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Marine Conservation Zones

Natural England's advice to Defra on Marine Conservation Zones to be considered for consultation in 2017

Annex 2: Advice on Tranche 3 MCZs with the species feature of conservation importance smelt (Osmerus eperlanus)

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June 2018

Contents

1 Summary of Natural England's pre-consultation advice on smelt (*Osmerus eperlanus*)

The tables below summarise Natural England's advice on the scores against the four principles considered as being important in the identification of MCZs for highly mobile species (Table 1; JNCC and Natural England 2016a) and on the General Management Approach (GMA) (and our confidence in this) (Table 2).

Table 1 Summary of Natural England's pre-consultation advice on smelt FOCI features against the principles set out in JNCC and Natural England (2016a)[1]

Site with smelt proposed as a feature	Principle 1 – Ecological significance	Principle 2 – Persistence	Principle 3 – Size and delineation	Principle 4 – Appropriateness of management
Alde Ore Estuary	High	High	Moderate	High
Blackwater, Crouch, Roach and Colne Estuary	Low	Moderate	Low	High
Medway Estuary	High	High	Moderate	High
Ribble Estuary	High	High	Moderate	Moderate
Solway Firth	Low	Moderate	Low	Moderate
Upper Thames Estuary	High	High	Moderate	High
The Swale Estuary[2]	Low-Moderate	High	Low-Moderate	Low-Moderate
Wyre-Lune	High	High	Moderate	High

[1] Assessed based on scoring criteria outlined in Table 5 of JNCC and Natural England (2016)
[2] Range of Low-Moderate is given for Principles 1, 3 and 4 based on the Swale being considered as a standalone site (where it would score 'low') or jointly with the Medway Estuary (resulting in a score of 'moderate')

Table 2 Summary of Natural England's pre-consultation advice on the General Management Approach (GMA) for proposed smelt (*Osmerus eperlanus*) FOCI features

Site with smelt proposed as a feature	GMA advised	Confidence in GMA[3]
Alde Ore Estuary	Recover	Low
Blackwater, Crouch, Roach and Colne Estuary	Recover	Low
Medway Estuary	Recover	Low
Ribble Estuary	Recover	Low
Solway Firth	Recover	Low
Upper Thames Estuary	Recover	Low
The Swale Estuary	Recover	Low
Wyre-Lune	Recover	Low

[3] As with other features, the GMA were developed by carrying out a vulnerability assessment for the feature due to direct lack of direct condition evidence and therefore the confidence in feature condition cannot be scored higher than 'Low' according to Technical Protocol F (JNCC and Natural England 2012b). For more information on this, please see the GMA methodology description in the Advice Overview.

2 Introduction

This component of our Tranche 3 pre-consultation advice focuses on the species feature of conservation importance (FOCI) smelt for the Regional Project recommended MCZs (rMCZs) in which it is proposed (Table 3). For five of the sites, smelt was originally proposed by the Regional Projects as a feature of the site. For the remaining three (Blackwater, Crouch, Roach and Colne Estuary; Medway Estuary; The Swale Estuary), new evidence has led to smelt being considered as an additional feature (see sections 4 and 5). The Ecological Network Guidance (ENG: Natural England and JNCC 2010) recommends that smelt may be suitable for protection where appropriate spawning, nursery or foraging grounds occur. Smelt is an anadromous[4] fish that was once widespread in estuaries within the UK, but has declined considerably over the past two hundred years (Maitland 2003; Colclough 2013). Smelt are known to congregate in large shoals in lower estuaries and migrate into fresh water where they spawn in spring (Maitland 2003). Spawning usually takes place during the highest spring tides when the water has reached at least 5^{o}C (Colclough 2013). This temperature threshold appears to vary from estuary to estuary, which may be related to the latitude (Colclough 2013). Spawning usually takes place at night. Adhesive eggs stick to gravel, stone and soft vegetation such as the moss *Fontinalis*, as available (Colclough 2013). Estuaries therefore provide critical habitats required to complete smelt lifecycles including for feeding and post-larval (juvenile) development. Given this dependence on estuaries and the anthropogenic pressures smelt may encounter within estuaries during their migration, they are considered suitable candidates for protection within MPAs.

Table 3 Tranche 3 inshore Regional Project recommended MCZs with smelt as a proposed feature

Site name	Site Status	Feature status	CP2 region
Alde Ore Estuary	Tranche 3 proposed	Regional Project Feature	Southern North Sea
Blackwater, Crouch, Roach and Colne Estuary	Tranche 1 designated	Tranche 3 SNCB Additional Feature	Southern North Sea
Medway Estuary	Tranche 1 designated	Tranche 3 SNCB Additional Feature	Southern North Sea
Ribble Estuary	Tranche 3 proposed	Regional Project Feature	Irish Sea
Solway Firth	Tranche 3 proposed	Regional Project Feature	Irish Sea
Upper Thames Estuary	Tranche 3 proposed	Regional Project Feature	Southern North Sea
The Swale Estuary	Tranche 2 designated	Tranche 2 SNCB Additional Feature	Southern North Sea
Wyre-Lune	Tranche 3 proposed	Regional Project Feature	Irish Sea

2.1 Summary of smelt status

Within the UK, 52 estuarine or tidal river systems (comprising at least 26 populations) are known to have contained smelt at one time, however many of these populations are now extinct (Maitland 2003). Jones *et al*. (2013) makes reference to 18 known smelt populations left in England. These are: Mersey, Ribble, Lune, Wyre, Solway, Tyne, Esk, Humber, Wash, Broads, Alde, Stour, Orwell, Blackwater, Crouch, Thames,

[4] Anadromous: fish which ascend rivers from the sea to breed

Adur and Plymouth Sound. A significant smelt population is also known to occur in the Medway (Colclough 2013). In Scotland there are three known populations remaining (Cree, Forth and Tay) with potential populations in the Conwy and Dee in North Wales (Jones *et al*. 2013). Of the 18 sites in English waters, eight have been proposed by the Regional Projects as having the strongest evidence were assessed for designation.

Overexploitation, erection of barriers and water quality deterioration threaten many European smelt populations, with local populations easily driven to extinction (ICES 2005). Like salmonids, smelt are thought to return to their natal river to spawn although the degree of fidelity may not be as strong as in Atlantic salmon (*Salmo salar*) (Jones *et al*. 2013). This may have implications if smelt populations become extinct in isolated estuaries as it could affect the speed at which recolonization may occur. The need to strengthen existing legislation, coupled with the enforcement of international directives, has long been recognised as a requirement to ensure the future viability and survival of this species (ICES 2005). Many estuaries which had known historic smelt populations may therefore still warrant protection due to the potential to manage the pressures which caused these declines, with the aim of restoring these local populations.

2.2 Contribution of the rMCZs with smelt as a feature to the ecologically coherent network of Marine Protected Areas

The target for protection of smelt in the MPA network is three replicates in each biogeographic region (Natural England and JNCC 2010). There is currently only one existing MPA for smelt; The Tamar Estuary MCZ which falls within the Western Channel and Celtic Seas CP2 region. The Tranche 3 rMCZs for which smelt is being considered as a feature offer sufficient replication to enable the target to be met in the Irish Sea and Southern North Sea CP2 regions (Table 3). For the other regions (Northern North Sea, Eastern Channel, Western Channel and Celtic Seas) there are no known options/further options and therefore no known regional gap for this feature (JNCC 2016).

2.3 How Natural England's advice on smelt has been developed

Natural England is committed to the use of the best available evidence to support the designation of MCZs. For MCZ features in Tranches 1–3 proposed by the Regional MCZ Projects, Natural England followed the guidelines set out in the ENG (Natural England and JNCC 2010) and applied Technical Protocol E (JNCC and Natural England 2012) and the data sufficiency guidelines (JNCC and Natural England 2015) and previous versions; JNCC and Natural England 2016b) to assess confidence in, and sufficiency of, the evidence on presence and extent of those features being proposed.

Smelt was one of the three highly mobile species FOCI included in the ENG which were considered appropriate for designation where spawning, nursery or foraging grounds occur (Natural England and JNCC 2010). The other two FOCI species, European eel (*Anguilla anguilla*) and undulate ray (*Raja undulata*) were not included in this advice. Eel are part of a global management plan for which site-based management (of the sort offered by MCZ designation) would be unsuitable and undulate ray was found at only one site, for which there was low confidence in feature presence. In previous tranches, Natural England has provided advice on the confidence in presence and extent of smelt as a feature of rMCZs, along with an assessment of scientific confidence in condition, to provide the proposed Conservation Objective (now replaced by the General Management Approach, GMA). This advice was previously developed according to the methods described in key guidance and protocols (e.g. JNCC and Natural England 2011; JNCC and Natural England 2012a; b), as has been described in detail in our Tranche 1 and Tranche 2 published advice. For consistency, the same methods have therefore been used in Tranche 3 to develop these components of our advice on smelt as a feature of the eight rMCZs (these results can be found in **Annex 4** – Results tables for advice on Regional Project recommended MCZs and New site options).

However, Technical Protocol E and thus the data sufficiency guidelines are less applicable to highly mobile species features as they assess presence and extent rather than more suitable factors such as ecological importance. Instead, third-party proposals for other highly mobile species MCZs have been assessed using the separate guidelines that were developed for highly mobile species proposals (JNCC and Natural England 2016a). The outcomes of those former assessments for the proposed sites and features are provided to Defra separately to this advice on smelt. However, to help achieve consistency between the advice on smelt and that on other highly mobile species proposals in Tranche 3, we have combined the existing methodology described above with that more recent, highly mobile species guidance and have therefore also scored each of the eight smelt rMCZs against the highly mobile species principles.

The highly mobile species guidelines complement and sit alongside the ENG. The four principles detailed in those guidelines draw on the MCZ network principles set out in the ENG, as well as experience in selecting SPAs and SACs for highly mobile species under the European Wild Birds and Habitats Directives respectively. The four principles are:

1. **Ecological significance** – The area considered should have critical importance to the life history of the highly mobile species at a population or sub-population level, e.g. for feeding or breeding behaviours
2. **Persistence** – Supporting data should demonstrate long-term persistence (allowing for natural seasonal and inter-annual variation) of the highly mobile species in the site at a population density greater than[5] the average density the wider sea area.
3. **Site size and delineation** – An MCZ should be large enough to maintain the supporting functions that a highly mobile species requires in a given location. The site should ensure that any supporting habitats, oceanographic processes, geological/geomorphological features or species important to the conservation of a given highly mobile species in the same locality are also considered in the context of MCZ size and extent.
4. **Appropriateness of management** – The particular value of site-based protection measures to the conservation of the species must be clear in an MCZ proposal to conserve a highly mobile species in that locality. For example, the proposal should demonstrate how a site-based measure compares to wider (possibly already existing) measures. Site-based measures may be particularly useful where localised threats are present that are not adequately addressed by wider existing measures.

Table 5 in the highly mobile species guidelines sets out the criteria for assessing the robustness of the ecological evidence supporting the mobile species proposals for each of the four mobile species selection principles. Section 11 sets out the criteria for principles 1–3 (taken from the mobile species guidelines document (JNCC and Natural England 2016a)) which have been applied to the evidence for smelt for each site and which have formed the basis for the assessments in this document against principles 1–3.

In most cases the evidence of smelt occurring in estuaries comes from Environment Agency Water Framework Directive (WFD) estuarine surveys aimed at sampling general estuarine assemblages and not specifically the presence of smelt or evidence of smelt spawning. The Environment Agency's National Fish Population Database (NFPD) is considered to be a source of high quality empirically-based evidence regarding the persistent presence of smelt in, and ecological significance of, estuaries for this species. This is especially true where length data and the presence of juvenile smelt indicate local recruitment; supporting the ecological significance of these estuaries as spawning sites for smelt. These data have been extracted from the Environment Agency's NFPD (Environment Agency 2016). The exception to this is the Thames Estuary where the Zoological Society of London (ZSL) have conducted smelt specific surveys in order to identify smelt spawning grounds within the upper Thames. Some estuaries are not covered by Environment Agency WFD fisheries surveys and other data sources have therefore also been used (e.g. from Cefas surveys) as detailed below.

[5] This does not necessarily equate to a sustainable population size, however.

The Tranche 3 pre-consultation advice on GMA has primarily taken into consideration evidence of the impact of existing barriers to spawning migrations and access to spawning grounds because a direct impact on the current condition of the smelt population is considered likely. Additional pressures to which smelt are sensitive are detailed in the site-specific sections below where they are present, or could be present, in the rMCZs. However, whilst management relating to such pressures could be required, and site-based measures would be appropriate (as reflected in scoring for principle 4: Appropriateness of Management), those pressures were not always considered as part of the GMA advice unless otherwise stated because of insufficient evidence of a direct impact on the current condition of the population. This explains why for some sites the GMA advice may appear different to the scoring for principle 4.

2.4 Structure of Natural England's Tranche 3 pre-consultation advice on smelt

Section 1 of this advice chapter contains summary tables presenting our advice on the scores against the four principles considered as being important in the identification of MCZs for highly mobile species (Table 1) and on the GMA (and our confidence in this) (Table 2).

Sections 3 – 10 contain site-specific evidence summaries to provide some brief information about each site, explain the advised GMA and, importantly, to provide justification/explanation for the score for each of the four principles. Where applicable, further considerations are provided such as additional known threats and potential management needs. A summary of Natural England's pre-consultation stakeholder engagement is also provided for each site.

Section 11 sets out the criteria for principles 1–3 (taken from the mobile species guidance document (JNCC and Natural England 2016a)) which have been applied to the evidence for smelt for each site.

Boundary maps are provided in the site specific sections of **Annex 1 – Advice on Regional Project recommended MCZs**. Feature maps are not provided for this highly mobile species (see Annex 1 for an explanation). Natural England's advice on the confidence in presence and extent of smelt in each site according to Protocol E (JNCC and Natural England 2012 – see Section 2.3 above) is provided in **Annex 4 – Results tables** for advice on Regional Project recommended MCZs and New site options. **Annex 4** also contains the details of evidence used to support this component of our advice, evidence that could not be used as part of our pre-consultation advice due to when it became available and a summary of our last published advice on confidence in presence/extent and GMA for smelt compared to that being advised now (where applicable). For further explanation of the contents of **Annex 4**, please refer to Sections 2 and 3 of the **Advice Overview document**.

3 Alde Ore Estuary rMCZ

Smelt has been put forward as a feature for the Alde Ore Estuary rMCZ based upon data provided by the Environment Agency.

For a map of the Alde Ore Estuary rMCZ site boundary, please refer to **Annex 1 – Advice on Regional Project recommended MCZs**.

3.1 Brief rationale for the advised Recover GMA for smelt in the Alde Ore Estuary rMCZ

Natural England's GMA advice (Recover) is based on expert judgement that Snape Maltings tide gates, which form the upper boundary of the site and the artificial tidal limit of the estuary, are likely to be a barrier to migration. Tide gates, because of the way they operate, only allow water to flow out at low tides and are generally considered impassable to most fish, unless they are forced open by debris. Evidence of smelt spawning runs was recorded in Environment Agency electrofishing surveys during a single year in spring 2003 (128 smelt) at Langham Bridge upstream of Snape Maltings (Colclough 2013). This confirms that, if they can, smelt will migrate upstream to spawn. However, under most conditions when the tide gates are fully operational they are considered to be impassable for smelt and therefore likely to be hindering the reproductive capacity of the population due to restricted access to spawning habitat. Fish and eel pass feasibility assessments completed by the Environment Agency confirm that the structure is considered impassable for all fish species (Wood, Environment Agency 2016 pers. comm.).

3.2 Assessment against highly mobile species MCZ selection criteria

3.2.1 Ecological significance of the Alde Ore Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Environment Agency survey data indicating species presence and persistent use of the estuary over a number of years between 2003 and 2015. Records of juvenile smelt (as small as 49 millimetres) provide evidence of local recruitment (2005, 2014 and 2015), supporting the presence of a local spawning population and the ecological significance of the estuary for smelt.

Smelt are generally confined to estuarine (and coastal) habitats which are critical for spawning, larval development and migration. The Alde Ore contains one of only 18 known remaining smelt populations left in England (Jones *et al*. 2013). There is good quality evidence from Environment Agency survey data at Iken Cliffs which support the persistent presence and use of the estuary by smelt over a number of years (2003-2005, 2014, 2015), with between 5-132 individual estuarine smelt records per year. In terms of the evidence regarding the ecological significance of the estuary for smelt, length data from these surveys record the presence of juvenile smelt over a number of years in 2005, 2014 and 2015. This includes juveniles as small as 49 millimetres which, given the survey timing, is considered consistent with fish which would have been recruited from local spawning events within the estuary. Electrofishing surveys in 2003 also recorded upstream freshwater smelt spawning runs (128 smelt) above Snape Maltings Sluice and upstream of the rMCZ boundary, suggesting some of the historical spawning habitat is currently excluded from the rMCZ boundary and lack of access may be hindering reproductive capacity of the population (Colclough 2013). Environment Agency data extracted from the Water Quality Archive (WIMS) also indicates that, subject to suitable spawning substrate, spawning could potentially occur at the top of the estuary (upstream of Barbers Point, Iken) and within the boundary of the rMCZ. At present the exact spawning location is unclear but the evidence of local recruitment from Environment Agency surveys does support the presence of a local spawning population. Despite the current uncertainty over the location of spawning grounds in relation to the rMCZ boundary, the site would still protect larval development, nursery

and foraging habitat and is likely to contain spawning grounds given the impassibility of Snape Maltings sluice.

3.2.2 Persistence of smelt in the Alde Ore Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Historical reference of smelt populations dating back to 1966 and empirical evidence from Environment Agency surveys showing the persistent presence of smelt from 2003 to 2015.

Survey data extracted from the Environment Agency's NFPD supports the persistent presence of smelt in the Alde Ore with between 5-132 estuarine records per year covering 2003-2005, 2014 and 2015. A total of 246 records exist in both spring and autumn seine netting surveys in the upper and lower estuary (Iken Cliffs and Shingle Street), 189 of which were recorded in 2014/15. Freshwater surveys in 2003 also recorded an additional 128 smelt migrating above Snape Maltings. There is historical reference of smelt populations in the Alde Ore dating back to 1966 (Maitland 2003).

There is also evidence of local population recruitment based on length data during 2005, 2014 and 2015.

3.2.3 MPA size and delineation of the Alde Ore Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
Moderate	The Snape Maltings tide gates which form the upper rMCZ boundary are currently likely to be hindering the access of smelt to their historical spawning grounds, this is supported by records of spawning smelt runs in 2003 (Colclough 2013). While based on current evidence the current rMCZ boundary is likely to include spawning sites within the estuary, future work may be required if and when fish passage, including for smelt, is improved at Snape Maltings tide gates.

While Snape Maltings tide gates currently delineate the artificial tidal limit and the upper boundary of the rMCZ, smelt may have historically spawned upstream of this before access was restricted. Smelt spawning runs have been recorded above the structure once in 2003 but not since; it is not known how the gates were operating in 2003 to allow passage (Colclough 2013). The current tide gate structures may therefore be limiting access to historical spawning grounds which are not currently included within the rMCZ site boundary. Further work is required to understand how passible these tide gates are under different operating conditions and where smelt spawn upstream of this during the limited times they may be able to access the river above this structure.

Environmental conditions may also be suitable for spawning downstream of Snape Maltings tide gates, within the boundary of the rMCZ, however the presence and extent of any suitable spawning habitats is currently unknown.

The downstream boundary of the rMCZ extends to the mouth of the estuary thereby ensuring the whole of the tidal estuary is included within the rMCZ boundary.

3.2.4 Appropriateness of Management in the Alde Ore Estuary rMCZ

Score: High

Smelt were recorded undertaking spawning runs above the tidal limit and rMCZ boundary at Snape Maltings tide gates in 2003. Given the tide gates represent an artificial tidal limit it is likely to be limiting

upstream migration and reproductive capacity of the population, as referenced in Colclough (2013). Currently, the only opportunity for smelt to pass from the saltwater of the estuary to the freshwater Alde would be when freshwater is allowed to pass out of the river and into the estuary at low tide, however in these instances it is likely that the water velocities through the tide gates may exceed smelt swimming abilities. It is therefore likely that many do not succeed in migrating past the sluice gate. The Environment Agency may be considering modifications to the sluice in the future. At this point consideration could be given to increasing fish passage opportunities.

Existing or future activities occurring within the estuary could cause disturbance to smelt (e.g. piling, in-channel dredging, flood defence work), especially if they occur during the time of the spawning migration or where activities may directly affect spawning and nursery habitats (e.g. through dredging or habitat modification), although the location of suitable spawning habitats is yet to be identified. Further consideration of the management of these activities and consideration of new licences may be required if their timing or location are found to significantly impact on smelt spawning or migration behaviour.

Entrainment of smelt has been recorded at the Sizewell power station, situated to the north of the rMCZ, suggesting options such as screening to limit such affects could be required if it was found the entrained smelt originated from the Alde Ore smelt population.

At present there are no known issues associated with water quality or commercial fisheries within the site to suggest they are likely to be significantly affecting the population.

3.3 Summary of 2016 stakeholder engagement for smelt in the Alde Ore Estuary rMCZ

Initial uncertainty was expressed by local fishermen and other stakeholders regarding the validity of smelt as a feature of the estuary. This has been addressed but not fully alleviated through presentation and explanation of the evidence base.

Concerns have been raised around the nature of management measures following designation, and the activities that might be impacted e.g. recreational sailing and mooring activities. Natural England helped to alleviate these concerns by identifying that if any restrictions on maintenance work on moorings were required, they would be unlikely to coincide with the peak sailing season. Further, such management would likely be focussed in the upper reaches of the estuary, where reduced salinity conditions are suitable for spawning but less activity occurs.

4 Blackwater, Crouch, Roach and Colne MCZ

The Blackwater, Crouch, Roach and Colne (BCRC) MCZ was designated in 2013. Smelt is a new feature proposed in Tranche 3. This feature was put forward by Defra based upon data collected during Environment Agency and Cefas surveys which show the presence of smelt in these systems.

For a map of the Blackwater, Crouch, Roach and Colne MCZ site boundary, please refer to **Annex 1 – Advice on Regional Project recommended MCZs**.

4.1 Brief rationale for the advised Recover GMA for smelt in the Blackwater, Crouch, Roach and Colne MCZ

Existing barriers may create the artificial tidal limit in these rivers. It is considered likely, based on expert judgement, that these barriers could also be limiting fish passage and therefore be restricting access to spawning grounds. A Recover GMA has therefore been advised. However, it is yet to be established if spawning does take place within these estuarine systems and indeed whether it occurs or could occur within the boundary of the MCZ. These sites are not part of the Environment Agency WFD sampling programme, therefore only limited autumn survey data exists (mainly from more general Cefas surveys). Smelt within these systems may also be exposed to other pressures including entrainment in power station intakes, water quality and other development activities.

4.2 Assessment against highly mobile species MCZ selection criteria

4.2.1 Ecological significance of the Blackwater, Crouch, Roach and Colne MCZ

Score	Summary of supporting evidence in relation to scoring criteria
Low	There is good evidence supporting the presence of smelt from surveys in the years between 2001 and 2009 though the number of records is small (4-92 per year). A single possible spawning location has been identified based on the presence of suitable habitat and there is anecdotal evidence from the Environment Agency of suitable conditions based on observed sea lamprey spawning in the area. Maitland (2003) and Colclough (2013) suggest that smelt recorded in these estuaries are part of a larger Greater Thames population but the evidence is currently weak. Further investigations are required in order to validate the ecological importance of these estuaries for smelt spawning.

There is good quality empirical evidence from joint Cefas/Environment Agency survey data which show the presence and use of the estuary by smelt over a number of years (2001-2006, 2008, 2009), with between 4-92 records per year. Smelt have been recorded in the BCRC MCZ by Cefas since 1981 with historical references dating back to the 1950s alluding to their presence within the estuarine system (Wheeler 1979; Maitland 2003). It has also been suggested that these estuaries are used for breeding purposes and that recorded smelt are part of a larger Greater Thames population; however this currently remains unsubstantiated (Maitland 2003; Colclough 2013). One potential smelt spawning location is the Beeleigh Weir located at the tidal limit on the Blackwater where the clean gravel provides an ideal habitat. Furthermore, sea lamprey have been recorded spawning in the vicinity (Markham, Environment Agency 2015, pers. comm.) providing a further potential indicator of suitable conditions (Colclough 2016, pers. comm.). Further investigations are required in order to validate the ecological importance of these estuaries for smelt spawning.

4.2.2 Persistence of smelt in the Blackwater, Crouch, Roach and Colne MCZ

Score	Summary of supporting evidence in relation to scoring criteria
Moderate	There is good evidence supporting the presence and persistence of smelt from surveys in the years between 2001 and 2009. Lack of spring smelt records can be explained by the timing of surveys and the exclusion of these sites from the Environment Agency WFD sampling programme. The Blackwater and Crouch systems have not been sampled since 2009.

There is good quality empirical evidence from joint Cefas/Environment Agency survey data which show the presence and use of the estuary by smelt over a number of years (2001-2006, 2008, 2009), with between 4-92 samples per year, resulting in a total of 203 records. Lack of spring smelt records can be explained by the timing of surveys and the exclusion of these sites from the Environment Agency WFD sampling programme.

The Blackwater and Crouch systems have not been sampled since 2009. There is historical reference of smelt populations in the BCRC estuaries since at least the 1950s (Wheeler 1979 as cited in Maitland 2003). Spawning sites have yet to be identified although there may be suitable habitat in the Blackwater Estuary at Beeleigh Weir.

4.2.3 MPA size and delineation of the Blackwater, Crouch, Roach and Colne MCZ

Score	Summary of supporting evidence in relation to scoring criteria
Low	As smelt spawning locations in these systems have yet to be identified, the current extent of spawning and whether it occurs within the MCZ boundary is unknown and therefore further investigative work is required.

As smelt spawning locations in these systems have yet to be identified, the current extent of spawning and whether it occurs within the MCZ boundary is unknown and therefore further investigative work is required. This may indicate that spawning activity is limited by barriers to migration which are known to occur at the upper tidal limit on these rivers; and thus the proposed site boundary may exclude key areas of historical spawning habitat, access to which may need to be re-established.

The downstream boundary of the rMCZ extends to the mouth of the estuary which is considered to be appropriate.

4.2.4 Appropriateness of Management in the Blackwater, Crouch, Roach and Colne MCZ

Score: High

Of primary concern are weirs which are likely to form artificial tidal limits and which may act as barriers to migration and may be limiting the reproductive capacity of any smelt population present in this estuarine system. If weirs are found to represent significant barriers, further consideration may need to be given to increasing fish passage either through removal or river restoration, if deemed possible, or weir modification to include fish pass facilities.

Poor water quality and WFD status over the last four years (for heavy metals and macroalgal growth) may be affecting smelt or suitable spawning substrates within the BCRC MCZ (particularly macroalgal growth) and further measures to improve conditions may therefore be required. In addition, possible entrainment in Bradwell Power Station intakes may also affect the population and this should be considered in any future

modifications to the power station. There may also be a need to consider the management of activities which could cause disturbance to smelt (e.g. piling, in-channel dredging, flood defence work), during the time of the spawning migration.

Coastal development and habitat creation (e.g. Wallasea Island) also encroach into the estuaries, potentially jeopardising the selective tidal stream transport of early life stages of many fish species (Colclough *et al*. 2002). However, we have no evidence to suggest that this is a particular barrier to smelt migration in the site.

Finally, whilst at present no targeted fisheries for smelt are known to occur in the site, there are reports that smelt are taken in the wider Thames off Blythe Sands through fisheries which are not currently authorised by the Environment Agency or managed by the IFCA (Colclough 2013).

4.3 Summary of 2016 stakeholder engagement for smelt in the Blackwater, Crouch, Roach and Colne MCZ

The Kent and Essex IFCA (K&EIFCA) have expressed concern regarding the suitability of designating this feature on the basis of them having no knowledge of spawning or nursery grounds having ever been present within any of the estuaries. Further, they have explained that they are only aware of very small quantities of smelt being present in the site, which has led them to question the importance of the site in terms of its support of a wider population.

5 Medway Estuary MCZ

The Medway Estuary MCZ was designated during Tranche 1; smelt are being considered for addition as a new feature during Tranche 3 based on evidence that there is a large population present within the Medway estuary.

Current evidence is that smelt spawn just upstream of the existing MCZ site boundary at Borstal, Wouldham and downstream of Allington Lock which represents the tidal limit of the Medway. Therefore Natural England is advising an upstream boundary amendment for smelt, in order to incorporate these potential spawning locations within the site boundary (see the boundary map in **Annex 1 – Advice on Regional Project recommended MCZs**). Natural England's pre-consultation advice is based upon this proposed boundary amendment which now extends the MCZ to the tidal limit at Allington Lock.

5.1 Brief rationale for the advised Recover GMA for smelt in the Medway Estuary MCZ

Allington Lock may be limiting smelt migration and therefore a Recover GMA has been advised. However, there are a number of adequate spawning substrates downstream (Lyons, Environment Agency 2016, pers. comm.) In addition, the river upstream of Allington is canalised for navigation with potentially limited spawning habitat. Anecdotally, the odd smelt has been caught by anglers upstream of Allington Lock (Lyons, Environment Agency 2016, pers. comm.). Further work may be required to establish to what extent Allington Lock may be hindering the reproductive capacity of the population and if this could be improved and whether upstream habitat is still suitable for spawning. Smelt within the Medway may also be exposed to a range of other pressures including entrainment in power station intakes, dredging, water quality and other development activities.

5.2 Assessment against highly mobile species MCZ selection criteria

5.2.1 Ecological significance of the Medway Estuary MCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Environment Agency survey data indicating species presence and persistent use of the estuary over and number of years between 1998 and 2015 with historical references dating back to 1879. Records of juvenile smelt (as small as 21 millimetres) provide evidence of local recruitment (1998, 2000-2001, 2006 and 2010-2015) supporting the presence of a local spawning population and the ecological significance of the estuary for smelt.

Smelt have been recorded in the Medway Estuary MCZ in Environment Agency surveys since 1998 with over 792 records spanning 1998-2006, 2008-2014 and 2015. There are historical references to smelt dating back to 1879 (Maitland 2003). Although spawning sites have not been formally identified within the river, length frequency data and the presence of juvenile smelt shows evidence of local recruitment within the Medway (in 1998, 2000-2001, 2006 and 2010 -2015). This good quality empirical evidence supports the presence of a local spawning population. This includes juveniles as small as 21 millimetres which is considered consistent with fish which would have been recruited from local spawning events. Areas of suitable spawning substrate and salinity occur in the Medway at Borstal, Wouldham and downstream of Allington Lock (Lyons 2016; Colclough 2013). Allington Lock could be limiting smelt migration and reproductive capacity, although the extent of any effect is currently unknown.

5.2.2 Persistence of smelt in the Medway Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Historical reference of smelt populations dating back to 1879 and good empirical evidence from Environment Agency surveys showing the persistent presence of smelt from 1998 to 2015. Smelt recolonisation of the Medway is known to have occurred in the late 1980s following declines due to poor water quality in the 1950s.

There is good quality empirical evidence from Environment Agency survey data for the estuary which show the presence and persistent use of the estuary by smelt over a number of years (1998-2006, 2008-2014, 2015) with between 3-234 individuals recorded per year resulting in a total of 729 smelt records for the estuary from the Environment Agency database. There are historical references to smelt dating back to 1879 (Maitland 2003). It is also known that the Medway has supported a commercial smelt fishery since the 19th century, until the significant decline of smelt due to water quality in the 1950s (Maitland 2003). The significant declines in smelt numbers in the Medway at the end of 1950s occurred at the same time as declines in water quality and the smelt population within the Thames (Wheeler 1979, Thomas 1998, as cited in Power and Attrill 2007; Maitland, 2003), however, recolonization is known to have occurred after water quality recovery in the late 1980s (Colclough 2013).

5.2.3 MPA size and delineation of the Medway Estuary MCZ

Score	Summary of supporting evidence in relation to scoring criteria
Moderate	The three potential spawning areas for smelt including Borstal, Wouldham and below Allington Lock are included within the revised site boundary. All of the habitats required to support the current population would be included within the site. However, the extent to which Allington Lock is a barrier and currently limiting smelt migration and reproductive capacity may require further investigation.

There is evidence of local recruitment in the Medway at Borstal and Wouldham. Suitable spawning substrate and salinity also occurs just downstream of Allington Lock. These three potential spawning areas lie upstream of the current site boundary, and have therefore been incorporated into the site through the boundary amendment.

High numbers of recently hatched smelt larvae have been recorded within the MCZ, indicating the site is also important and suitable for larval development and nursery lifecycle stages.

The downstream boundary of the MCZ extends to the mouth of the estuary which is considered to be appropriate.

5.2.4 Appropriateness of Management in the Medway Estuary MCZ

Score: High

The extent to which Allington Lock is a barrier currently limiting smelt migration and reproductive capacity may require further investigation. Although fish passes have been installed at this site, their effectiveness for smelt remains untested. Furthermore, it should be established if suitable habitat is available for smelt upstream. Of particular importance for management would be any spawning grounds, which are now within the amended boundary.

Consideration should be given to the management of activities which may cause disturbance to smelt (e.g. piling, in-channel dredging, flood defence work, development encroachment) especially during the time of

the spawning migration. Maintenance dredging, whilst already highly regulated, is probably one of the main activities requiring further consideration (albeit against a background of existing high suspended sediment loads); further seasonal restrictions may be required. Activities such as piling do occur but are relatively small scale compared to those occurring in the Thames. The entrainment of smelt has been recorded at Grain power station at the mouth of the Medway. A range of options may be considered to limit entrainment of fish into intake structures. The Environment Agency's consideration of other mobile species (e.g. European eels) in relation to these development activities may in some instances already provide a degree of mitigation for smelt.

Smelt are sensitive to water quality and this has been an issue in the past in the Medway and the Thames, which may have impacted smelt populations. For example, an incident in May 2007 in the Thames may have eradicated the entire 0+ year class in the estuary (Colclough 2013).

There is also the potential threat of encroachment on habitats by development. Narrowing of the river channel has the potential to affect the velocity of water and therefore the movement of fish (Colclough *et al.* 2002). The upper part of the MCZ is already quite narrow and constrained by hard defences and development. Although there is no direct evidence to suggest this is a particular barrier to smelt migration in the site, it is recommended that new development follow best practice guidelines and resist encroaching further into the estuary where possible in order to ensure that important intertidal areas are maintained and protected.

Commercial smelt fisheries are not known to occur within the Medway MCZ. There may be some risk of bycatch in other fisheries, although the recent 'no take zone' in the north part of the middle estuary may offer some benefit to smelt.

It should be noted that in the estuary there are other conservation designations (SPA, Ramsar, SSSI) which sometimes require winter restrictions for activities. If required, additional seasonal restrictions for smelt could potentially lead to developers having quite constrained time frames in which to undertake their works. The spawning grounds themselves are not protected by these other designations.

5.3 Summary of 2016 stakeholder engagement for smelt in Medway Estuary MCZ

Dialogue with the Environment Agency has revealed that whilst smelt fisheries require a licence, there are currently none in the Medway. The potential issues and management needs have been briefly discussed and no major concerns have been raised. Such discussions may however also be worthwhile with national Environment Agency staff in response to smelt MCZ proposals.

The Kent and Essex IFCA (K&EIFCA) have questioned if a spatial conservation measure such as an MCZ is the best way of protecting the species; their concerns are that the aims of the designation need to be clear, including the status of protection of supporting habitats. K&EIFCA have also asked why the site does not encompass all of the potential spawning grounds; the proposed boundary amendment should therefore address the IFCA's query/concern.

6 Ribble Estuary rMCZ

The Ribble Estuary rMCZ was recommended during the Irish Sea Conservation Zones Estuaries Workshop (April 2011), where participants noted that there is a small self-recruiting population in the Ribble and historically there was a substantial smelt fishery. It was of the opinion of the group that despite there being only a small population in the Ribble this did not undermine the potential for recovery.

The spawning grounds used by the smelt population in the Ribble have not been formally identified but are likely to be at the upper tidal limit. This 'true' tidal limit is probably located outside of the originally proposed site boundary as whilst the boundary was based on the "designated tidal limit" it is acknowledged locally that the tidal influence (especially on high tides) reaches further upriver to the weir at Samlesbury (approximately 4.5 kilometres upstream of the original boundary). Therefore, Natural England is advising an upstream amendment to the original boundary in order to incorporate the potential spawning locations into the site (see the boundary map in **Annex 1 – Advice on Regional Project recommended MCZs**). Natural England's pre-consultation advice is based upon this proposed boundary amendment.

6.1 Brief rationale for the advised Recover GMA for smelt in the Ribble Estuary rMCZ

Barriers are present in close proximity to the original and proposed site boundary (at the tidal limit) that are considered likely to be restricting access to historical spawning grounds, and therefore reducing potential reproductive capacity. The Environment Agency and Ribble Rivers Trust also consider that the weir at Samlesbury is likely to be a barrier to fish migration, particularly during low flow conditions. A Recover GMA has therefore been advised. Smelt within the Ribble Estuary may also be exposed to a range of other pressures to which they are sensitive and which could be impacting on the population, in particular water quality.

6.2 Assessment against highly mobile species MCZ selection criteria

6.2.1 Ecological significance of the Ribble Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Environment Agency survey data indicating species presence and persistent use of the estuary over and number of years between 2004 and 2015 with historical references dating back to 1977. Records of juvenile smelt (as small as 28 millimetres) provide evidence of local recruitment (2004-2005, 2011-2012 and 2014) supporting the presence of a local spawning population and the ecological significance of the estuary for smelt.

Smelt have been recorded in the Ribble Estuary rMCZ in Environment Agency surveys since 2004 with historical reference to populations dating back to 1977 (Maitland 2003). There are 28 smelt records between 2004 and 2015 for the Ribble Estuary. Data from the Ribble in the Environment Agency NFPD includes juveniles as small as 28 millimetres which, given the survey timing, is considered consistent with fish which would have been recruited from local spawning events within the estuary. This length data suggests local recruitment may have occurred in 2004-2005, 2011-2012 and 2014. The spawning grounds used by the population have not been formally identified but are likely to be at the upper tidal limit, which has been incorporated into the site through the proposed boundary amendment. Further work is required to identify the actual location of the spawning grounds within the site.

6.2.2 Persistence of smelt in the Ribble Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Historical reference of smelt populations dating back to 1977 including a number of historical records between 1977 and 1993 and empirical evidence from Environment Agency surveys showing the persistent presence of smelt from 2004 to 2015.

There is good quality evidence from Environment Agency survey data which shows the presence and persistence of smelt over a number of years, albeit in low numbers; between 1–8 smelt records per year covering 2004, 2005, 2007-2012, 2014 and 2015, resulting in a total of 28 records. Maitland (2003) cites fisheries for smelt in the Ribble "within living memory". Further, there are a number of historical records (between 1977 and 1993) indicating the long-term presence of smelt in the estuary, as well as an all-year round presence (Sewell 1983; Conlan *et al.* 1988; Potts and Swaby 1993; Maitland 2003).

6.2.3 MPA size and delineation of the Ribble Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
Moderate	It is likely that current spawning locations are included within the amended site boundary as this now extends to the top of the tidal limit below the weir at Samlesbury. However, it is also likely that access to historical spawning sites may currently be restricted by the presence of the gauging weir.

The smelt spawning locations in the Ribble have yet to be identified and it is not known whether these occur within the rMCZ boundary, as originally proposed or as amended by Natural England (boundary now extends to the top of the tidal limit below the weir at Samlesbury). The Environment Agency gauging weir at Samlesbury, as well as tidal flaps and locks on the tributaries entering into the Ribble, are reported to have an impact on fish migration, preventing fish such as smelt migrating into freshwater habitats to spawn. Thus the site boundary, even as amended, could exclude key historical spawning habitat, although current spawning is likely to occur within the boundary (i.e. at the 'true' upper tidal limit); further work is required to establish the extent of this. Despite this uncertainty, it is likely that the parts of the estuary within the rMCZ boundary are also important and suitable for larval development, nursery functions and as feeding habitat.

The downstream boundary of the rMCZ extends to the mouth of the estuary thereby ensuring the whole of the tidal estuary is included within the site boundary.

6.2.4 Appropriateness of Management in the Ribble Estuary rMCZ

Score: Moderate

The estuary catchment was classified by the Environment Agency as having poor ecological status and good chemical status in 2015. The reasons for the site not achieving good ecological status are diffuse pollution from industry and road run-off, sewage discharge and physical modifications. The Environment Agency and Ribble Rivers Trust are currently working with relevant parties to address water quality issues so it is likely these will improve.

If weirs/tide flaps are found to represent significant barriers further consideration may need to be given to increasing fish passage.

Consideration should be given to the management of activities which may cause disturbance to smelt (e.g. piling, in-channel dredging, flood defence work), during the time of the spawning migration.

At present there are no known targeted commercial fisheries for smelt within the site which are licenced by the Environment Agency.

6.3 Summary of 2016 stakeholder engagement for smelt in the Ribble Estuary rMCZ

Discussions have been held with the Environment Agency, North West Inshore Fisheries & Conservation Authority (NWIFCA), Ribble Rivers Trust and a group of local fishermen from Lytham St Anne's. No major concerns have been raised.

7 Solway Firth rMCZ

The Solway Firth rMCZ was recommended as result of discussions held during the Irish Sea Conservation Zones Estuaries Workshop (April 2011) which concluded there was sufficient evidence to support the importance of the Solway with respect to smelt and general fish nursery functions.

For a map of the Solway Firth rMCZ site boundary, please refer to **Annex 1 – Advice on Regional Project recommended MCZs**.

7.1 Brief rationale for the advised Recover GMA for smelt in the Solway Firth rMCZ

The smelt population within the Solway and in particular the River Eden are historically thought to have been significantly higher. Maitland (2003) also suggests that the population that historically ran the River Eden may be largely extinct. While records of smelt, including some evidence of local recruitment, have been detected within the rMCZ, given the number of rivers flowing into the Solway including the River Esk just to the north, it is hard to distinguish if a breeding population is still present within the River Eden. As a result, a Recover GMA is proposed. Current evidence on the location of barriers versus likely spawning location has been used in combination with expert judgement to conclude the barriers are unlikely to be significantly hindering smelt spawning at present.

7.2 Assessment against highly mobile species rMCZ selection criteria

7.2.1 Ecological significance of the Solway Firth rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
Low	Smelt, of wide length range, have been recorded at all three of the Environment Agency sample stations from 2008, 2009, 2012-2013 and 2015. Whilst only three of these records occurred in the rMCZ boundary (at Bowness), 36 of the records occurred at the Silloth sample station 0.5 kilometres west of the rMCZ boundary. The presence of a juvenile record (65 millimetres) in 2009 suggests recruitment occurred locally in that year although at present given the survey locations it is hard to say from which river these may have originated. While at present abundance of smelt in the Solway appears be relatively low based on recent records, historically the area supported much larger populations with historical reference to the Solway smelt population being fished to the verge of extinction (e.g. Maxwell 1897 as cited in Maitland 2003). The Solway therefore has a good potential to carry a larger population based on historical data and references. Expert opinion from the Environment Agency (Parker, Environment Agency 2015, pers. comm.) suggests there are likely to be many more historical records of smelt catches from Burgh Marsh and Bowness (in the rMCZ) towards the mouth of the Eden.

The MCZ regional stakeholder group identified smelt within the Solway Firth because of its historical importance to the species and the potential benefits that management of the site could offer to a species which is in sharp decline nationally.

It is important to note that the low score is based on the currently available data, which is described further below. The sources of these data are the current Environment Agency sample stations, which are all located in more open coastal or outer estuary locations, rather than within the three rivers (or the fourth that is located just outside the rMCZ boundary) where higher smelt catches would be considered more likely due to the aggregation of smelt within the upper estuary/rivers (as is the case for the other rMCZs).

Smelt, of wide length range, have been recorded at all three of the Environment Agency sample stations since 2008, with 40 smelt records (ranging from 1-23 records per year) resulting from 2008, 2009, 2012-2013 and 2015. Whilst only three of these records occurred in the rMCZ boundary (at Bowness), 36 of the records occurred at the Silloth sample station 0.5 kilometres west of the rMCZ boundary. The presence of a juvenile fish (65 millimetres) in 2009 suggests recruitment occurred locally in that year although at present given the survey locations it is hard to say from which river these may have originated. Maitland (2003) documents that smelt numbers were likely to have been significantly higher in the past with reports of large smelt by-catch associated with the Salmon haaf net fishery between the 1960s and 1980s. Expert opinion from the Environment Agency (Parker, Environment Agency 2015, pers. comm.) suggests there are likely to be many more historical records of smelt catches from Burgh Marsh and Bowness (in the rMCZ) towards the mouth of the Eden.

The only remaining recorded smelt spawning area on the Solway is in the River Cree on the Scottish side of the Firth, although anecdotal evidence from River Nith Catchment Fishery Trust indicates that smelt are also present in the River Nith. Maitland (2003) suggests the significant population that ran the Eden River is likely to be largely extinct. However, expert opinion from the Environment Agency (Parker, Environment Agency 2015, pers. comm.) suggests that both regular and recent records of smelt in the Silloth and Bowness surveys mean it would be reasonable to assume that local spawning populations must still be present in the wider area.

7.2.2 Persistence of smelt in the Solway Firth rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
Moderate	There are records of smelt in the Environment Agency database which support the persistent presence of smelt in, or in close proximity to, the rMCZ boundary between 2008 and 2015. Only three of these records occurred in the rMCZ boundary (at Bowness) with the remaining records occurring at Silloth sampling station 0.5 kilometres west of the rMCZ boundary.

There are records of smelt in the Environment Agency database from 2008, 2009, 2012-2013 and 2015. Prior to this there are records of significant smelt populations in the Solway for over 100 hundred years. Maxwell (1897) discusses the smelt population being fished to the verge of extinction in the Solway Firth (Maxwell 1897 as cited in Maitland 2003). The salmon haaf net fishery on the Solway has occurred regularly for decades, regularly reporting smelt by-catch between the 1960s and 1980s indicating a persistent population which may have been moving into the Eden to spawn (Maitland 2003). Declines in the reports of smelt by-catch from the haaf fishery in recent years are likely to be reflective of the significant decline of that fishery (Parker, Environment Agency 2015, pers. comm.).

7.2.3 MPA size and delineation of the Solway Firth rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
Low	The smelt spawning locations in the Solway (Rivers Eden, Waver and Wampool) have yet to be identified and it is therefore not currently known whether these occur within the rMCZ boundary or above this (especially for the Eden).

The smelt spawning locations in the Solway (Rivers Eden, Waver and Wampool) have yet to be identified and it is therefore not currently known whether these occur within the rMCZ boundary or above this (especially for the Eden). The boundary currently covers only the southern side of the Solway and the channel of the River Esk, which is a large river on the English side of Solway, is not captured in the rMCZ.

7.2.4 Appropriateness of Management in the Solway Firth rMCZ

Score: Moderate

At present no targeted commercial fisheries for smelt occur within the Solway rMCZ, however there is historical reference to the Solway smelt population being fished to the verge of extinction (e.g. Maxwell 1897 as cited in Maitland 2003). There is likely to be a low potential for smelt to be caught as by-catch in other fisheries which take place in or near the rMCZ, specifically salmon and trout haaf net fishing, demersal shrimp trawling and staked nets on the shore as the information from the North West Inshore Fisheries & Conservation Authority (NWIFCA) and Environment Agency indicate the intensity of these fisheries is low (Environment Agency 2015; Knott, NWIFCA. 2016, pers. comm.) This may be in part due to the current low smelt numbers as historically these fisheries, especially the haaf fishery, regularly reported smelt by-catch in the 1960s and 1980s (see Maitland 2003). Shrimp fisheries elsewhere including in the Wash and in the Netherlands are also known to take smelt by-catch. There may therefore also be a by-catch risk associated with the Solway shrimp fishery, although further work is required to establish whether this is the case and if so, the scale of the problem.

Gravel extraction/river bed deepening and flood risk management activities occur regularly in a number of locations along the Eden. If smelt spawning habitats are identified in the future it is recommended that these activities are undertaken in a manner to ensure they do not have detrimental impacts on spawning habitats.

The Solway Firth catchment is classified as having a moderate ecological status (under WFD standards) and good chemical status. The reasons for the site not achieving good ecological status are diffuse pollution from agricultural and land management and the water industry. Further investigations could be carried out to establish if water quality could be improved.

Weirs on the Eden and tributaries may be associated with a restriction on smelt movement up river to suitable spawning sites. Weirs can be found approximately 8.5 kilometres and 14 kilometres up river from the rMCZ boundary and the tidal limit, however there is no evidence to suggest these are actively stopping smelt movement. However, this lack of evidence could be influenced by the overarching lack of smelt records in the Eden. The Eden is designated for lamprey and salmon as part of the SAC meaning the weirs may have been subject to some review with regard to fish passage for these species. It could be useful to assess if any fish passage requirements for these species would also be suitable for smelt.

There may be a need to consider the management of other future activities which could cause disturbance to smelt (e.g. piling, in-channel dredging, flood defence work), especially during the time of the spawning migration.

In summary, there is little evidence to suggest current activities could be limiting the site's potential to help conserve and restore the smelt population. There may be a requirement to review weir placement and fish passage on the Eden along with a more detailed assessment of future flood risk projects and river bed management to ensure smelt passage and spawning areas are maintained. Further improvement could be made regarding water quality and assessing the extent of any by-catch in Solway fisheries.

7.3 Summary of 2016 stakeholder engagement for smelt in the Solway Firth rMCZ

Discussions have been held with the Environment Agency, NWIFCA, Eden Rivers Trust, Galloway and Nith Fisheries Trusts and the West Coast Inshore Fisheries Group. No major concerns have been raised.

8 Upper Thames Estuary rMCZ

The Upper Thames Estuary rMCZ is under consideration for consultation in 2017 based on the known presence of smelt, including the protection of identified spawning grounds. To note: a second site located further downstream, Swanscombe rMCZ, is under consideration for the protection of broadscale habitats (intertidal sand & muddy sand, intertidal mixed sediments, intertidal mud, subtidal sand) as well as the species tentacled lagoon worm (*Alkmaria romijni*). These two sites have been derived from the original Thames Estuary rMCZ. For further details on the boundary amendments that led to the two sites, see Sections 23.4.2 and 25.4.2 of **Annex 1 – Advice on Regional Project recommended MCZs**.

For a map of the Upper Thames Estuary rMCZ site boundary, please refer to **Annex 1 – Advice on Regional Project recommended MCZs**.

8.1 Brief rationale for the advised Recover GMA for smelt in the Upper Thames Estuary rMCZ

Barriers are present in close proximity to the site boundary at the tidal limit which could be limiting upstream migration and therefore reproductive capability. A range of other ongoing pressures also occur within the Thames to which smelt may be sensitive and exposed and therefore a Recover GMA is advised. These pressures/activities include poor water quality, maintenance and capital dredging, water temperature, piling and construction noise, shoreside development encroachment and entrainment from abstraction activities.

8.2 Assessment against highly mobile species MCZ selection criteria

8.2.1 Ecological significance of the Upper Thames Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	There is a significant body of empirical evidence which supports the ecological significance of the Thames estuary for smelt with historical records going back many hundreds of years. There is Environment Agency survey data indicating species presence and persistent use of the estuary over a number of years since 1992. There is evidence of almost annual recruitment since 1992 to 2015 from Environment Agency length records data. Spawning is known to take place in the Wandsworth area, which lies within the rMCZ boundary. Zoological Society of London (ZSL) has recently undertaken survey work to confirm that smelt spawning occurs from Wandsworth Bridge and 600 metres upstream.

The Thames estuary contains a large population of smelt. Historically smelt have been fished in the Thames for many hundreds of years (Maitland 2003) and it once was one of the most valuable fisheries in the inner reaches of the estuary (Colclough 2013).

Spawning takes place in the Wandsworth area, which lies within the rMCZ boundary. Zoological Society of London (ZSL) has recently confirmed smelt spawning occurring from Wandsworth Bridge and 600 metres upstream of this. However, it cannot be ruled out that the spawning activity could also extend further west to Barnes Bridge (Benson and Baugh 2016). Environment Agency sampling since 1992 for the Thames (not necessarily within the rMCZ site boundary) shows 7,089 records with a further ~75,000 from power station intake sampling. Evidence exists of almost annual recruitment since 1992 to 2015 from Environment Agency length records data. Very early post-larvae (18 millimetres) have been found at Millwall and Greenwich (Geoghehan 1995, as cited in Colclough 2013) and 0+ cohort fish have been found as far upstream as Richmond by late June. Most of the juvenile fish descend to the lower estuary by the early autumn. Teddington Lock and Weir forms the tidal limit of the Thames 4.5 kilometres upstream of the rMCZ boundary. While smelt spawning grounds have been located within the rMCZ it is unclear to what extent

this weir may be limiting upstream migration and therefore reproductive capacity of the population.

8.2.2 Persistence of smelt in the Upper Thames Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Smelt records have been recorded nearly annually in the Thames, though not necessarily in the proposed boundary, by Environment Agency sampling since 1992 supporting the presence of a persistent population. The history of smelt within the Thames goes back hundreds of years. Declines occurred in the 1950s due to water quality but recolonization occurred in the 1970s and there has been evidence of persistent population recruitment since then.

Smelt records have been recorded nearly annually in the Thames, though not necessarily in the proposed boundary, by Environment Agency sampling since 1992. Historical records of commercial fisheries for smelt in the Thames date back to the 1800s. The Environment Agency database also has 1262 smelt records from within the Thames Estuary Upper rMCZ boundary which shows the presence and persistence of smelt over a number of years with between 1-439 smelt records per year (1993-1997, 2000-2003, 2005-2006, 2009-2011, 2013 and 2015). The history of smelt within the Thames goes back hundreds of years. Declines occurred in the 1950s due to water quality but recolonization occurred in the 1970s and there has been evidence of persistent population recruitment since then (Maitland 2003).

8.2.3 MPA size and delineation of the Upper Thames Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
Moderate	Smelt spawning grounds within the Thames identified by ZSL are captured within the Upper Thames Estuary rMCZ boundary. It is unclear to what extent the weir at Teddington Lock just 4.5 kilometres upstream of the rMCZ boundary may be limiting upstream migration and therefore reproductive capacity of the population. The majority of the estuary which is likely to be important for larval development and for providing important wider nursery and feeding functions lies downstream of the proposed site boundary.

Smelt spawning grounds within the Thames identified by Zoological Society of London (ZSL) have been captured within the Upper Thames Estuary rMCZ boundary. Teddington Lock and Weir forms the tidal limit of the Thames just 4.5 kilometres upstream of the rMCZ boundary. It is unclear to what extent this weir may be limiting upstream migration and therefore reproductive capacity of the population.

The majority of the estuary lies downstream of the proposed site boundary; this portion of the estuary is likely to be important for larval development and for providing important wider nursery and feeding functions (hence assessed as ‘moderate’).

8.2.4 Appropriateness of Management in the Upper Thames Estuary rMCZ

Score: High

Primary localised threats to smelt within the context of the Thames are likely to be poor water quality, including one-off pollution incidents, maintenance and capital dredging, water temperature, piling and construction noise, shoreside development encroachment and entrainment particularly at large scale abstraction sites such as power stations. A range of these activities are likely to occur within the Upper Thames Estuary rMCZ as well as downstream of the rMCZ and may therefore require consideration.

With reference to water quality incidents, an example from May 2007 that resulted in no observations of fish mortality at the time may have eradicated the entire 0+ smelt year class in the estuary, given where the young of year would have been at the time of the incident (Colclough 2013). The completion of the Tideway Tunnel is expected to improve and provide more stable water quality conditions which should have a positive effect on the smelt population (Colclough 2016, pers. comm.).

There is a potential for barriers to limit smelt migration. Richmond Lock and Weir occurs within the rMCZ site less than one kilometre downstream of the upper rMCZ boundary at Richmond Bridge. Richmond Lock and Weir is formed of three vertical sluice gates which ensure that the water levels between Richmond Lock and Teddington Lock are maintained at or above half-tide level. The gates are raised for around two hours either side of high tide to allow passage of river traffic, although this period of free navigation can be dramatically changed due to prevailing conditions. In drought conditions the gates will be closed for longer periods, whilst in periods of high fluvial flow they may remain open for much longer. Outside this period river traffic must use the lock alongside the barrage. Based on a preliminary assessment of data relating to the lock's operation provided by the Port of London Authority (PLA), our conclusion is that Richmond Lock is unlikely to be a significant barrier to smelt in the Thames, although a more detailed assessment may be required as our understanding of smelt behaviour in the Thames improves. Teddington Lock and Weir 4.5 kilometres upstream of the rMCZ boundary forms the artificial tidal limit of the Thames. Teddington Weir is likely to limit upstream smelt migration, although the impact of this structure on fish migration or the extent to which it may be hindering the reproductive capacity of the population is currently unknown. Furthermore it needs to be established whether suitable habitat for smelt is available upstream.

Maintenance and capital dredging is probably one of the main threats to smelt in the Thames as it can affect water quality or smother or directly remove supporting habitats including spawning gravels. Dredging is already highly regulated and it may be possible to manage this activity with seasonal restrictions, avoiding the times of the year that smelt are sensitive to such activity. Such issues could be considered by the Thames Dredging Liaison Group. Management of noise from construction activities may also need to be considered further e.g. through the use of timing restrictions in some circumstances. For some developments in the Thames it is known that the Environment Agency already suggest such conditions for fish. To what extent these specified conditions, or other existing regulations relating to dredging activities in the Thames, are appropriate for smelt would need consideration.

Water temperature is also known to impact smelt and in the Thames mean annual abundances are negatively correlated with mean annual estuarine water temperatures (Attrill and Power 2004). Thermal discharges from shoreside industry may therefore require further consideration.

Narrowing of the river channel from encroachment has the potential to affect the velocity of water and therefore affect the movement of fish (Colclough *et al.* 2002). The middle Thames in particular has a lot of shoreside development and hard coastal defences and is already relatively narrow. Consideration of the sympathetic design of future foreshore developments may help reduce encroachment impacts.

Entrainment of fish may occur, particularly at large scale abstraction sites such as power stations. There are some out of use power stations on the Thames, which if were put back into operation with the existing infrastructure would have entrainment issues. However, screening to protect fish is already required under existing legislation for new build power stations. Management options for entrainment for large scale abstraction from existing historical sites may need to be investigated if these are found to be causing significant levels of mortality.

At present no known targeted commercial fisheries for smelt occur within the Thames. There is a low potential for smelt to be caught as by-catch in other fisheries which predominantly occur in the lower and outer estuary, however there is currently no known evidence to suggest this is a significant threat to smelt in the Thames.

8.3 Potential management needs for smelt in the Upper Thames Estuary rMCZ

In addition to the information provided under 'Appropriateness of management', it should be noted that in the lower Thames estuary there are other conservation designations (SPA, Ramsar, SSSI) which sometimes require winter restrictions for activities. When seasonal fish restrictions have been suggested as well, developers have found themselves with limited windows of opportunity in which to undertake their works. In these circumstances it appears that it is the fish restrictions that are negotiated and compromised on. It is understood, however, that seasonal fish restrictions are initially quite broad and that shorter site-specific restrictions could be put forward if we improve our understanding of where and when smelt use the estuary.

8.4 Summary of 2016 stakeholder engagement for smelt in the Upper Thames Estuary rMCZ

The Port of London Authority (PLA) has raised concerns around seasonal restrictions that could leave developers with limited windows of opportunity in which to undertake works. The PLA advised that in the upper stretches of the Thames, within the boundary of the Upper Thames Estuary rMCZ and within/adjacent to spawning grounds, there are many small scale river users and operators who will not have the expertise to navigate the additional regulatory burden associated with smelt protection (e.g. houseboats, recreational boating clubs, boatyards, mini moorings). These users may need to carry out activities such as small scale dredging or piling. Also within these upper stretches there may need to be dredging activity as part of the Thames Tideway Tunnel project.

The PLA also highlighted that there might be future works at Richmond Lock and Weir (e.g. abstraction from local water company), that could potentially affect hydrodynamics in a localised area and questioned if/what works could impact smelt protected by the rMCZ. Natural England's response to this has been that further investigation will likely be required as this area is further upstream than known spawning grounds and it is not known if any of the smelt lifecycle occurs here, although there are some indications that it could/does.

Discussions with local Environment Agency staff have indicated that whilst smelt fisheries require a licence, there are currently none in the Thames. The potential issues and management needs have been briefly discussed and no major concerns were raised. Such discussions may however also be worthwhile with national Environment Agency staff in response to smelt MCZ proposals.

The Kent and Essex IFCA have questioned if a spatial conservation measure such as an MCZ is the best way of protecting the species; their concerns are that the aims of the designation need to be clear, including the status of protection of supporting habitats, which may occur outside of the site boundary.

9 The Swale Estuary MCZ

The Swale Estuary MCZ was designated during Tranche 2. It is now recommended that smelt is added as an additional feature due to the known presence in the site. The Swale Estuary is not a true estuary as it has no major freshwater inflows so it is essentially an extension of the Medway Estuary. It is therefore recommended that if the Swale is designated for smelt this is done in conjunction with the designation of smelt in the Medway Estuary as the smelt populations are likely to be linked and part of the same population.

For a map of The Swale Estuary MCZ site boundary, please refer to **Annex 1 – Advice on Regional Project recommended MCZs**.

9.1 Brief rationale for the advised Recover GMA for smelt in The Swale Estuary rMCZ

The smelt population of The Swale is considered to be linked to that of The Medway, which is reflected in the Recover GMA. This is because smelt in the Medway Estuary may be exposed to a range of pressures to which they are sensitive and which could be affecting smelt. These include: maintenance dredging, entrainment in power station intakes, water quality, shoreside development/encroachment and potentially barriers to migration.

9.2 Assessment against highly mobile species MCZ selection criteria

9.2.1 Ecological significance of The Swale Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
Low-Moderate	Reproduction is considered unlikely to occur in the Swale itself due to limited suitable spawning habitat (lack of freshwater input and low salinity areas) and the scoring for this principle is therefore considered to be low. The continued presence of smelt in the Swale despite lack of suitable spawning habitat may indicate the Swale is an important area for these wider populations. Thus considering the Swale and the Medway (which it directly abuts) together the scoring against this principle for this site is considered to be Moderate.

Reproduction is considered unlikely to occur in the Swale itself due to limited suitable spawning habitat (lack of freshwater input and low salinity areas) (Colclough 2014). It is therefore thought that smelt use the Swale as an extension of the Medway, transiting through the estuary in order to reach spawning grounds in the Medway. Further, the smelt population in the Swale is thought to be part of a wider Greater Thames Estuary population located in the estuarine and coastal areas of the Medway, Thames and Lee (Maitland 2003).

The continued presence of smelt in the rMCZ despite lack of suitable spawning habitat may indicate the Swale is an important area for these wider populations. Thus considering the Swale and the Medway (which it directly abuts) together the scoring against this principle for this site is considered to be Moderate. However, if the Swale was considered in its own right scoring against this principle is considered to be low.

9.2.2 Persistence of smelt in The Swale Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Smelt have been commonly recorded in Cefas surveys in the Swale (including Faversham Creek) since 1987, with historical reports of commercial fisheries since the 19th century (Maitland 2003). The Environment Agency database contains records supporting the persistent presence of smelt (1999, 2001-2006, 2008 and 2009).

Smelt have been commonly recorded in Cefas surveys in the Swale (including Faversham Creek) since 1987; with historical reports of commercial fisheries since the 19th century (Maitland 2003). The Environment Agency database contains 266 records for the Swale which fall within the rMCZ site boundary, with between 1-63 smelt records per year (1999, 2001-2006, 2008 and 2009). While there is insufficient evidence to suggest the presence of a self-sustaining population within the Swale, their continued presence and absence of suitable spawning conditions indicates that the estuary is linked to a larger population within the wider area; most likely the Medway given its proximity and/or the Thames.

The strength of evidence relating to the persistence and significance of smelt populations in the Medway MCZ and Upper Thames Estuary rMCZ is described in sections 5 and 8 of this chapter.

9.2.3 MPA size and delineation of The Swale Estuary rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
Low-Moderate	The Swale is not thought to protect any known spawning populations of smelt, although records show the persistent presence of smelt in the Swale indicating it may support wider Thames populations e.g. that of the Medway Estuary. Designation of the Swale as an MCZ to protect smelt should be considered in conjunction with protection of the Medway population.

The Swale is not thought to protect any known spawning populations of smelt, although records show the persistent presence of smelt in the Swale indicating it may support wider Thames populations e.g. that of the Medway Estuary. Designation of the Swale as an MCZ to protect smelt should be considered in conjunction with protection of the Medway population.

As such, the Swale is assessed jointly with the Medway resulting in a score of Moderate for this principle. If considered separately in would be assessed as Low.

9.2.4 Appropriateness of Management in The Swale Estuary rMCZ

Score: Low-Moderate

It should be noted that as the Swale smelt population is thought to be linked to that of wider populations in particular the Medway Estuary; pressures/threats exerted there are therefore likely to be of relevance to The Swale rMCZ. Further information can be found within the relevant sections of this advice document for those sites.

Maintenance dredging is probably one of the main activities to consider in the Swale itself. This can affect water quality and smother habitats, although it should be noted that the estuary is a dynamic environment with background levels of suspended sediments. Dredging impacts would be most problematic in the narrow constrained parts of the estuary where smelt may be passing through. Piling and construction noise can cause disturbance. Activities such as piling do occur within the estuary, although they are considered

to be of small scale.

There is also the potential threat of encroachment on habitats by development. Narrowing of the river channel has the potential to affect the velocity of water and therefore affect the movement of fish (Colclough *et al.* 2002). There are already some narrow areas constrained by development and hard coastal defences. Development and activity levels in the Swale are generally quite low however, and threats from these activities to the smelt population are likely to be more significant in the Medway.

There is currently no known exploitation of smelt by commercial fisheries in the Swale. There is always the threat of by-catch from other fisheries; however this is considered low risk within the Swale Estuary itself.

Dredging is already highly regulated and it may be possible to manage this activity with seasonal restrictions, avoiding the times of the year that smelt are sensitive. Noise from construction activities could also be managed with timing restrictions. The Environment Agency is known to specify license conditions for other fish species, which could also provide some mitigation for smelt. If spawning grounds were found within the Swale itself, these would be of particular importance for management.

9.3 Potential management needs for smelt in The Swale Estuary rMCZ

It should be noted that in the estuary there are other conservation designations (SPA, Ramsar, SSSI) which sometimes require winter restrictions for activities. This could mean that for some works additional seasonal restrictions for smelt could potentially lead to developers having quite constrained time frames in which to undertake their works.

9.4 Summary of 2016 stakeholder engagement for smelt in The Swale Estuary rMCZ

Discussions with local Environment Agency staff have indicated that whilst smelt fisheries require a licence, there are currently none in the Swale Estuary. The potential issues and management needs have been briefly discussed and no major concerns were raised. Such discussions may however also be worthwhile with national Environment Agency staff in response to smelt MCZ proposals.

The Kent and Essex IFCA have questioned if a spatial conservation measure such as an MCZ is the best way of protecting the species; their concerns are that the aims of the designation need to be clear, including the status of protection of supporting habitats**.**

10 Wyre-Lune rMCZ

The Wyre-Lune rMCZ was recommended based on discussions during the Irish Sea Conservation Zones Estuaries Workshop (April 2011) where participants recommended the site based on there being sufficient evidence to support the importance of the Wyre with respect to smelt and general marine nursery functions. The Lune would add additional connectivity within the system.

The spawning grounds used by the smelt population in the Wyre-Lune have not been formally identified but are likely to be at the upper tidal limit. This 'true' tidal limit is probably located outside of the originally proposed site boundary as whilst the boundary was based on the "designated tidal limit" it is acknowledged locally that the tidal influence (especially on high tides) reaches further upriver than was originally recommended by the Regional Project. Therefore, Natural England is advising an upstream amendment to the original boundary in order to incorporate the potential spawning locations into the site. Natural England's pre-consultation advice is based upon this proposed boundary amendment.

For a map of the Wyre-Lune rMCZ site boundary, please refer to **Annex 1 – Advice on Regional Project recommended MCZs**.

10.1 Brief rationale for the advised Recover GMA for smelt in The Wyre Lune rMCZ

The previous 'Maintain' Conservation Objective was 'reasonably uncertain'. A 'Recover' GMA has now been proposed due to the presence of weirs in close proximity to the original and proposed site boundary at the tidal limit in both the Lune and Wyre Estuaries, which are considered to hinder smelt migration into freshwater habitats to spawn and may therefore be hindering the reproductive capacity of the population. Smelt within the Wyre-Lune Estuary may also be exposed to a range of other pressures to which they are sensitive which could be impacting on the population, in particular entrainment in power station intakes, water quality and potentially fisheries by-catch.

10.2 Assessment against highly mobile species MCZ selection criteria

10.2.1 Ecological significance of the Wyre-Lune rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Smelt have been recorded in the Wyre-Lune rMCZ in Environment Agency surveys since 2004 with historical reference to populations dating back to 1981. Records of juvenile smelt (as small as 33 millimetres) indicate local recruitment (2005 and 2006) supporting the presence of a local spawning population and the ecological significance of the estuary for smelt.

Smelt have been recorded in the Wyre-Lune rMCZ in Environment Agency surveys since 2004 with historical reference to populations dating back to 1981 in the Wyre (National Anglers' Council; in Maitland 2003) and 1963 in the Lune (K. Denham; in Maitland 2003). The Environment Agency database has 21 smelt records of fish of various lengths from between 2004 and 2014 for the Wyre-Lune. The size range captured suggests localised spawning and recruitment may have occurred within the River Wyre in 2005 and 2006 with records of juvenile smelt as small as 33 millimetres recorded. While smelt spawning sites have not been formally documented, anecdotal records from the Environment Agency indicate that 20 years ago smelt spawned in large numbers below the weir at St Michaels on Wyre, which marks the tidal limit (Dent, Environment Agency 2015, pers. comm.).

10.2.2 Persistence of smelt in the Wyre-Lune rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
High	Environment Agency surveys showing the persistent presence of smelt between 2004 and 2014.

The Environment Agency database has 21 smelt records for the Wyre-Lune showing presence and persistence albeit in in low numbers with between 1-11 records per year covering 2004-2006 and 2014. Maitland (2003) cites fisheries for smelt in the Lune "within living memory". Smelt were recorded in the Lune Estuary between 1963 and 1966 (K. Denham; in Maitland 2003) and there were reports of smelt being taken a short distance downstream of Lancaster in the early 1970s (D. Cragg-Hine; in Maitland 2003). Discussions with commercial fishermen who fish Morecombe Bay and the Lune Estuary indicate that 40 years ago small smelt were regularly caught within the Lune Estuary. Bigger smelt were taken from Morecombe Bay although none have been seen for 3-4 years (Dent, Environment Agency 2015, pers. comm.).

10.2.3 MPA size and delineation of the Wyre-Lune rMCZ

Score	Summary of supporting evidence in relation to scoring criteria
Moderate	It is likely that current spawning locations are included within the amended site boundary as this now extends to the top of the tidal limit below the weir at Michael's on Wyre. Anecdotal records suggest smelt used to spawn here in large numbers. However, it is also likely that access to historical spawning sites may currently be restricted by the presence of weirs on both the Wyre and Lune Estuaries.

The smelt spawning locations in the Wyre and Lune have yet to be fully defined however anecdotal records suggest smelt used to spawn in large numbers below the weir at St Michael's on Wyre which is within the amended site boundary (Dent, Environment Agency 2015, pers comm.). The weir at St Michaels on Wyre is known to be a partial barrier to the upstream migration of salmonids, so it is likely to also be a full or partial barrier for smelt. Thus the site boundary, even as amended, could still exclude key historical spawning habitat.

The downstream boundary of the rMCZ extends to the mouth of the estuary thereby ensuring the whole of the tidal estuary is included within the site boundary.

10.2.4 Appropriateness of Management in the Wyre-Lune rMCZ

Score: High

The following localised threats to smelt within the Wyre-Lune are considered to be present. Firstly, entrainment on intake screens of nuclear power stations (Heysham 1 and 2), which occur on the edge of the rMCZ boundary is known to occur. A range of options may be considered to limit entrainment of fish into intake structures. Water quality is also a threat, with the Wyre catchment having been classified by the Environment Agency as having moderate ecological status and a failing chemical status and the Lune catchment classified as having bad ecological status and good chemical status in 2015. The reasons for not achieving good status included diffuse pollution from industry, sewage discharge and physical modifications. The Wyre Waters Catchment Partnership is currently working to improve the ecological status of the entire catchment through habitat improvement works.

Barriers to migration (weirs at Skerton, Lancaster on the Lune and at St Michaels on Wyre) are reported to

impact on fish migration, preventing fish such as smelt from migrating into freshwater habitats to spawn. If these are found to represent significant barriers further consideration may need to be given to removing these barriers or increasing fish passage.

Potential threats may also exist from the proposal for a tidal hydro-energy plant across the Wyre Estuary between Fleetwood and Knott End; however no formal project proposals have been submitted.

At present no known commercial fisheries for smelt occur within the site. There is potential for smelt to be caught as by-catch in other fisheries which take place in or near the rMCZ, specifically salmon and trout haaf net fishing and drift netting and the sprat fishery, although there is little evidence from discussions with the Environment Agency and North Western IFCA to suggest this is currently a significant issue or concern.

10.3 Summary of 2016 stakeholder engagement for smelt in the Wyre-Lune rMCZ

Discussions have been held with the Environment Agency, North Western IFCA, Wyre Rivers Trust, Lune Rivers Trust and a commercial fisher from the Lune Estuary. Concerns were raised about the potential impact of the designation on the set net fishery for sprat in the Lune; however, there is little evidence to suggest this is a significant issue at present.

11 Evidence scoring criteria

Criteria for principles 1–3 which have been applied to the evidence for smelt in each site and which have formed the basis for the assessments in this document that relate to the presence and extent of the mobile species features (from Table 5 of JNCC and Natural England 2016a).

	Assessment
Principle 1: Ecological significance	
Significant body of reliable, empirically-based evidence supporting the conclusion that the area has clear ecological significance to the life-histories of the species for designation as a feature of an MCZ based on at least one high quality source of data, ideally derived from more than one independent source of information.	High
There is a convincing case that for each feature, the proposed MCZ makes a significant contribution to the life cycle of the species due to its role in providing supporting habitats or processes and it makes a contribution to the representivity, replication and / or connectivity of sites within the MPA network, and to the adequacy of the network as a whole.	
There is evidence that the area is of ecological significance to the life-histories of the species as a feature of an MCZ based on one or more data sources, the reliability of which may be open to question due to e.g. lack of corroborative information, lack of confidence in the analysis, and in some cases the age of the underlying data.	Moderate
There is a less compelling case that the proposed site makes a significant contribution to supporting the life cycle of each feature and contributes to the MPA network is less compelling.	
There is evidence that the area has ecological significance to the life-histories of the species is based only on data sources of unknown quality or low reliability or of greater age (with no recent data), or is predominantly based on expert judgement/inference without independent corroboration.	Low
The case that proposed site makes a significant contribution to the life history of each feature, or enhances the MPA network as a whole is not compelling. For example, the proposed conservation benefit is already fulfilled by existing sites in the MPA network, or by wider conservation measures.	
No suitable evidence is provided that the area has ecological significance to the life-histories of the species or the evidence is insufficient to allow such a conclusion to be reached. The case supporting each feature is not made at all or is insufficient.	Not met
Principle 2: Persistence	
There is a significant body of reliable, empirically-based evidence (and/or where appropriate modelled) to support the conclusion that the area is likely to have persistent presence at higher densities of the species proposed as a protected feature of an MCZ than the surrounding waters; the justification should show the data within the proposed MCZ in its wider context. Such evidence is based on at least one high quality source of data, but ideally is derived from more than one independent source of information.	High
Underlying data are considered high quality; they have large and representative sample sizes (accounting for inter-annual and seasonal variation) and were collected over an adequate period of time (refer to Annex II for species specific detail). Data are appropriately collected and analysed according to best practice, (e.g. effort-corrected sightings data, robust modelling approaches) and yields outputs that have low levels of uncertainty. Data provided are appropriate to the ecological scale of the species population or subpopulation and are supplied on a species-by-species basis	

There is some evidence that the area supports the persistent presence of the feature at higher densities than the surrounding waters (by placing data within the proposed MCZ in its wider context) for a suitable period of time (see Annex II). The proposal is based on a data source or sources whose reliability may be open to question due to issues such as a shorter time span of data, lack of corroborative information, a higher proportion of older data, lack of quality review or evidence of quality assurance and/or inter- and annual seasonal variation reducing confidence. Elevated densities are demonstrated in the majority of years.	Moderate
Underlying data are considered to have only moderate quality. That is, they have moderate sample sizes, elevated densities are demonstrated only in the majority of years with consideration of inter-annual and seasonal variation, data are appropriately collected and analysed according to best practice (e.g. effort-corrected sightings data, robust modelling approaches) but may yield outputs that have moderate levels of uncertainty Data provided are appropriate to the ecological scale of the species population or sub-population and are supplied on a species-by species basis.	
The evidence that the area supports the persistent presence of the feature at higher densities than the surrounding waters is based only on a single data source or sources of low or unknown reliability, or which are short-term and/or many years old. Elevated densities are only demonstrated in a minority of years or the evidence does not allow the data within the proposed MCZ to be placed in the wider context at the scale of the features population or sub-population.	Low
Underlying data are considered low quality; that is they may have insufficient and unrepresentative sampling, have inherent biases, may not be collected over a sufficient period of time, may not be appropriately collected according to best practice, may not be appropriately analysed according to best practice (e.g. not effort corrected sightings data, questionable modelling approaches) and/or may yield outputs that have a high degree of uncertainty.	
The evidence suggesting the area supports the persistent presence of the feature at higher densities than the surrounding waters is not provided or is insufficient to allow such a conclusion to be reached. The underlying data are not considered to have the appropriate quality with which to demonstrate persistent presence of the species within the proposed MCZ in contrast to surrounding waters. Typically the data are too old or the study has insufficient sampling effort, insufficient duration and/or poor survey design, and there is high uncertainty around population estimates etc.	Not met
Principle 3: MPA Size and delineation	
There is a strong evidence base to demonstrate that the size and shape of the area included within the proposed MCZ boundary is appropriate to that required to ensure the viability of the site; that is, it will most likely maintain the integrity of its features and/or additional features that are ecologically relevant to the species proposed for designation in a MCZ. A significant body of reliable, recent, empirically-based evidence has been used to determine the location of the proposed MCZ boundary. This evidence is based on at least one high quality source of data, but ideally is derived from more than one independent source of information.	High
Underlying data are considered to have good quality; (i.e. there are large and representative sample sizes, they account for inter-annual and seasonal variation, they are appropriately collected according to best practice and have been appropriately analysed according to best practice (e.g. effort-corrected sightings data, robust modelling approaches), and yield boundaries that have low levels of uncertainty in their construction.	
There is a reasonable evidence base to demonstrate that the size and shape of the area included within the proposed MCZ boundary is appropriate to that required to ensure the viability of the site. That is, it will most likely maintain the integrity of its features and/or additional features that are ecologically relevant to the species proposed for designation in a MCZ. An adequate body of reliable, empirically-based evidence has been used to determine the location of the boundary. This evidence is based on a data source or sources whose reliability may be open to question due to issues such as a lack of corroborative information and/or	Moderate

significant age of underlying data.	
Underlying data are considered to have only moderate quality: i.e. they have moderate sample sizes, they account for inter-annual and seasonal variation; they are appropriately collected and have been appropriately analysed (e.g. effort-corrected sightings data, robust modelling approaches) but only yield boundaries that have moderate levels of uncertainty in their construction.	
The evidence to demonstrate that the size and shape of the area included within the proposed MCZ boundary is not appropriate to that required to ensure the viability of the site; that is, it is questionable how the site will maintain the integrity of its features and/or additional features which are ecologically relevant to the species proposed for designation in a MCZ. The evidence is based on a single data source or sources of unknown or low reliability or of significant age, or is predominantly based on expert judgement/inference for which quality assurance is not provided, or does not allow the data within the proposed MCZ to be placed in a wider context to define a clear boundary.	Low
Underlying data are considered to have low quality: e.g. there is insufficient and unrepresentative sampling, they may have inherent biases, may not be collected over a sufficient period of time, may not be appropriately collected according to best practice, may not be appropriately analysed according to best practice (e.g. not effort-corrected sightings data, questionable modelling approaches), and yield boundaries that have a high degree of uncertainty in their placement.	
The evidence is not provided or is insufficient to allow any conclusion to be reached that the size and shape of the area included within the proposed MCZ boundary is appropriate to that required to ensure the viability of the site. The underlying data are not considered to have the appropriate quality with which to delineate a boundary between areas of elevated and persistent species presence inside the proposed MCZ in contrast to that in surrounding waters. It is likely the data are too old, and there was insufficient sampling effort, insufficient duration, poor survey design and high uncertainty around population estimates.	Not met

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