

## Appendix 5: Low-risk pressures

### Consideration of “pressures” from the Natural England Advice on Operations for “fishing/demersal trawl” – Low-risk interactions

*N.B.* There has been no attempt to differentiate between “features” and “sub-features” within this section, with all being referred to as features for simplicity. In all cases, only features which have not been screened out for other reasons are included in these assessments.

“Low risk” is defined within the Advice on Operations matrix as, “unless there are evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, this pressure generally does not occur at a level of concern and should not require consideration as part of an assessment.” All interactions considered below are identified as “direct” interactions in the Advice on Operations matrix. All assessments have been based on the advice on operations on the Natural England designated sites webpage on 24 July 2017<sup>1</sup>.

### Summary of findings

#### “Low-risk” pressures that were scoped out:

- Above water noise
- Collision below water with static or moving objects not naturally found in the marine environment
- Deoxygenation
- Hydrocarbon & PAH contamination
- Introduction of light
- Litter
- Nutrient enrichment
- Organic enrichment
- Physical change (to another seabed type)
- Physical change (to another sediment type)
- Synthetic compound contamination (including pesticides, antifoulants, pharmaceuticals)
- Transition elements & organo-metal (e.g. TBT) contamination
- Underwater noise changes
- Visual disturbance

**“Low-risk” pressures for which further work was needed following consultation with Natural England:** Introduction or spread of invasive non-indigenous species. [The content of the assessment below now includes the changes made following the consultation.]

**“Low-risk” pressures for which further work is needed:** None

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<sup>1</sup><https://designatedsites.naturalengland.org.uk/Marine/FAPMatrix.aspx?SiteCode=UK0017075&SiteName=wash+and+north+norfolk&SiteNameDisplay=The+Wash+and+North+Norfolk+Coast+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=>

**Format for completion of examinations:**

<p><b>From “Advice on Operations” webpage</b>  <a href="https://designatedsites.naturalengland.org.uk/Marine/FAPMatrix.aspx?SiteCode=UK0017075&amp;SiteName=wash+and+north+norfolk&amp;SiteNameDisplay=The+Wash+and+North+Norfolk+Coast+SAC&amp;countyCode=&amp;responsiblePerson=&amp;SeaArea=&amp;FCAArea=)">           (https://designatedsites.naturalengland.org.uk/Marine/FAPMatrix.aspx?SiteCode=UK0017075&amp;SiteName=wash+and+north+norfolk&amp;SiteNameDisplay=The+Wash+and+North+Norfolk+Coast+SAC&amp;countyCode=&amp;responsiblePerson=&amp;SeaArea=&amp;FCAArea=)         </a></p>	
<b>Pressure</b>	Copied from within the pop-up window generated by clicking on e.g. an “S” in the “Advice on Operations” table
<b>Pressure Description</b>	Copied from within the pop-up window generated by clicking on e.g. an “S” in the “Advice on Operations” table
<b>Pressure Benchmark</b>	Copied from within the pop-up window generated by clicking on e.g. an “S” in the “Advice on Operations” table
<b>Activity Pressure Justification</b>	Copied from within the pop-up window generated by clicking on a Pressure name in the “Advice on Operations” table
<b>Pressure considered “Not Relevant” for features –</b>	Extracted from the “Advice on Operations” table
<b>Insufficient Evidence for the features –</b>	Extracted from the “Advice on Operations” table
<b>Features considered Not Sensitive to the pressure –</b>	Extracted from the “Advice on Operations” table
<b>Features considered Sensitive to the pressure –</b>	Extracted from the “Advice on Operations” table
<b>Discussion (this section generated by Eastern IFCA)</b>	Generated by Eastern IFCA, considering the magnitude and form of the pressure generated by shrimp beam trawling and the sensitivities of the feature under consideration, including where appropriate consideration of specific biotopes which make up the feature (obtained by clicking on “S” in the “Advice on Operations” table, and then clicking on the number in the “Relevant Biotopes” section of that pop-up)
<b>Conclusion</b>	<p>Conclusion on whether adverse effect on site integrity can be ruled out for this pressure, or whether there is a need to consider this pressure further. If so, an assessment as to -</p> <ul style="list-style-type: none"> <li>• Which aspects of the pressure</li> <li>• Which biotopes making up the feature</li> <li>• Which effects to consider</li> </ul> <p>are of relevance.</p>

## Assessment of “low risk” pressures:

From “Advice on Operations” webpage	
Pressure	<b>Above water noise</b>
<b>Pressure Description</b> This pressure relates to any loud noise made onshore or offshore by construction, vehicles (including aircraft), vessels, tourism, mining, blasting etc. that may disturb birds and reduce time spent in feeding or breeding area.	
<b>Pressure Benchmark</b> The introduction of airborne noise above background levels during periods of site occupancy by the feature.	
<b>Activity Pressure Justification</b> Noise arises from many activities in the marine environment which can evoke a disturbance response in marine mammals and birds. <ul style="list-style-type: none"> <li>• BirdLife International, 2012</li> <li>• Rodgers and Schwikert, 2002</li> <li>• Smit and Visser, 1993</li> <li>• Southall et al., 2007</li> <li>• Richardson et al., 1995</li> </ul> In relation to fishing, the operation of gear and vessels, as well as presence of people, may result in an increase in above water noise (Seafish, 1988). However, the magnitude of the pressure will depend on the nature, scale, intensity and duration of the activity. Further, the impact of such disturbance on birds <ul style="list-style-type: none"> <li>• Wildfowl and Wetlands Trust (WWT) Consulting, 2012</li> <li>• Ruddock and Whitfield, 2007</li> </ul> may be considered better captured by the pressure 'visual disturbance'.	
<b>Pressure considered “Not Relevant” for features –</b> <ul style="list-style-type: none"> <li>• All except Harbour Seal</li> </ul>	
<b>Insufficient Evidence for the features –</b>	
<b>Features considered Not Sensitive to the pressure –</b>	
<b>Features considered Sensitive to the pressure –</b> <ul style="list-style-type: none"> <li>• Harbour Seal</li> </ul>	
<b>Discussion (this section generated by Eastern IFCA)</b>  The routine operation of the shrimping vessels is not considered to generate sufficiently loud noise for this to be an issue.  The deployment and recovery of the beams (operations each conducted only once per trip, at the start and conclusion of fishing activities respectively) can generate more noise due to metal beams hitting metal of the fishing vessel, but these are relatively low level and very short-lived noise pressures.	
<b>Conclusion</b>  As there are no evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, it is not considered that the pressure “above water noise” needs to be addressed further in this assessment.  <b>There is no adverse effect on site integrity from above water noise.</b>	

<b>From “Advice on Operations” webpage</b>	
<b>Pressure</b>	<b>Collision BELOW water with static or moving objects not naturally found in the marine environment</b>
<b>Pressure Description</b> This pressure relates to the injury or mortality of biota from collisions with both static and/or moving structures. Examples include collisions with: - rigs (e.g. birds) - screens in intake pipes (e.g. fish at power stations) - wind turbine blades (e.g. birds) - tidal devices (e.g. fish and mammals) and - shipping (e.g. fish and mammals). Activities increasing number of vessels transiting areas, e.g. new port development or construction works will influence the scale and intensity of this pressure. In the assessments the above and below collision risks were assessed separately as two independent pressure types.	
<b>Pressure Benchmark</b> The presence of propelled vessels (particularly ducted propelled vessels) and/or tidal power devices OR 0.1% of tidal volume on an average tide, passing through an artificial structure.	
<b>Activity Pressure Justification</b> Pressure relates to vessels associated with this sub-activity and their movement. Collision with fishing gear (e.g. nets) can also occur but the consideration of this would be better done through the pressure 'Removal of non-target species'. Vessels are documented to have collided with mobile marine species (particularly mammals). Almost all vessel sizes and classes have been involved in collisions with marine mammals, including cargo ships, recreational vessels, and research vessels. Species can collide with the propeller or other parts of the hull. The most lethal and serious injuries are caused by large ships (e.g. 80 m or longer) and vessels travelling at speeds faster than 14 knots (Laist et al., 2001). Most minor injuries, by contrast, involved collisions with vessels less than 45m long. Collisions are rarely reported for vessels doing less than 10 km/hour. <ul style="list-style-type: none"> <li>• Laist et al., 2001</li> <li>• Whale and Dolphin Conservation Society, 2009</li> </ul>	
<b>Pressure considered “Not Relevant” for features –</b> <ul style="list-style-type: none"> <li>• All except Harbour Seal</li> </ul>	
<b>Insufficient Evidence for the features –</b>	
<b>Features considered Not Sensitive to the pressure –</b>	
<b>Features considered Sensitive to the pressure –</b> <ul style="list-style-type: none"> <li>• Harbour Seal</li> </ul>	
<b>Discussion (this section generated by Eastern IFCA)</b>  The vessels used in the shrimp fishery do not fit into the category “ducted propelled vessels”.  Eastern IFCA expert opinion indicates that incidence of seals being caught in shrimp trawls is exceedingly rare, with a minimal number of instances known over a period of decades. The very low speed of shrimp fishing vessels while fishing and low speed when transiting to and from fishing grounds, coupled with the highly developed senses and intelligence of seals indicates a very low likelihood of collision with the fishing vessels.	
<b>Conclusion</b>	

As there are no evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, it is not considered that the pressure “collision below water with static or moving objects not naturally found in the marine environment” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from collision below water with static or moving objects not naturally found in the marine environment.**

**From “Advice on Operations” webpage**

<b>Pressure</b>	<b>Deoxygenation</b>
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**Pressure Description**  
 Any deoxygenation that is not directly associated with nutrient or organic enrichment. The lowering, temporarily or more permanently, of oxygen levels in the water or substrate due to anthropogenic causes (some areas may naturally be deoxygenated due to stagnation of water masses, e.g. inner basins of fjords). This is typically associated with nutrient and organic enrichment, but it can also derive from the release of ballast water or other stagnant waters (where organic or nutrient enrichment may be absent). Ballast waters may be deliberately deoxygenated via treatment with inert gases to kill non-indigenous species.

**Pressure Benchmark**  
 Exposure to dissolved oxygen concentration of less than or equal to 2mg/l for 1 week (a change from WFD poor status to bad status).

**Activity Pressure Justification**  
 This pressure is associated with sediment mobilisation as well as the deposition of organic matter. The spatial and temporal persistence of any change will depend on factors such as the gear type and intensity of the activity, levels of natural disturbance, temperature and the sediment type/composition, resulting in many changes being relatively short lived and localized.

- ABPmer, 2008
- Centre for Environment, 2011
- O'Neill et al., 2008
- Dale et al., 2011

Resuspension of organic rich sediments in the wake of towed gears can result in localised removal of oxygen in the water column or more anoxic conditions in the remaining substrate.

- Gubbay and Knapman, 1999
- Sewell et al., 2007
- Sewell and Hiscock, 2005
- English Nature, 1992
- Riemann and E, 1991
- O'Neill et al., 2008
- Dale et al., 2011
- Kaiser et al., 2002
- Centre for Environment, 2011

Further, organic matter at the surface may be buried within anaerobic subsurface layers or conversely anaerobic sediments may be exposed to aerobic conditions by such mixing (PilskaIn et al., 1998). In fisheries where discards are spatially

concentrated, particularly in areas of low current flow, discards may cause localised hypoxia or anoxia of the seabed.

- Gilman et al., 2012
- Dayton et al., 1995

Additionally, ghost fishing associated with lost gear could result in concentrations of organic matter.

- Brown and Macfadyen, 2007
- Matsuoka et al., 2005

**Pressure considered “Not Relevant” for features –**

- Harbour seal

**Insufficient Evidence for the features**

**Features considered Not Sensitive to the pressure –**

- Intertidal coarse sediment
- Intertidal biogenic reef: mussel beds
- Subtidal biogenic reefs: mussel beds
- Intertidal mud

**Features considered Sensitive to the pressure –**

- Subtidal coarse sediment
- Subtidal mixed sediments
- Intertidal sand and muddy sand
- Subtidal mud
- Subtidal sand
- Water column

**Discussion (this section generated by Eastern IFCA)**

There is no pathway identified by which shrimp trawling could produce a magnitude of change in oxygen levels approaching that of the pressure benchmark. WFD status assessments for the area have not been “bad” in recent years.

**Conclusion**

As there are no evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, it is not considered that the pressure “deoxygenation” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from deoxygenation.**

<b>From “Advice on Operations” webpage</b>	
<b>Pressure</b>	<b>Hydrocarbon &amp; PAH contamination</b>
<b>Pressure Description</b>	
<p>Increases in the levels of these compounds compared with background concentrations. Naturally occurring compounds, complex mixtures of two basic molecular structures: - straight chained aliphatic hydrocarbons (relatively low toxicity and susceptible to degradation) - multiple ringed aromatic hydrocarbons (higher toxicity and more resistant to degradation) These fall into three categories based on source (includes both aliphatics and polyaromatic hydrocarbons): - petroleum hydrocarbons (from natural seeps, oil spills and surface water run-off) - pyrogenic hydrocarbons (from combustion of coal, woods and petroleum) - biogenic hydrocarbons (from plants &amp; animals) Ecological consequences include tainting, some are acutely toxic, carcinomas, growth defects.</p>	
<b>Pressure Benchmark</b>	
Compliance with all AA EQS, conformance with PELs, EACs/ER-Ls	
<b>Activity Pressure Justification</b>	
<p>Pressure primarily relates to vessels associated with this sub-activity and their movement, but potentially also mobilisation of contaminated sediments. The primary chemicals of environmental concern in vessel oil and fuel are polycyclic aromatic hydrocarbons (PAHs). Deliberate discharges of oil or oil/water mixtures from ships are prohibited within the North West European Waters Special Area, established by the International Maritime Organisation under MARPOL Annex I in 1999. This includes all waters around the UK and its approaches. However, accidental discharges still occur. Information on accidental discharges of oil from ships and offshore platforms is compiled annually by the Advisory Committee on Protection of the Sea (ACOPS) on behalf of the Maritime and Coastguard Agency. Although the majority of incidents are minor, several incidents occur annually that lead to the actual or potential release of significant amounts of oil (typically from large shipping vessels and tankers).</p> <ul style="list-style-type: none"> <li>• Defra and UK MMAS, 2010</li> <li>• Ware, 2009</li> <li>• The Green Blue, 2006</li> <li>• The Green Blue, 2009</li> </ul> <p>Further, sediment disturbance by fishing activities could result in the remobilisation of contaminants/substances.</p> <ul style="list-style-type: none"> <li>• Eggleton and Thomas, 2004</li> <li>• Kaiser et al., 2002</li> </ul> <p>However, the likelihood and severity of any impact depends upon factors such as the type and degree of existing contamination, the sediment type and intensity of activity. In many cases, natural disturbance may contribute the majority of contaminated sediment resuspension (Roberts, 2012).</p>	
<b>Pressure considered “Not Relevant” for features –</b>	
<b>Insufficient Evidence for the features –</b>	
<ul style="list-style-type: none"> <li>• Harbour seal</li> </ul>	
<b>Features considered Not Sensitive to the pressure –</b>	
<ul style="list-style-type: none"> <li>• Intertidal coarse sediment</li> <li>• Intertidal biogenic reef: mussel beds</li> <li>• Subtidal biogenic reefs: mussel beds</li> </ul>	

- Intertidal mud
- Subtidal coarse sediment
- Subtidal mixed sediments
- Intertidal sand and muddy sand
- Subtidal mud
- Subtidal sand

**Features considered Sensitive to the pressure –**

- Water column

**Discussion (this section generated by Eastern IFCA)**

The management of these compounds is subject to stringent regulatory requirements for the operation of vessels and equipment at sea. There is no pathway identified by which the specific activity of shrimp trawling could produce an impact of this type, except by being in breach of those regulations. This is considered adequate mitigation.

Furthermore, the shrimp fishery affects the surface of the seabed and does not penetrate the substratum deeper than the top few centimetres (Eastern IFCA, Senior IFCO, *Pers. comm.*). Natural disturbance through wave action is dominant in the intertidal and shallow subtidal areas (<10m depth) (see Appendix 9). There is no evidence or concern that physical disturbance in The Wash and north Norfolk coast is resulting in hydrocarbon and PAH contamination of the water column through the disturbance of surface sediments. The site is not known to contain significant levels of existing contamination, and concentrations of PAHs are lower in the water column than in biota and sediments, because of their low solubility (Kennish, 1997).

**Conclusion**

There is uncertainty on the level of pressure on a receptor, i.e. insufficient evidence for Harbour seal. The regulatory measures identified above are considered sufficient to effectively mitigate against the possibility of occurrence of this interaction due to shrimp beam trawl fishing.

As there are no evidence based case or site-specific factors that increase the risk, it is not considered that the pressure “Hydrocarbon & PAH contamination” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from hydrocarbon and PAH contamination.**

<b>From “Advice on Operations” webpage</b>	
<b>Pressure</b>	<b>Introduction of light</b>
<b>Pressure Description</b> Direct inputs of light from anthropogenic activities, i.e. lighting on structures during construction or operation to allow 24 hour working; new tourist facilities, e.g. promenade or pier lighting, lighting on oil & gas facilities etc. Ecological effects may be the diversion of bird species from migration routes if they are disorientated by or attracted to the lights. It is also possible that continuous lighting may lead to increased algal growth.	
<b>Pressure Benchmark</b> Change in incident light via anthropogenic means.	
<b>Activity Pressure Justification</b> Pressure relates to vessels associated with this sub-activity e.g. operational and navigation lighting. Marine birds are frequently attracted to or become disorientated by artificial light sources, which can result in collision and therefore injury or death. <ul style="list-style-type: none"> <li>• Montevecchi, 2006</li> <li>• Ryan, 1991</li> <li>• D., 2013</li> <li>• BirdLife International, 2012</li> </ul> Disturbance caused by light from vessels may also be of concern, particularly where significant levels of activity occur in close proximity to sensitive bird habitats including coastal inshore waters. <ul style="list-style-type: none"> <li>• Hill, 1992</li> <li>• Montevecchi, 2006</li> </ul> <p>However, there are also concerns about the potential wider impacts of light pollution in the aquatic, particularly coastal, environment on the behaviour, reproduction and survival of marine invertebrates, amphibians and fish (Depledge et al., 2010).</p>	
<b>Pressure considered “Not Relevant” for features –</b>	
<b>Insufficient Evidence for the features –</b> <ul style="list-style-type: none"> <li>• Harbour seal</li> <li>• Intertidal biogenic reef: mussel beds</li> <li>• Intertidal coarse sediment</li> <li>• Subtidal biogenic reefs: mussel beds</li> <li>• Subtidal coarse sediment</li> <li>• Subtidal mixed sediments</li> </ul>	
<b>Features considered Not Sensitive to the pressure –</b> <ul style="list-style-type: none"> <li>• Intertidal mud</li> <li>• Subtidal mud</li> </ul>	
<b>Features considered Sensitive to the pressure –</b> <ul style="list-style-type: none"> <li>• Intertidal sand and muddy sand</li> <li>• Subtidal sand</li> <li>• Water column</li> </ul>	
<b>Discussion (this section generated by Eastern IFCA)</b>  From information linked to the Advice on Operations table it is evident that concerns relate to long duration and high intensity of lighting. The low levels and moving light sources sometimes used by the shrimp vessels for the purposes of navigation and deck work (light is not used in the shrimp fishing activity as an attractor), coupled	

with the generally very low levels of light transmission in waters in shallow areas of The Wash mean that shrimp fishing activities are not expected to result in impacts on features.

**Conclusion**

There is uncertainty on the level of pressure on some receptors, i.e. insufficient evidence for Harbour seal, Intertidal biogenic reef: mussel beds, Intertidal coarse sediment, Subtidal biogenic reefs: mussel beds, Subtidal coarse sediment & Subtidal mixed sediments.

However, for all the intertidal features, shrimp beam trawling will not occur in the immediate vicinity when these features are exposed (perforce – or the vessel would be aground). The moderate levels of lighting, if any, used aboard shrimp beam trawling vessels, coupled with the poor light transmission of the waters of The Wash and North Norfolk Coast, effectively mitigate against the possibility of occurrence of this interaction due to shrimp beam trawl fishing.

As there are no evidence based case or site-specific factors that increase the risk, it is not considered that the pressure “Introduction of light” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from introduction of light.**

<b>From “Advice on Operations” webpage</b>	
<b>Pressure</b>	<b>Introduction or spread of invasive non-indigenous species (INIS)</b>
<b>Pressure Description</b> The direct or indirect introduction of invasive non-indigenous species, e.g. Chinese mitten crabs, slipper limpets, Pacific oyster and their subsequent spreading and out-competing of native species. Ballast water, hull fouling, stepping stone effects (e.g. offshore wind farms) may facilitate the spread of such species. This pressure could be associated with aquaculture, mussel or shellfishery activities due to imported seed stock or from accidental releases.	
<b>Pressure Benchmark</b> A significant pathway exists for the introduction or spread of one or more non-indigenous invasive species; OR there is a potential for the introduction of highly invasive/impact species.	
<b>Activity Pressure Justification</b> Aquatic organisms may be transferred to new locations as biofouling on vessels and gear and can be harmful and invasive in locations where they do not naturally occur. <ul style="list-style-type: none"> <li>• Ware, 2009</li> <li>• ICES (International Council for Exploration of the Sea), 2009</li> <li>• Dafforn et al., 2011</li> <li>• Tidbury et al., 2014</li> <li>• Pearce et al., 2012</li> </ul> All craft have some biofouling, even if recently cleaned or anti-fouled <ul style="list-style-type: none"> <li>• International Maritime Organisation (IMO), 2012</li> <li>• Davidson et al., 2010</li> </ul>	
<b>Pressure considered “Not Relevant” for features –</b>	
<b>Insufficient Evidence for the features –</b> <ul style="list-style-type: none"> <li>• Harbour seal</li> </ul>	
<b>Features considered Not Sensitive to the pressure –</b> <ul style="list-style-type: none"> <li>• Intertidal coarse sediment</li> </ul>	
<b>Features considered Sensitive to the pressure –</b> <ul style="list-style-type: none"> <li>• Intertidal biogenic reef: mussel beds</li> <li>• Subtidal biogenic reefs: mussel beds</li> <li>• Subtidal coarse sediment</li> <li>• Subtidal mixed sediments</li> <li>• Intertidal mud</li> <li>• Subtidal mud</li> <li>• Intertidal sand and muddy sand</li> <li>• Subtidal sand</li> <li>• Water column</li> </ul>	
<b>Discussion (Generated by Eastern IFCA)</b> Preventing the introduction or spread of invasive non-indigenous species is a high priority for Eastern IFCA. Reflecting low levels of concern around shrimp beam trawling, most biosecurity research and planning within The WNNC SAC to date has focused on imports of shellfish to aquaculture lays rather than beam trawling activity.  Shrimp beam trawling in the SAC has not been highlighted as a high-risk pathway for the introduction or spread of non-indigenous species. The activity does not involve any intentional introduction or translocation of species. The vessels do not	

use ballast water, identified as a major vector of invasive species connected with shipping (Ware, 2009).

The extent to which vessels engaged in the shrimp fishery in The WNNC SAC travel outside the SAC for shrimp fishing is limited, which further limits the possibility of accidental spread of non-indigenous species. Levels of non-shrimp fishing related marine traffic into and out of The WNNC SAC far exceeds the movement of shrimp beam trawl vessels, as identified for example by Davidson *et al.* (2010). Approximately 93% of UK shrimp landings are from The WNNC SAC fishery (Poseidon, 2017). Of the vessels engaged in the fishery, up to 20 fish for shrimp outside of the SAC, off the nearby Lincolnshire coast. This is an area that supports very low levels of commercial shipping and recreational boating (Tidbury *et al.*, 2014), has no authorised aquaculture (Fish Health Inspectorate, *Pers. comms.*) and where the spread of non-indigenous species is not likely to be facilitated by ocean currents (Tidbury *et al.*, 2014). A single vessel also regularly fishes for shrimp on the Suffolk Coast (with the possibility of one further vessel beginning to do so). When transiting between areas, fishing gear is usually stowed, allowing it to dry. Drying equipment has been identified as one of the most effective methods of sanitizing equipment of non-native pathogens (Environment Agency, 2017).

Some Wash shrimp fishing vessels participate periodically in the Thames estuary cockle fishery, which is regarded as a 'hotspot' for INIS. These vessels only fish for cockles in the area, using different fishing gear from that used in the shrimp fishery. Therefore, there is no pathway for the introduction or spread of invasive non-indigenous species into The Wash and North Norfolk Coast from fishing gear used in The Thames cockle fishery. The Wildlife and Countryside Act (1981) makes it an offence to "release or allow to escape into the wild" any animal which is not ordinarily resident in and is not a regular visitor to Great Britain in a wild state, or is included on a list of non-native animals which are established in the wild (Legislation.gov.uk). This existing regulation requires fishing vessel operators as well as any other vessel to ensure their actions do not result in the release or escape of non-native animals.

#### **Conclusion**

The possible pathways for the spread of non-indigenous species are limited, and would not generate the pressure "introduction or spread of invasive non-indigenous species" at a level meeting the pressure benchmark. It is not considered that the pressure will have a significant impact on any of the features identified as sensitive to the pressure.

There is no known pathway identified whereby the activity of shrimp beam trawling would introduce or spread invasive non-indigenous species which could pose a threat to Harbour seals.

**There is no adverse effect on site integrity from the introduction or spread of invasive non-indigenous species.**

From "Advice on Operations" webpage	
Pressure	Litter
<p><b>Pressure Description</b>  Marine litter is any manufactured or processed solid material from anthropogenic activities that are discarded, disposed of or abandoned once entering the marine and coastal environment including: plastics, metals, timber, rope, fishing gear etc. and their degraded components, e.g. microplastic particles. Ecological effects can be physical (smothering), biological (ingestion, including uptake of microplastics; entangling; physical damage; accumulation of chemicals) and/or chemical (leaching, contamination).</p>	
<p><b>Pressure Benchmark</b>  Introduction of man-made objects able to cause physical harm (surface, water column, sea floor and/or strandline)</p>	
<p><b>Activity Pressure Justification</b>  Marine litter is items made or used by people and deliberately discarded or unintentionally lost into the sea and on beaches. Despite international legislation such as Annex V of the International Convention for the Prevention of Pollution from Ships, 1973 (International Maritime Organisation, 1983 - 2005), maritime activity is still a major source of litter. Fishing is an important source of marine litter. For example, 14 % of the litter identified during the UK Beachwatch survey (2006) was fishing related (Lozano and Mouat, 2009), net loss in UK fisheries has been estimated at 36 km per year (Brown and Macfadyen, 2007) and surveys across 32 sites in European waters (continental shelves to canyons) found that derelict fishing gear was the second most abundant item encountered (34 % of total) (Pham et al., 2014). Various types of litter result from fishing in general including galley waste, fish boxes, floats/buoys, nets, ropes, lines, pots, weights and micro-plastic particles resulting from disintegration of plastic gear.</p> <ul style="list-style-type: none"> <li>• Lozano and Mouat, 2009</li> <li>• Bowmer and Kershaw, 2010</li> </ul> <p>Impacts of such litter include entanglement of marine wildlife including mammals and birds, ingestion and ghost fishing.</p> <ul style="list-style-type: none"> <li>• Wildfowl and Wetlands Trust (WWT) Consulting, 2012</li> <li>• Lozano and Mouat, 2009</li> <li>• Derraik, 2002</li> <li>• Defra and UK MMAS, 2010</li> <li>• Matsuoka et al., 2005</li> <li>• Brown and Macfadyen, 2007</li> </ul> <p>Ghost gears can also damage benthic habitats (through abrasion, 'plucking' of organisms or meshes closing around them, and the translocation of seabed features) (Brown and Macfadyen, 2007). Alongside existing legislation, potential mitigation measures are discussed in various sources of literature</p> <ul style="list-style-type: none"> <li>• Derraik, 2002</li> <li>• Lozano and Mouat, 2009</li> <li>• Brown and Macfadyen, 2007</li> </ul>	
<p><b>Pressure considered "Not Relevant" for features –</b></p>	
<p><b>Insufficient Evidence for the features –</b></p>	
<p><b>Features considered Not Sensitive to the pressure –</b></p>	
<p><b>Features considered Sensitive to the pressure –</b></p>	

- Harbour seal
- Water column

**Features Not Assessed for this pressure –**

- Intertidal coarse sediment
- Intertidal biogenic reef: mussel beds
- Subtidal biogenic reefs: mussel beds
- Subtidal coarse sediment
- Subtidal mixed sediments
- Intertidal rock
- Intertidal mud
- Subtidal mud
- Intertidal sand and muddy sand
- Subtidal sand

**Discussion (this section generated by Eastern IFCA)**

The disposal of litter at sea is subject to stringent regulatory requirements for the operation of vessels and equipment, as identified in the activity pressure justification. This is considered adequate mitigation when considering the possibility of litter from vessels engaged in shrimp beam trawl fishing.

The facts that the fishing area is well known, gear is always attended (as opposed to pots and set nets), that the seabed where fishing occurs is generally fairly level and smooth, and that fishers consciously avoid snags mean that the accidental loss of fishing gear is of a very low level within the shrimp beam trawling activity.

**Conclusion**

As there are no evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, it is not considered that the pressure “litter” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from litter.**

From "Advice on Operations" webpage	
Pressure	Nutrient enrichment
<p><b>Pressure Description</b>  Increased levels of the elements nitrogen, phosphorus, silicon (and iron) in the marine environment compared to background concentrations. Nutrients can enter marine waters by natural processes (e.g. decomposition of detritus, riverine, direct and atmospheric inputs) or anthropogenic sources (e.g. waste water runoff, terrestrial/agricultural runoff, sewage discharges, aquaculture, atmospheric deposition). Nutrients can also enter marine regions from 'upstream' locations, e.g. via tidal currents to induce enrichment in the receiving area. Nutrient enrichment may lead to eutrophication (see also organic enrichment). Adverse environmental effects include deoxygenation, algal blooms, changes in community structure of benthos and macrophytes</p>	
<p><b>Pressure Benchmark</b>  Compliance with WFD criteria for good status</p>	
<p><b>Activity Pressure Justification</b>  This pressure may result from disturbance and resuspension of the sediment in the wake of towed gears</p> <ul style="list-style-type: none"> <li>• Sewell et al., 2007</li> <li>• Riemann and E, 1991</li> <li>• Dale et al., 2011</li> </ul> <p>, which can trigger considerable productivity pulses due to the rate of release of dissolved and particulate nutrients and have consequences for biogeochemical cycling.</p> <ul style="list-style-type: none"> <li>• Polet and Depestele, 2010</li> <li>• Kaiser et al., 2002</li> <li>• Allen and Clarke, 2007</li> <li>• Pilskaln et al., 1998</li> </ul> <p>The spatial and temporal persistence of any change will depend on factors such as the gear type and intensity of the activity, levels of natural disturbance and primary production, and the type/composition of the substrate and biota (including abundance of filter feeders)</p> <ul style="list-style-type: none"> <li>• Dale et al., 2011</li> <li>• Lohrer and Wetz, 2003</li> <li>• Allen and Clarke, 2007</li> <li>• Pilskaln et al., 1998</li> </ul>	
<p><b>Pressure considered "Not Relevant" for features –</b></p> <ul style="list-style-type: none"> <li>• Harbour seal</li> </ul>	
<p><b>Insufficient Evidence for the features –</b></p>	
<p><b>Features considered Not Sensitive to the pressure –</b></p> <ul style="list-style-type: none"> <li>• Intertidal coarse sediment</li> <li>• Intertidal biogenic reef: mussel beds</li> <li>• Subtidal biogenic reefs: mussel beds</li> <li>• Subtidal coarse sediment</li> <li>• Subtidal mixed sediments</li> <li>• Intertidal mud</li> <li>• Subtidal mud</li> <li>• Intertidal sand and muddy sand</li> <li>• Subtidal sand</li> </ul>	

**Features considered Sensitive to the pressure –**

- Water column

**Discussion (this section generated by Eastern IFCA)**

The only feasible pathway identified for this pressure is by sediments raised by the passage of fishing gear. Shrimp beam trawling will not introduce additional elemental nutrients into the environment.

The amount of sediment raised by the shrimp beam trawl gear is relatively low, and tends to come from the very topmost layers of the seabed (ABPmer and Ichthys Marine, 2015). These layers are regularly perturbed by natural processes – therefore, the additional amount of nutrient added through the activity of shrimp beam trawling will not be significant.

**Conclusion**

As there are no evidence based cases or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, it is not considered that the pressure “Nutrient Enrichment” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from nutrient enrichment.**

From "Advice on Operations" webpage	
Pressure	Organic enrichment
<b>Pressure Description</b>	
<p>Resulting from the degraded remains of dead biota &amp; microbiota (land &amp; sea); faecal matter from marine animals; flocculated colloidal organic matter and the degraded remains of: sewage material, domestic wastes, industrial wastes etc. Organic matter can enter marine waters from sewage discharges, aquaculture or terrestrial/agricultural runoff. Black carbon comes from the products of incomplete combustion (PIC) of fossil fuels and vegetation. Organic enrichment may lead to eutrophication (see also nutrient enrichment). Adverse environmental effects include deoxygenation, algal blooms, changes in community structure of benthos and macrophytes.</p>	
<b>Pressure Benchmark</b>	
A deposit of 100gC/m <sup>2</sup> /yr.	
<b>Activity Pressure Justification</b>	
<p>This pressure is associated with sediment mobilisation as well as the deposition of organic matter. The spatial and temporal persistence of any change will depend on factors such as the gear type and intensity of the activity, levels of natural disturbance, temperature and the sediment type/composition, resulting in many changes being relatively short lived and localised.</p> <ul style="list-style-type: none"> <li>• ABPmer, 2008</li> <li>• Centre for Environment, 2011</li> <li>• O'Neill et al., 2008</li> <li>• Dale et al., 2011</li> </ul> <p>For fishing, the pressure may result from disturbance of the sediment in the wake of towed gears and resuspension of organic rich sediments.</p> <ul style="list-style-type: none"> <li>• Gubbay and Knapman, 1999</li> <li>• Sewell et al., 2007</li> <li>• Sewell and Hiscock, 2005</li> <li>• English Nature, 1992</li> <li>• Riemann and E, 1991</li> <li>• O'Neill et al., 2008</li> <li>• Dale et al., 2011</li> <li>• Centre for Environment, 2011</li> </ul> <p>Further, organic matter at the surface may be buried within anaerobic subsurface layers (Pilskaln et al., 1998). In fisheries where discards are spatially concentrated, particularly in areas of low current flow, discards may result in localised increases in organic matter and potentially hypoxia or anoxia of the seabed.</p> <ul style="list-style-type: none"> <li>• Gilman et al., 2012</li> <li>• Dayton et al., 1995</li> </ul> <p>Additionally, ghost fishing associated with lost gear could result in concentrations of organic matter</p> <ul style="list-style-type: none"> <li>• Brown and Macfadyen, 2007</li> <li>• Matsuoka et al., 2005</li> </ul>	
<b>Pressure considered "Not Relevant" for features –</b>	
<ul style="list-style-type: none"> <li>• Harbour seal</li> </ul>	
<b>Insufficient Evidence for the features –</b>	
<ul style="list-style-type: none"> <li>• Subtidal coarse sediment</li> </ul>	

- Subtidal mixed sediments

**Features considered Not Sensitive to the pressure –**

- Intertidal coarse sediment
- Intertidal biogenic reef: mussel beds
- Subtidal biogenic reefs: mussel beds
- Intertidal mud
- Intertidal sand and muddy sand

**Features considered Sensitive to the pressure –**

- Subtidal mud
- Subtidal sand
- Water column

**Discussion (this section generated by Eastern IFCA)**

There is uncertainty on the level of pressure on some receptors, i.e. insufficient evidence for subtidal coarse sediment and subtidal mixed sediments. Coarse sediments occur in areas of higher natural bed shear stress, which will tend to mitigate against the settlement of any organic matter raised from the sediment by the passage of the beam trawl. Subtidal mixed sediments have appreciable fine particle fractions, and any sediment raised will tend to be of the same composition as that already present in the sediment.

Feasible pathways by which shrimp beam trawling may cause organic enrichment are by sediments raised by the passage of fishing gear and by the disposal of (dead organic) discarded bycatch.

The amount of sediment raised by the shrimp beam trawl gear is relatively low, and tends to come from the very topmost layers of the seabed (ABPmer and Ichthys Marine, 2015). These layers are regularly perturbed by natural processes – therefore, the additional amount of organic enrichment added via the pathway of disturbed sediment through the activity of shrimp beam trawling will not be significant.

The shrimp fishery is obliged under the Shrimp Fishing Nets Order 2002 to use “veil” nets to reduce bycatch. Catchpole *et al.* (2008) calculated that, for shrimp beam trawls using a “veil” net, an average catch from one tow of 22.3kg of marketable shrimp would also result in the capture of 23.7kg of unmarketable small shrimp and 6.2kg of finfish. There is a requirement that the catch be riddled prior to the shrimps being processed (boiled) on board the vessels. This riddling removes and returns to the sea, alive in so far as is possible, the small shrimp and a proportion of the finfish. Lancaster and Frid (2002) determined that it can be anticipated that 92% of undersized shrimps “riddled out” can be expected to survive long term. Therefore, calculations below assume an 8% mortality.

In subsequent calculations, it has been assumed that each kg of marketable shrimp landed has resulted in the discarding dead of  $(6.2/22.3 =) 0.28$  kg of finfish and  $((23.7/22.3) * 8\% =) 0.085$  kg of undersized shrimp, a total of 0.365 kg. This is an overestimate / worst case, for the following reasons:

- Some of the finfish will be returned alive to the sea from the riddle.
- Much of the dead shrimp and fish returned to the sea is taken by seabirds (principally gulls and terns) before it can impact on seabed features.

To estimate the concentration of organic matter potentially introduced via dead discards, it is necessary to calculate the total amount of matter introduced, and the area over which it will be spread. The calculation below presents such an assessment based on data for the years 2010 – 2015.

	High	Low	note
Annual landings, tonnes	900	260	(1)
Tonnes organic matter per tonne landings	0.365	0.365	(2)
Total Tonnes organic matter	328.5	94.9	(3)
ASSUME total organic spread over, km <sup>2</sup>	100	100	(4)
Organic matter, g / m <sup>2</sup>	3.285	0.949	(5)

- (1) MMO Landings data – highest in period = 2012, 894 tonnes. Lowest in period 2015, 256 tonnes.
- (2) From calculation above
- (3) = (1) \* (2)
- (4) Total area of Wash & North Norfolk Coast SAC = 1077.18 km<sup>2</sup>. Assumption of organic matter spread over 100 km<sup>2</sup> is less than 10% of the total area – a precautionary assumption based on current knowledge of distribution of shrimp fishing effort
- (5) = (3) / (4)

The highest figure derived from that calculation above does not approach the pressure benchmark figure of 100g C/m<sup>2</sup>/yr. There are additional factors which make these results even less of a concern –

- The assumption that there will be 0.365 kg of dead organic matter/kg of marketable shrimp landed is precautionary, as noted in the calculations for that figure.
- The highest figure derived at (5) above assumes a level of catch in excess of that seen over the last five years, but with no increase in the area over which the activity (and therefore the discards) would be spread from the precautionary <10% of the total site area
- This calculation is based on the TOTAL organic matter, whereas the pressure benchmark is based on carbon only. There is imprecision in the pressure benchmark in that there is no identification as to whether the figure refers to 100 g dry weight carbon, or “wet weight”. In either case, the calculated figures do not approach the pressure benchmark.

- Organic enrichment is associated with fisheries where discards are spatially concentrated and flow rates are low. Neither of these conditions occur in the Wash and North Norfolk shrimp fishery.

Jansen *et al.* (2003) found that, in areas studied within the entrance to the Baltic, “slightly silty sand sediments” could be expected to experience annual accumulation of 8 g organic matter / m<sup>2</sup>, “very silty sand” and “extremely silty sandy mud” some 30 – 40 g organic matter / m<sup>2</sup>, “extremely silty slightly sandy mud” and “silt” some 120 – 130 g organic matter / m<sup>2</sup>.

The potential amount of organic enrichment to those sediments considered potentially sensitive will not produce any significant effects.

#### **Conclusion**

There is uncertainty on the level of pressure on a receptor, i.e. insufficient evidence for Subtidal coarse sediments and Subtidal mixed sediments. As calculations above show, the potential impact of organic enrichment arising from shrimp beam trawling on these features cannot be considered significant.

There is no pathway identified by which shrimp beam trawling would generate the pressure “Organic Enrichment” at a level approaching the pressure benchmark.

As there are no evidence based case or site-specific factors that increase the risk, it is not considered that the pressure “Organic Enrichment” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from organic enrichment.**

<b>From "Advice on Operations" webpage</b>	
<b>Pressure</b>	<b>Physical change (to another seabed type)</b>
<b>Pressure Description</b>	
<p>The permanent change of one marine habitat type to another marine habitat type, through the change in substratum, including to artificial (e.g. concrete). This therefore involves the permanent loss of one marine habitat type but has an equal creation of a different marine habitat type. Associated activities include the installation of infrastructure (e.g. surface of platforms or wind farm foundations, marinas, coastal defences, pipelines and cables), the placement of scour protection where soft sediment habitats are replaced by hard/coarse substratum habitats, removal of coarse substrata (marine mineral extraction) in those instances where surficial finer sediments are lost, capital dredging where the residual sedimentary habitat differs structurally from the pre-dredge state, creation of artificial reefs, mariculture i.e. mussel beds. Protection of pipes and cables using rock dumping and matting techniques. Placement of cuttings piles from oil &amp; gas activities could fit this pressure type, however, there may be an additional pressures, e.g. "pollution and other chemical changes" theme. This pressure excludes navigation dredging where the depth of sediment is changes locally but the sediment typology is not changed.</p>	
<b>Pressure Benchmark</b>	
Change from sedimentary or soft rock substrata to hard rock or artificial substrata or vice-versa.	
<b>Activity Pressure Justification</b>	
<p>Mobile fishing gear is one of the best known sources of anthropogenic degradation of seabed habitat and associated benthic communities (see 'Abrasion' pressure). Whilst the physical damage caused by persistent interaction with bottom towed gear could result in loss of certain sensitive habitats such as seagrass, the change is unlikely to be permanent if the activity were to cease, although recovery rates may be slow in some cases. Therefore there may be few examples of where the association between the activity and this particular pressure is actually realised, but it should be taken into consideration.</p> <ul style="list-style-type: none"> <li>• Kaiser et al., 2001</li> <li>• Kaiser et al., 2002</li> </ul>	
<b>Pressure considered "Not Relevant" for features –</b>	
<ul style="list-style-type: none"> <li>• Subtidal coarse sediment</li> <li>• Subtidal mixed sediments</li> <li>• Harbour seal</li> <li>• Intertidal coarse sediment</li> <li>• Intertidal biogenic reef: mussel beds</li> <li>• Subtidal biogenic reefs: mussel beds</li> <li>• Intertidal mud</li> <li>• Intertidal sand and muddy sand</li> <li>• Subtidal mud</li> <li>• Subtidal sand</li> <li>• Water column</li> </ul>	
<b>Insufficient evidence for the features –</b>	
<b>Features considered Not Sensitive to the pressure –</b>	
<b>Features considered Sensitive to the pressure –</b>	

**Discussion (this section generated by Eastern IFCA)**

Current shrimp beam trawl activity within the site is the continuation of a long running activity, which has not resulted in the change to another seabed type. All features consider this pressure “not relevant”.

**Conclusion**

As there are no evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, it is not considered that the pressure “Physical change (to another seabed type)” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from physical change (to another seabed type).**

From "Advice on Operations" webpage	
Pressure	Physical change (to another sediment type)
<p><b>Pressure Description</b></p> <p>The permanent change of one marine habitat type to another marine habitat type, through the change in substratum, including to artificial (e.g. concrete). This therefore involves the permanent loss of one marine habitat type but has an equal creation of a different marine habitat type. Associated activities include the installation of infrastructure (e.g. surface of platforms or wind farm foundations, marinas, coastal defences, pipelines and cables), the placement of scour protection where soft sediment habitats are replaced by hard/coarse substratum habitats, removal of coarse substrata (marine mineral extraction) in those instances where surficial finer sediments are lost, capital dredging where the residual sedimentary habitat differs structurally from the pre-dredge state, creation of artificial reefs, mariculture i.e. mussel beds. Protection of pipes and cables using rock dumping and matting techniques. Placement of cuttings piles from oil &amp; gas activities could fit this pressure type, however, there may be an additional pressures, e.g. "pollution and other chemical changes" theme. This pressure excludes navigation dredging where the depth of sediment is changes locally but the sediment typology is not changed.</p>	
<p><b>Pressure Benchmark</b></p> <p>Change in sediment type by one Folk class (based on UK SeaMap simplified classification)</p>	
<p><b>Activity Pressure Justification</b></p> <p>Mobile fishing gear is one of the best known sources of anthropogenic degradation of seabed habitat and associated benthic communities (see 'Abrasion' pressure). Whilst the physical damage caused by persistent interaction with bottom towed gear could result in loss of certain sensitive habitats such as seagrass, the change is unlikely to be permanent if the activity were to cease, although recovery rates may be slow in some cases. Therefore there may be few examples of where the association between the activity and this particular pressure is actually realised, but it should be taken into consideration.</p> <ul style="list-style-type: none"> <li>• Kaiser et al., 2001</li> <li>• Kaiser et al., 2002</li> </ul>	
<p><b>Pressure considered "Not Relevant" for features –</b></p> <ul style="list-style-type: none"> <li>• Harbour seal</li> <li>• Water column</li> </ul>	
<p><b>Insufficient Evidence for the features –</b></p>	
<p><b>Features considered Not Sensitive to the pressure –</b></p> <ul style="list-style-type: none"> <li>• Intertidal biogenic reef: mussel beds</li> </ul>	
<p><b>Features considered Sensitive to the pressure –</b></p> <ul style="list-style-type: none"> <li>• Intertidal coarse sediment</li> <li>• Subtidal biogenic reefs: mussel beds</li> <li>• Intertidal mud</li> <li>• Subtidal coarse sediment</li> <li>• Subtidal mixed sediments</li> <li>• Intertidal sand and muddy sand</li> <li>• Subtidal mud</li> </ul>	

- Subtidal sand

**Discussion (this section generated by Eastern IFCA)**

The current Shrimp Beam Trawl activity within the site is the continuation of a long running activity, which has not resulted in the change to another seabed type.

**Conclusion**

As there are no evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, it is not considered that the pressure “Physical change (to another sediment type)” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from physical change (to another sediment type).**

From "Advice on Operations" webpage

**Pressure**     **Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)**

**Pressure Description**

Increases in the levels of these compounds compared with background concentrations. Synthesised from a variety of industrial processes and commercial applications. Chlorinated compounds include polychlorinated biphenols (PCBs), dichlor-diphenyl-trichloroethane (DDT) & 2,3,7,8-tetrachlorodibenzo(p)dioxin (2,3,7,8-TCDD) are persistent and often very toxic. Pesticides vary greatly in structure, composition, environmental persistence and toxicity to non-target organisms. Includes: insecticides, herbicides, rodenticides & fungicides. Pharmaceuticals and Personal Care Products originate from veterinary and human applications compiling a variety of products including, Over the counter medications, fungicides, chemotherapy drugs and animal therapeutics, such as growth hormones. Due to their biologically active nature, high levels of consumption, known combined effects, and their detection in most aquatic environments they have become an emerging concern. Ecological consequences include physiological changes (e.g. growth defects, carcinomas).

**Pressure Benchmark**

Compliance with all AA EQS, conformance with PELs, EACs, ER-Ls within site.

**Activity Pressure Justification**

Pressure primarily relates to vessels associated with this sub-activity and their movement, but potentially also mobilisation of contaminated sediments. The primary chemicals of environmental concern in vessel oil and fuel are polycyclic aromatic hydrocarbons (PAHs). Deliberate discharges of oil or oil/water mixtures from ships are prohibited within the North West European Waters Special Area, established by the International Maritime Organization under MARPOL Annex I in 1999. This includes all waters around the UK and its approaches. However, accidental discharges still occur. Information on accidental discharges of oil from ships and offshore platforms is compiled annually by the Advisory Committee on Protection of the Sea (ACOPS) on behalf of the Maritime and Coastguard Agency. Although the majority of incidents are minor, several incidents occur annually that lead to the actual or potential release of significant amounts of oil (typically from large shipping vessels and tankers). Antifouling compounds like tributyltin (TBT; banned on vessels under 25 m in the UK since 1987, however) and copper wash from ship coatings enter and persist in the marine environment, with highest concentrations generally found in heavily used shipping routes or within harbours

- Defra and UK MMAS, 2010
- Ware, 2009
- OSPAR Commission, 2011
- Turner, 2010
- The Green Blue, 2006
- The Green Blue, 2009

Further, sediment disturbance by fishing activities could result in the remobilisation of contaminants/substances

- Eggleton and Thomas, 2004
- Kaiser et al., 2002

However, the likelihood and severity of any impact depends upon factors such as the type and degree of existing contamination, the sediment type and intensity of activity. In many cases, natural disturbance may contribute the majority of contaminated sediment resuspension (Roberts, 2012).

**Pressure considered “Not Relevant” for features –**

**Insufficient Evidence for the features –**

- Harbour seal

**Features considered Not Sensitive to the pressure –**

- Intertidal biogenic reef: mussel beds
- Intertidal coarse sediment
- Subtidal biogenic reefs: mussel beds
- Intertidal mud
- Subtidal coarse sediment
- Subtidal mixed sediments
- Intertidal sand and muddy sand
- Subtidal mud
- Subtidal sand

**Features considered Sensitive to the pressure –**

- Water column

**Discussion (this section generated by Eastern IFCA)**

The management of these compounds is subject to stringent regulatory requirements for the operation of vessels and equipment at sea. There is no pathway identified by which the specific activity of shrimp trawling could produce an impact of this type, except by being in breach of those regulations. This is considered adequate mitigation.

**Conclusion**

There is uncertainty on the level of pressure on a receptor, i.e. insufficient evidence for Harbour seal. The strict regulatory requirements for the management of these compounds is considered adequate mitigation for this, and all other, features. As there are no evidence based case or site-specific factors that increase the risk, it is not considered that the pressure “Synthetic compound contamination (including pesticides, antifoulants, pharmaceuticals)” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)**

From "Advice on Operations" webpage	
Pressure	Transition elements & organo-metal (e.g. TBT) contamination
<p><b>Pressure Description</b></p> <p>Increases in the levels of these compounds compared with background concentrations. Synthesised from a variety of industrial processes and commercial applications. Chlorinated compounds include polychlorinated biphenols (PCBs), dichlor-diphenyl-trichloroethane (DDT) &amp; 2,3,7,8-tetrachlorodibenzo(p)dioxin (2,3,7,8-TCDD) are persistent and often very toxic. Pesticides vary greatly in structure, composition, environmental persistence and toxicity to non-target organisms. Includes: insecticides, herbicides, rodenticides &amp; fungicides. Pharmaceuticals and Personal Care Products originate from veterinary and human applications compiling a variety of products including, Over the counter medications, fungicides, chemotherapy drugs and animal therapeutics, such as growth hormones. Due to their biologically active nature, high levels of consumption, known combined effects, and their detection in most aquatic environments they have become an emerging concern. Ecological consequences include physiological changes (e.g. growth defects, carcinomas).</p>	
<p><b>Pressure Benchmark</b></p> <p>Compliance with all AA EQS, conformance with PELs, EACs, ER-Ls within site.</p>	
<p><b>Activity Pressure Justification</b></p> <p>Pressure primarily relates to vessels associated with this sub-activity and their movement, but potentially also mobilisation of contaminated sediments. The primary chemicals of environmental concern in vessel oil and fuel are polycyclic aromatic hydrocarbons (PAHs). Deliberate discharges of oil or oil/water mixtures from ships are prohibited within the North West European Waters Special Area, established by the International Maritime Organization under MARPOL Annex I in 1999. This includes all waters around the UK and its approaches. However, accidental discharges still occur. Information on accidental discharges of oil from ships and offshore platforms is compiled annually by the Advisory Committee on Protection of the Sea (ACOPS) on behalf of the Maritime and Coastguard Agency. Although the majority of incidents are minor, several incidents occur annually that lead to the actual or potential release of significant amounts of oil (typically from large shipping vessels and tankers). Antifouling compounds like tributyltin (TBT; banned on vessels under 25 m in the UK since 1987, however) and copper wash from ship coatings enter and persist in the marine environment, with highest concentrations generally found in heavily used shipping routes or within harbours</p> <ul style="list-style-type: none"> <li>• Defra and UK MMAS, 2010</li> <li>• Ware, 2009</li> <li>• OSPAR Commission, 2011</li> <li>• Turner, 2010</li> <li>• The Green Blue, 2006</li> <li>• The Green Blue, 2009</li> </ul> <p>Further, sediment disturbance by fishing activities could result in the remobilisation of contaminants/substances.</p> <ul style="list-style-type: none"> <li>• Eggleton and Thomas, 2004</li> <li>• Kaiser et al., 2002</li> </ul> <p>However, the likelihood and severity of any impact depends upon factors such as the type and degree of existing contamination, the sediment type and intensity of</p>	

activity. In many cases, natural disturbance may contribute the majority of contaminated sediment resuspension (Roberts, 2012).

**Pressure considered “Not Relevant” for features –**

**Insufficient Evidence for the features –**

- Harbour seal

**Features considered Not Sensitive to the pressure –**

- Intertidal biogenic reef: mussel beds
- Intertidal coarse sediment
- Subtidal biogenic reefs: mussel beds
- Intertidal mud
- Subtidal coarse sediment
- Subtidal mixed sediments
- Intertidal sand and muddy sand
- Subtidal mud
- Subtidal sand

**Features considered Sensitive to the pressure –**

- Water column

**Discussion (this section generated by Eastern IFCA)**

The management of these compounds is subject to stringent regulatory requirements for the operation of vessels and equipment at sea. There is no pathway identified by which the specific activity of shrimp trawling could produce an impact of this type, except by being in breach of those regulations. This is considered adequate mitigation.

**Conclusion**

There is uncertainty on the level of pressure on a receptor, i.e. insufficient evidence for Harbour seal. The strict regulatory requirements for the management of these compounds is considered adequate mitigation for this, and all other, features.

As there are no evidence based case or site-specific factors that increase the risk, it is not considered that the pressure “transition elements & organo-metal (e.g. TBT) contamination” needs to be addressed further in this assessment.

**There is no adverse effect on site integrity from transition elements & organo-metal (e.g. TBT) contamination.**

<b>From “Advice on Operations” webpage</b>	
<b>Pressure</b>	<b>Underwater noise changes</b>
<p><b>Pressure Description</b></p> <p><b>For Harbour seal:</b> Increases over and above background noise levels (consisting of environmental noise (ambient) and incidental man-made/anthropogenic noise (apparent)) at a particular location. Species known to be affected are marine mammals and fish but could potentially include diving birds and crustaceans. The theoretical zones of noise influence are temporary or permanent hearing loss; discomfort and injury; response; and masking. In extreme cases noise pressures may lead to physical injury and death. The physical or behavioural effects are dependent on a number of variables, including the sound pressure level and frequency of the noise. High amplitude low and mid-frequency impulsive sounds and low frequency continuous sound are of greatest concern for effects on marine organisms. Some species may be responsive to the associated particle motion rather than the usual concept of noise (i.e. pressure wave). Noise propagation can be over large distances (tens of kilometres) but transmission losses can be attributed to factors such as water depth and sea bed topography. Noise levels associated with construction activities, such as pile-driving, are typically significantly greater than operational phases (i.e. shipping, operation of a wind farm).</p> <p><b>For other features:</b> Any loud noise made onshore or offshore by construction, vehicles, vessels, tourism, mining etc. that may disturb birds and reduce time spent in feeding or breeding area. Only relevant to birds and sea mammals that spend time on land for breeding purposes (haul-outs). It is unlikely to be relevant to habitat sensitivity assessments. NB: MSFD indicator (2010) states “the proportion of days within a calendar year, over areas of 15’N x 15’E/W in which anthropogenic sound sources exceed either of two levels, 183 dB re 1µPa<sup>2</sup>.s (i.e. measured as Sound Exposure Level, SEL) or 224 dB re 1µPa peak (i.e. measured as peak sound pressure level) when extrapolated to one metre, measured over the frequency band 10 Hz to 10 kHz”</p>	
<p><b>Pressure Benchmark</b> Marine Strategy Framework Directive (MSFD) indicator levels (SEL or peak SPL) exceeded in areas used by features.</p>	
<p><b>Activity Pressure Justification</b> Vessel movement is an important source of underwater noise, with noise emitted typically varying with vessel size whereby larger vessels generate lower frequency sound. Although propeller cavitation is the main source of such noise, gear deployment/towing/hauling, turbulence around the hull and the use of fish finding sonars will also result in noise being transmitted underwater by fishing vessels.</p> <ul style="list-style-type: none"> <li>• Thomsen and Intersessional correspondence group on underwater noise (2007 - 2009), 2009</li> <li>• Defra and UK MMAS, 2010</li> <li>• OSPAR Commission, 2009</li> </ul> <p>For example, the source levels associated with small sea going vessels and echosounders are typically 160-180 dB and 235 (Peak) re 1 µPa-m (RMS), respectively (Thomsen and Intersessional correspondence group on underwater noise (2007 - 2009), 2009). Underwater noise can result in disturbance particularly to mobile receptors such as fish, birds and mammals</p> <ul style="list-style-type: none"> <li>• Thomsen and Intersessional correspondence group on underwater noise (2007 - 2009), 2009</li> </ul>	

<ul style="list-style-type: none"> <li>• OSPAR Commission, 2009</li> <li>• Southall et al., 2007</li> <li>• Van der Graaf et al., 2012</li> <li>• Richardson et al., 1995</li> </ul>
<p><b>Pressure considered “Not Relevant” for features –</b></p> <ul style="list-style-type: none"> <li>• Intertidal biogenic reef: mussel beds</li> <li>• Intertidal coarse sediment</li> <li>• Subtidal biogenic reefs: mussel beds</li> <li>• Intertidal mud</li> <li>• Subtidal coarse sediment</li> <li>• Intertidal sand and muddy sand</li> <li>• Subtidal mud</li> </ul>
<p><b>Insufficient Evidence for the features –</b></p> <p><b>Features considered Not Sensitive to the pressure –</b></p> <ul style="list-style-type: none"> <li>• Subtidal mixed sediments</li> <li>• Subtidal sand</li> </ul>
<p><b>Features considered Sensitive to the pressure –</b></p> <ul style="list-style-type: none"> <li>• Harbour seal</li> <li>• Water column</li> </ul>
<p><b>Discussion (this section generated by Eastern IFCA)</b></p> <p>The shrimp beam trawling activity has continued in the same way for a number of years, and no change has been observed or is anticipated which would bring the pressure in line with those levels identified within the descriptions above.</p> <p>Populations of harbour seals within the site are at a high level, with the feature being considered in favourable condition (Thompson, 2016). Previous significant reductions in the populations have been ascribed to disease outbreaks, rather than other sources such as fishery or construction activities.</p>
<p><b>Conclusion</b></p> <p>As there are no evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, it is not considered that the pressure “underwater noise changes” needs to be addressed further in this assessment.</p> <p><b>There is no adverse effect on site integrity from underwater noise changes.</b></p>

<b>From “Advice on Operations” webpage</b>	
<b>Pressure</b>	<b>Visual disturbance</b>
<b>Pressure Description</b>	
<p>This pressure relates to the disturbance of biota by anthropogenic activities, e.g. increased vessel movements, such as during construction phases for new infrastructure (bridges, cranes, port buildings, offshore platforms, offshore wind farms etc.), increased personnel movements, increased tourism, moving wind turbine blades, increased vehicular movements onshore and offshore disturbing bird roosting areas, rafting areas, feeding areas, seal haul out areas etc.</p>	
<b>Pressure Benchmark</b>	
<b>For Harbour Seals –</b>	
The presence of activity within the visual range of the feature.	
<b>For Water Column &amp; Not Sensitive features –</b>	
Daily duration of transient visual cues exceeds 10% of the period of site occupancy by the feature	
<b>Activity Pressure Justification</b>	
<p>The movement of vessels and people, as well as that of gear, can create visual stimuli which can evoke a disturbance response in mobile species such as fish, marine mammals, seabirds and coastal birds. However, the magnitude of the pressure will depend on the nature, scale, intensity and duration of the activity, plus other factors such as species present and age, weather conditions and degree of habituation to disturbance source.</p> <ul style="list-style-type: none"> <li>• Liley et al., 2012</li> <li>• Schwemmer et al., 2011</li> <li>• Wildfowl and Wetlands Trust Consulting, 2012</li> <li>• BirdLife International, 2012</li> <li>• Rodgers and Schwikert, 2002</li> <li>• Ruddock and Whitfield, 2007</li> <li>• Chatwin et al., 2013</li> <li>• Cutts et al., 2009</li> </ul>	
<b>Pressure considered “Not Relevant” for features –</b>	
<ul style="list-style-type: none"> <li>• Intertidal biogenic reef: mussel beds</li> <li>• Subtidal biogenic reefs: mussel beds</li> <li>• Intertidal mud</li> <li>• Subtidal mixed sediments</li> </ul>	
<b>Insufficient Evidence for the features –</b>	
<b>Features considered Not Sensitive to the pressure –</b>	
<ul style="list-style-type: none"> <li>• Intertidal coarse sediment</li> <li>• Subtidal coarse sediment</li> <li>• Intertidal sand and muddy sand</li> <li>• Subtidal mud</li> <li>• Subtidal sand</li> </ul>	
<b>Features considered Sensitive to the pressure –</b>	
<ul style="list-style-type: none"> <li>• Harbour seal</li> <li>• Water column</li> </ul>	
<b>Discussion (this section generated by Eastern IFCA)</b>	
<p>Populations of Harbour seals within the site are at a high level, with the feature being considered in favourable condition (Thompson, 2016). Previous significant reductions in the populations have been ascribed to disease outbreaks, rather than anthropogenic sources.</p>	

The shrimp beam trawling activity has continued in the same way for a number of years, and no change has been observed or is anticipated which would bring the pressure in line with those levels identified within the descriptions above.

**Conclusion**

As there are no evidence based case or site-specific factors that increase the risk, or uncertainty on the level of pressure on a receptor, it is not considered that the pressure “visual disturbance” needs to be addressed further in this assessment.

**There is no adverse effect on the integrity of the site from visual disturbance.**

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<sup>2</sup> Citations detailed in Natural England advice text (yellow tables) are not detailed in the reference list but can be found through the web link