potential loss of a right to fish should be considered. Sussex IFCA has the power to make byelaws under Section 155 of the MCAA 2009 'for the purpose of performing the duty imposed by Section 153', and can therefore regulate bait digging as an activity without the consent of those who enjoy the right to dig bait for personal use in connection with fishing, and those who dig bait for commercial use (legal opinion obtained from Blake Lapthorn by Southern IFCA in 2011). The proposed byelaw also only prohibits specified activities from a small section of the foreshore, where known eelgrass beds are present, and persons can dig for bait close by.

As outlined in Section 5.1 Sussex IFCA will continue to adopt an evidence-based decision making cycle approach to the management of fisheries within EMS. If new evidence becomes available regarding potential costs to the fishing industry from the proposed management Sussex IFCA is currently considering, the recommendations will be reviewed.

6.2 Enforcement, monitoring and administrative costs

Sussex IFCA would be responsible for the enforcement of the proposed byelaw which may have associated resource costs. Compliance work will be proportionate to intelligence on the level of activity at the eelgrass sites. Currently, intelligence and IFCO observations indicate there is no legal commercial activity at these sites, although illegal clam collection is known to occur. It is envisaged that patrol costs associated with the management of the eelgrass areas will be absorbed within the current operational budget. Patrols will encompass sightings, intelligence gathering and the delivery of key communication messages.

No additional costs related to intelligence assets are anticipated as Sussex IFCA has good intelligence networks around Chichester Harbour, through local fishermen and CHC. If intelligence is received regarding non-compliance and an increase in activity over the eelgrass areas, Sussex IFCA will adjust tactical options and specialist intertidal patrols to known beds may be required. The costs per day to operate a sea patrol and land patrol are £2,500 and £350-400 respectively. Precise calculation of the number of patrols required is not possible at this stage as the likely level of compliance is not known however, it is estimated approximately 3-4 patrols a month will be conducted within Chichester Harbour which will encompass compliance work on the eelgrass areas.

The purchase of specialist equipment may be needed including mud shoes, hand-held GPS, and safety equipment. Staff time for monitoring work will be absorbed within the existing operational budget.

Time and money will also be needed to implement an education and communication strategy to ensure stakeholders are aware of the proposed management measure. This could include the provision of advice and information packages, attendance at public events and community groups, and signage, that can be delivered during specific meetings or whilst conducting routine land or sea patrols. Potential costs associated with post-byelaw signage are estimated at £1,000.

Staff time, legal advice and advertising costs associated with making the proposed byelaw are estimated at £10,000.

6.3 Wider Impacts

No wider impacts associated with the proposed eelgrass protection byelaw are anticipated.

6.4 Benefits

Environmental and fisheries benefits are difficult to quantify and are therefore described here as non-monetised benefits.

Environmental benefits

The proposed byelaw will facilitate the protection of an internationally important habitat which is a key component sub-feature/attribute for the designation of the Solent Maritime European Marine Site. Restricting gear types known to damage eelgrass beds will help protect them from current and possible future destructive fishing activity and help achieve the conservation objective of maintaining the habitat in favourable condition as measured by its extent.

Eelgrass beds are a declining habitat, included on the OSPAR List of Threatened and/or Declining Species and Habitats (declining in Region II – North Sea and Region III – Celtic Sea, and threatened in Region V – Wider Atlantic). Eelgrass is also a UKBAP Priority Habitat and an important feature in estuary Sites of Special Scientific Interest, under the UK Wildlife and Countryside Act 1981. In addition, they provide important food for wildfowl, such as brent geese, and nutrients to support animal communities on the seabed.

Sustainable fisheries

Protecting eelgrass beds from known damaging gear types will also help support sustainable fisheries in the district. Eelgrass beds are important nursery and spawning areas for a variety of commercial fish and shellfish species and provide a sheltered home for many other animals, such as pipefish and seahorses.

Ecosystem services

Protecting eelgrass beds for their ecosystem services role is an important consideration. As well as promoting biodiversity, eelgrass beds store carbon, cycle nutrients, support numerous industries (e.g. fishing and tourism) and help reduce coastal erosion as their roots catch and trap sediments. Eelgrass/algae beds value is estimated as $19,004 $ha^{-1}yr^{-1}$ globally – some three times more than coral reefs[27].

7.0 Risks and assumptions

There are several risks and assumptions associated with the preceding assessment of management measures, impacts and cost. Sussex IFCA holds limited data on hand gathering and bait digging activity within the area. At present, based on existing information the assumption is that there is only interaction between the eelgrass beds and hand collection activity at the site near Oar Rithe. However, this could solely be due to knowledge gaps regarding the extent of these activities and interaction could be more widespread.

As the site straddles the boundaries between two IFCAs there is the risk that different management measures could be proposed making compliance confusing for stakeholders. Under the revised approached, government expects that in such cases any management measure proposed for a site feature is consistent across the IFCA boundaries.

Government's advice under the revised approach to fisheries refers solely to commercial fisheries. However, as differentiating between commercial and recreational hand gathering and bait collection activity would be impossible for management purposes these have both been encompassed within the proposed byelaw.

8.0 Summary and preferred option

Government has revised the approach to the management of fishing activities within English EMS to bring commercial fisheries management in line with other activities and ensure compliance with EU Habitats and Birds Directives to protect habitats and species for which sites were designated.

The introduction of the proposed 'Chichester Harbour European Marine Site (Specified Areas) Prohibition of Fishing Method' byelaw will protect a sensitive feature identified as red risk within the government's generic risk matrix, both from the low level of current damaging fishing activity within known beds and from any possible future increase in activity levels in these areas.

It is considered that the environmental benefits of introducing the proposed byelaw outweigh the potential administrative and enforcement burden and it is anticipated that no cost to industry will be incurred.

The effectiveness of the recommended byelaw will be reviewed 6 years after its introduction through Natural England's established EMS features condition monitoring programme.

This work contributes to the fulfilment of Sussex IFCAs responsibility to ensure the sustainable management of inshore fisheries balancing environmental, social and economic costs and benefits. Conservation of eelgrass beds within the harbour will also contribute to the delivery of Defra's aim to conserve and enhance the marine environment and promote sustainable fisheries.

Annexes

Annex I Chichester Harbour site specific matrices – Solent Maritime SAC and Chichester and Langstone Harbours SPA

Annex II Eelgrass location map, Chichester Harbour

Annex III Fishing activity map for Chichester Harbour, compiled by Sussex IFCA

Annex IV Chichester Harbour European Marine Site (Specified Areas) Prohibition of Fishing Method Byelaw

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