European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC)

Fourth Report by the United Kingdom under Article 17

on the implementation of the Directive from January 2013 to December 2018

Conservation status assessment for the habitat:

H1140 - Mudflats and sandflats not covered by seawater at low tide

UNITED KINGDOM

IMPORTANT NOTE - PLEASE READ

- The information in this document represents the UK Report on the conservation status of this habitat, submitted to the European Commission as part of the 2019 UK Reporting under Article 17 of the EU Habitats Directive.
- It is based on supporting information provided by the geographically-relevant Statutory Nature Conservation Bodies, which is documented separately.
- The 2019 Article 17 UK Approach document provides details on how this supporting information contributed to the UK Report and the fields that were completed for each parameter.
- The reporting fields and options used are aligned to those set out in the European Commission guidance.
- Maps showing the distribution and range of the habitat are included (where available).
- Explanatory notes (where provided) are included at the end. These provide additional audit trail information to that included within the UK assessments. Further underpinning explanatory notes are available in the related country-level and/or UK offshorelevel reports.
- Some of the reporting fields have been left blank because either: (i) there was insufficient information to complete the field; and/or (ii) completion of the field was not obligatory.
- The UK-level reporting information for all habitats and species is also available in spreadsheet format.

Visit the JNCC website, https://jncc.gov.uk/article17, for further information on UK Article 17 reporting.

NATIONAL LEVEL

1. General information

1.1 Member State	UK
1.2 Hahitat code	1140 - Mudflats and sandflats not covered by seawater at low tide

2. Maps

2.1 Year or period	1996-2018
2.3 Distribution map	Yes
2.3 Distribution map Method used	Based mainly on extrapolation from a limited amount of data
2.4 Additional maps	No

BIOGEOGRAPHICAL LEVEL

3. Biogeographical and marine regions

3.1 Biogeographical or marine region where the habitat occurs

3.2 Sources of information

Marine Atlantic (MATL)

England

ABP Marine Environment Research Ltd. 2011. River Hamble Maintenance Dredge Plan.

ABP Research and Consultancy Ltd. 2000. The Marine Environmental Impact Identification and Evaluation TS/ME2. ABP Southampton: Dibden Terminal, Associated British Ports, Southampton: ABP Research and Consultancy Ltd. ADAS Ltd. 2015. Solent Harbours Nitrogen Management Investigation: ADAS Ltd. Ahern, D. and Hellon, J. 2014. Condition monitoring of the saltmarsh feature of The Wash and the North Noroflk Coast SAC, Volume I: The Wash: Ahern Ecology. Andersen, J.H., Manca, E., Agnesi, S., Al-Hamdani, Z., Lillis, H., Mo, G., Populus, J., Reker, J., Tunesi, L. and Vasquez, M., 2018, European Broad-Scale Seabed Habitat Maps Support Implementation of Ecosystem-Based Management., Open Journal of Ecology, 8, 86-103.

Antill, R., Thomas, P. and Linnane, K. 2017. Natural England baseline intertidal and infralittoral rock survey of the Tweed Estuary SAC: APEM Scientific Report for Natural England.

APEM. 2013. The Wash and North Norfolk Coast SAC: Intertidal mud and sand flats assessment.: APEM.

Associated British Ports (ABP). 2011. Environmental Statement for Port of Southampton: Berth 201 / 202 Works updated by Further Information Associated British Ports.

Atkinson, P. W., Clark, N. A., Clark, J. A., Bell, M. C., Dare, P. J. and Ireland, P. L. 2003. Changes in commercially fished shellfish stocks and shorebird populations in the Wash, England. Biological Conservation, 114, 127-141.

Ball, J., Hill, C., Thomas, N., Kenny, A., Collins, K., Mallinson, J., Sheader, M. and Jenson, A. 2000. Solent and South Wight Mapping of Intertidal and Subtidal Marine cSACs: GeoData Institute.

Bedford, K. and Rees-Jones, S. 2004. Habitats Directive Stage 3 Review of Consents Technical Report. The Solent European Marine Site. The Impacts of Toxic Compounds in Effluents on Sediments.: Environment Agency.

Black & Veatch Ltd. 2011. Baseline Document for Maintenance Dredging in Lymington Harbour.

Bray, M. J., Carter, D. J. and Hooke, J. M. 2004. SCOPAC Sediment Transport Study (1991 and 2004): Lyme Regis to Portland Bill.: Portsmouth

University.http://www.scopac.org.uk/scopac_sedimentdb/chesl/chesl.htm Brazier, D. P. and Murray, E. 1994. Littoral survey of the estuaries of the southeast Scotland and north-east England. : Marine Nature Conservation Reviewhttps://wv-

Brazier, D. P., Davies, J., Holt, R. H. F. and Murray, E. 1998. Marine Nature Conservation Review Sector 5. South-east Scotland and north-east England: area summaries: Joint Nature Conservation Committee (Coasts and Sea of the United Kingdom MNCR Series).

Brils, J. 2008. Sediment monitoring and the European Water Framework Directive. Ann 1st Super Sanita, 44, 218-23.

British Oceanographic Data Centre. 2014. CSEM assessment using data extracted from MERMAN on 1 September 2014 [Online]. [Accessed

02/02/2017].https://www.bodc.ac.uk/projects/data_management/uk/merman/assessments and data access/csemp/

Bunker, F., J., M. and Perrins, J. 2002. Biotope survey of the intertidal of Plymouth Sound and Estuaries European Marine Site, A report to the Marine Conservation Society: MarineSeen.

Centre for Environment Fisheries and Aquaculture Sciences (Cefas), 2001. The impact of disposal of marine dredged material on the Wash and North Norfolk Coast Candidate Special Area of Conservation (cSAC): cefas.

Centre for Environment Fisheries and Aquaculture Sciences (Cefas), 2014. Classification of bivalve mollusc production areas in England & Wales. Alde Estuary. Sanitary Survey Report: Centre for Environment, Fisheries & Aquaculture Science (Cefas).

Centre for Marine and Coastal Studies Ltd. (CMACS). 2012. Solent Maritime SAC intertidal survey report: Centre for Marine and Coastal Studies Ltd. (CMACS), Report for Natural England.

Channel Coastal Observatory (CCO). 2004. Annual Report 2004 Isle of Wight: Channel Coastal

Observatory.http://www.channelcoast.org/data_management/online_data_catal ogue/metadata/search/index2.php?action=view_metadata&id=114091 Channel Coastal Observatory (CCO). 2004. Annual Report 2004 West Solent.:

Channel Coastal

Observatory.http://www.channelcoast.org/data_management/online_data_catalogue/metadata/search/index2.php?action=view_metadata&id=71397

Channel Coastal Observatory (CCO). 2004. Annual Survey Report 2004 Selsey Bill to Southampton Water: Channel Coastal

Observatory.http://www.channelcoast.org/data_management/online_data_catal ogue/metadata/search/index2.php?action=view_metadata2&id=114092&atb=ad d

Channel Coastal Observatory (CCO). 2015. Annual Survey Report 2015 Isle of Wight: Channel Coastal

Observatory.http://www.channelcoast.org/data_management/online_data_catalogue/metadata/search/index2.php?action=view_metadata&id=428027

Channel Coastal Observatory (CCO). 2015. Annual Survey Report 2015 Selsey Bill to Southampton Water: Channel Coastal

Observatory.http://www.channelcoast.org/data_management/online_data_catalogue/metadata/search/index2.php?action=view_metadata&id=427950

Channel Coastal Observatory (CCO). 2015. Annual Survey Report 2015

Southampton Water to Hurst Spit: Channel Coastal

Observatory.http://www.channelcoast.org/data_management/online_data_catal

ogue/metadata/search/index2.php?action=view_metadata&id=428028 Collins, K. 2008. Cowes Harbour entrance seagrass surveys Aug-Sept 08, Final report to Cowes Harbour Commissioners & ABPmer.:

Collins.http://www.dassh.ac.uk/dataDelivery/filestore/1/9/5_57a14c4ea9c23be/195_a702f04785556d1.pdf

Collins, K. and Sym, E. 2016. Seagrass surveys off East Cowes July/August 2016. Report to the Homes and Community Agency and Cowes Outer Harbour Commission.: Collins & Sym.

Curtis, L. 2011. Condition Monitoring of the Intertidal Mudflats and Sandflats Feature at Fal and Helford Marine Sites: Ecospan Environmental Ltd.

Curtis, L. A. 2010. Littoral Biotope Survey and Condition Assessment of the Tamar, Tavy & St John's Lake SSSI: Ecospan Environmental Ltd. for Natural England.

Curtis, L. A. 2010. Lynher Estuary SSSI Intertidal Biotope Survey: Ecospan for Natural England (NE).

Curtis, L. A. 2014. Littoral mud and sandflat condition monitoring and rMCZ verification survey of the Alde Ore and Butley Estuaries SAC, and Alde Ore Estuary rMCZ: : Ecospan Ltd.

Debut. 2007. Tamar Estuary Literature Review on Estuarine Processes: Debut Services (South West) Ltd with Westminster Dredging Co. and Black & Veatch. Devlin, M. J., Barry, J., Mills, D. K., Gowen, R. J., Foden, J., Sivyer, D. and Tett, P. 2008. Relationships between suspended particulate material, light attenuation and Secchi depth in UK marine waters. Estuarine, Coastal and Shelf Science, 79, 429-439.http://www.sciencedirect.com/science/article/pii/S0272771408001881 Dipper, 2003, Wash historical species study and Annex

Downie, A. J. and Gilliland, P. M. 1997. Broad scale biological mapping of Plymouth Sound and Estuaries: Posford Duvivier Environment.

Elliott, M., Nedwell, S., Jones, N. V., Read, S. J., Cutts, N. D. and Hemingway, K. L. 1998. Volume II Intertidal Sand and Mudflats & Subtidal Mobile Sandbanks. An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Oban, Scotland: English Nature.

EMU Ltd. 2004. EMU Solent bird invert prey availability report.: EMU Ltd, Natural England.

English Nature, 1998, NNC maps (fig 4-11) - showing Biotope, Biotope Complex and Life Form

Enviromuir, 2009, Wash intertidal report. Report for Natural England.

Environment Agency (EA). 2008, Sea State Report The Wash 2007-2008. Peterborough: Environment Agency.

Environment Agency (EA). 2009, WFD Monitoring Data 2009 for dissolved oxygen. Peterborough: Environment Agency.

Environment Agency (EA). 2009, WFD Monitoring Data 2009 SPM data.

Peterborough: Environment Agency.

Environment Agency (EA). 2011. Hunstanton Heacham Beach Management Ecological Monitoring Annual Report 2010-2011. Peterborough: Environment Agency.

Environment Agency (EA). 2011. Salinity, Particle Size Analysis and benthic invertebrate data for the Tweed: 2008 and 2011. Peterborough: Environment Agency.

Environment Agency (EA). 2014, TraC Dissolved Oxygen tool-level classifications (at water body level, aggregated to MPA). Peterborough: Environment Agency. Environment Agency (EA). 2014, Using lidar analysis to assess intertidal sediment change from 2008 to 2012. Peterborough: Environment Agency.

Environment Agency (EA). 2014. Chichester Harbour Intertidal survey data.

Peterborough: Environment Agency.

Environment Agency (EA). 2014. Langstone Harbour Intertidal survey data.

Peterborough: Environment Agency.

Environment Agency (EA). 2015. Catchment Planning System - Water Framework Directive Water Bodies in England: 2015 status and objectives for the update to the river basin management plans - Cycle 2.https://ea.sharefile.com/share/view/s0faa355450243538?_k=4895s2

Environment Agency (EA). 2015-2018. EA Catchment Data Explorer [Online]. https://environment.data.gov.uk/catchment-planning/

Environment Agency (EA). 2016. EA guidance and data for assessment of IQI and water quality attributes - MPA Infaunal Quality Index IQI Assessments for Plymouth Sound & Estuaries SAC, 2008-2015. Peterborough: Environment Agency.

Environment Agency (EA). 2016. EA guidance and data for assessment of IQI and water quality attributes - MPA Infaunal Quality Index IQI Assessments Version 4. Peterborough: Environment Agency.

Environment Agency (EA). 2016. Winter DIN Assessment (Nov 2010 - Feb 2016 data) - SACs and SCIs, version 1: Peterborough: Environment Agency.

Environment Agency (EA). 2017, NE EA Wash Intertidal Survey HRA 2017 Final (unpublished). Peterborough: Environment Agency.

Environment Agency (EA). 2017. Fal & Helford Intertidal Seagrass Survey data 2008-2017. Peterborough: Environment Agency.

Environment Agency (EA). 2017. Solent Maritime SAC Suspended Particulate (SPM) Matter Data (extract from WIMS database). Peterborough: Environment Agency.

Environment Agency (EA). 2018, EA guidance and data for assessment of IQI and water quality attributes - MPA Infaunal Quality Index IQI Assessments FINAL 2018 v2. Peterborough: Environment Agency.

Environment Agency (EA). 2018, Wash and North Norfolk Coast SAC - 2017 PSA Results (unpublished). Peterborough: Environment Agency.

ERT Ltd Marine Environmental Consultants. 2005. Solent Intertidal survey August to September 2005.

European Commission (EC). 2017. ENERGY Projects of common interest - Interactive map [Online].

http://ec.europa.eu/energy/infrastructure/transparency_platform/map-viewer/main.html

European Marine Observation Data Network (EMODnet) Seabed Habitats project , 42509, European Marine Observation Data Network (EMODnet) Seabed Habitats project

European Marine Observation Data Network (EMODnet) Seabed Habitats project , 42643, European Marine Observation Data Network (EMODnet) Seabed Habitats project

European Marine Observation Data Network (EMODnet) Seabed Habitats project , 43070, European Marine Observation Data Network (EMODnet) Seabed Habitats project

Foster-Smith, R. L., Sotheran, I., Foster-Smith, J. L. and Bunker, F. 1996. Mapping survey of the sublittoral and littoral biotopes of the Berwickshire coast: Appendix: BioMar Programme.

Foster-Smith. R. L and Gililand. P, 1990s, Using acoustic remote sensing and point samples to map and monitor biota in the dynamic sediments of the Wash, UK GB Non-Native Species Secretariat (GBNNSS). 2015-2018. Non-Native Species Secretariat website [Online]. http://www.nonnativespecies.org Geomatics. 2013. River Tweed elevation change (2003-2009) - Inner:

Environment Agency.

Gutherie, G. and Cottle, R. 2002. Suffolk Coast and Estuaries Coastal Habitat Management Plan: Royal Haskoning.

Guthrie, G., Cooper, N., Howell, D., Cooper, T., Gardiner, J., Lawton, P., Gregory, A. and Stevens, R. 2009. Northumberland and North Tyneside Shoreline Management Plan 2. Northumbrian Coastal Authority Group: Northumbrian Coastal Authority Group.

Hamshire & Isle of Wight Wildlife Trust. 2013. Solent EMS Eelgrass 2013 Surveys 2013-14 Final Report.

Hiscock, K. and Moore, J. 1986. Surveys of harbours, rias and estuaries in southern Britain: Plymouth area including the Yealm. Volume 1: Field Studies Council Oil Pollution Research Unit.

Hubble, M., Pears, S. and Perez-Dominguez, R. 2014. Tweed Estuary SAC: Biotope Survey 2013: APEM Aquatic Scientists.

Isle of Wight Council. 2010. Isle of Wight Shoreline Management Plan 2 - Appendix C: Baseline Process Understanding: Isle of Wight Council.

Jackson, E. L., Griffiths, C. A. and Durkin, O. 2013. A guide to assessing and managing anthropogenic impact on marine angiosperm habitat - Part 1:

Literature review.: Natural

England.http://publications.naturalengland.org.uk/publication/3665058 Jarvis, S., Mazik, K., Allen, J., Thomson, S., Burdon, D. and Cutts, N. 2003. Survey of Littoral Sediments of the Tweed Estuary cSAC.: Institute of Coastal Studies, University of Hull.

Jenkins G., Murphy J., Sexton D., Lowe J. 2009, UK Climate Projections: Briefing Report. Met Office Hadley Centre, Exeter. Available at http://ukclimateprojections.metoffice.gov.uk/22533

Jones, S. N. 1993. A Population Study of the Common Cockle (Cerastoderma edule) in the beds at Helford Passage: Helford Voluntary Marine Conservation Area.

Joyce, C., Teasdale, P. and Waller, C. 2009. A biological survey of the intertidal sediments of Brading Marshes to St Helen's Ledges, Kings Quay Shore and Yar Estuaries Sites of Special Scientific Interest (SSSI) Isle of Wight, for the purpose of SSSI condition assessment.: The Biogeography and Ecology Research Group at the University of Brighton.

Ke, X., Evans, G. and Collins, M. B. 1996. Hydrodynamics and sediment dynamics of The Wash embayment, eastern England. Sedimentology, 43, 157-174.

Knollys, M. 2015. HMNB Devonport Maintenance Dredging and Disposal Marine Licence Application - Information to Support the Baseline Document.

Laing, I., Bussell, J. and Somerwill, K. 2010. Project report: Assessment of the impacts of Didemnum vexillum and options for the management of the species in England.: Natural England; Cefas; Fera

Langston, W. J., Chesman, B. S., Burt, G. R., Hawkins, S. J., Readman, J. and Worsfold, P. 2003. Characterisation of European Marine Sites - Plymouth Sound and Estuaries SAC and SPA: Marine Biological Association (MBA).

Marine Management Organisation (MMO). 2017. Marine Information System (MIS) [Online]. [Accessed

14/11/2017].http://defra.maps.arcgis.com/apps/webappviewer/index.html?id=3 dc94e81a22e41a6ace0bd327af4f346

Marine Management Organisation (MMO). 2017-2018. Marine Information System [Online].

http://defra.maps.arcgis.com/apps/webappviewer/index.html?id=3dc94e81a22e41a6ace0bd327af4f346

Marine Nature Conservation Review (MNCR). 1992. Deben and Ore estuaries

littoral survey: Joint Nature Conservation Committee.

Marine Nature Conservation Review (MNCR). 1992. North-East England estuaries littoral survey: Joint Nature Conservancy Council (JNCC).

Marsden, A. L. 2015. Solent EMS Seagrass Surveys 2014-15, Final Report for Natural England: Hampshire and Isle of Wight Wildlife Trust.

Marsden, A. L. 2016. Solent EMS Seagrass Surveys 2015-16, Final Report for Natural England.: Hampshire & Isle of Wight Wildlife Trust.

Marsden, A. L. and Chesworth, J. C. 2014. Inventory of eelgrass beds in Hampshire and the Isle of Wight (Version 6) Section One: Hampshire and Isle of Wight Wildlife Trust.

Marsden, A. L. and Chesworth, J. C. 2015. Inventory of eelgrass beds in Hampshire and the Isle of Wight 2015, Section One: Report. Version 7: May 2015.: Hampshire and the Isle of Wight Wildlife

Trust.http://www.hiwwt.org.uk/sites/default/files/files/Reports/Eelgrass-Section 1_Report_2015_92pp_FINAL.pdf

Marsden, A. L. and L, S. A. 2015. Inventory of eelgrass beds in Hampshire and the Isle of Wight 2014, Section Two: Data: Hampshire and Isle of Wight Wildlife Trust. Marsden, A. L. and L, S. A. 2015. Inventory of eelgrass beds in Hampshire and the Isle of Wight 2015, Section Two: Data: Hampshire and Isle of Wight Wildlife Trust. Martin Wright Associates. 2011. Berwick Upon Tweed Estuary Study Stage 2 - Estuary Modelling Study Report: Martin Wright

Associates.http://www.northumberland.gov.uk/idoc.ashx?docid=511e1884-61ae-46c5-85d3-dff95ea46710&version=-1

MERMAN, 2016, CSEMP assessment using data extracted from MERMAN on 19 October 2016

MESL. 2012. Chichester Harbour assessment of bird prey availability: MESL.

MESL. 2015. Chichester Harbour SSSI Intertidal Mudflat Data Review. Chichester Harbour SSSI - 2015: MESL.

Moore, J., Smith, J. and Northen, K. O. 1999. Marine Nature Conservation Review: Sector 8. Inlets in the western English Channel: area summaries Peterborough: Joint Nature Conservation Committee (JNCC).

National Biodiversity Network Atlas, 2012-2018, NBN Gateway - species data [Online]. https://nbnatlas.org/

Natural England (NE). 2015. Fal & Helford Pacific Oyster Surveys 2014 & 2015: Natural England.

Natural England (NE). 2017. Fal & Helford Pacific Oyster Surveys 2016 & 2017: Natural England.

Natural England, 2013, Definitions of favourable condition for designated features of interest - Alde Ore Estuary SSSI, Definitions of favourable condition for designated features of interest - Alde Ore Estuary SSSI

Natural England, 2013, Mudflats and sandflats Evaluation spreadsheet

Natural England, 2013, Mudflats and sandflats review

Natural England, 2014, Site improvement plan - Alde-Ore Estuaries: Natural England.http://publications.naturalengland.org.uk/file/4785471632703488 Natural England, 2016, Natural England Conservation Advice for Marine

Protected Areas, Alde, Ore and Butley Estuaries UK0030076,

https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?Sit eCode=UK0030076&SiteName=alde&countyCode=&responsiblePerson=Natural England, 2018, marine GI database 2018

Natural England, 2016, Natural England Conservation Advice for Marine Protected Areas, Drigg Coast UK0013031,

https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?Sit eCode=UK0013031&SiteName=drigg coast&countyCode=&responsiblePerson=

Natural England, 2016, Natural England Conservation Advice for Marine Protected Areas, Essex Estuaries UK0013690,

https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0013690&SiteName=Essex

Estuaries&countyCode=&responsiblePerson=

Natural England, 2017, Natural England Conservation Advice for Marine Protected Areas, Fal and Helford UK0013112,

https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0013112&SiteName=fal

and&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

Natural England, 2017, Natural England Conservation Advice for Marine Protected Areas, Humber Estuary UK0030170,

https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0030170&SiteName=humber&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

Natural England, 2018, Natural England Conservation Advice for Marine Protected Areas, Morecambe Bay UK0013027,

https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0013027&SiteName=morecambe&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

Natural England, 2017, Natural England Conservation Advice for Marine Protected Areas, Plymouth Sound and Estuaries UK0013111,

https://designated sites.natural england.org.uk/Marine/MarineSiteDetail.aspx? SiteCode=UK0013111 & SiteName=plymouth & countyCode=& responsible Person=& Sea Area=& IFCAArea=

Natural England, 2018, Natural England Conservation Advice for Marine Protected Areas, Solent Maritime UK0030059,

https://designated sites.natural england.org.uk/Marine/MarineSiteDetail.aspx? SiteCode=UK0030059 & SiteName=solent & countyCode=& responsible Person=

Natural England, 2017, Natural England Conservation Advice for Marine

Protected Areas, The Wash and North Norfolk Coast UK0017075,

https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0017075&SiteName=the wash

and&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

Natural England, 2017, Natural England Conservation Advice for Marine Protected Areas, Tweed Estuary UK0030292,

https://designated sites.natural england.org.uk/Marine/MarineSiteDetail.aspx? SiteCode=UK0030292 & SiteName=tweed & countyCode=& responsiblePerson=& SeaArea=& IFCAArea=

Natural England, 2018, NE INNS GI Layer [accessed 10/04/2018].

NBN Atlas, 2018, NBN Gateway - species data

New Forest District Council (NFDC). 2010. North Solent Shoreline Management Plan - Appendix C: Baseline Process Understanding: New Forest District Council.

North East Coastal Observatory. on-going. North East Coastal Observatory website [Online]. North East Coastal Observatory

].http://www.necoastalobservatory.co.uk

Perrins, J. and Bunker, F. 1998. Biotope survey of the littoral sediments of the north Norfolk coast cSAC.: English Nature.

PMA. 2004. A desk study to assess the impact of dredging activity on the Tamar Estuary: PMA Applications Ltd.

Populus J., Vasquez M., Albrecht J., Manca E., Agnesi S., Al Hamdani Z., Andersen J., Annunziatellis A., Bekkby T., Bruschi A., Doncheva V., Drakopoulou V., Duncan G., Inghilesi R., Kyriakidou C., Lalli F., Lillis H., Mo G., Muresan M., Salomidi M.,

Sakellariou D., Simboura M., Teaca A., Tezcan D., Todorova V. and Tunesi L., 2017, EUSeaMap, a European broad-scale seabed habitat map.

Rees-Jones, S., Robinson, K. and Udal, I. 2014. Langstone Harbour Water Framework Directive DIN and Ecological Impact Investigations, Monitoring Period 2007 to 2012. Environment Agency, South East Region, Marine Report No: 10304: Environment Agency.

Rees-Jones, S., Robinson, K. and Udal, I. 2014. Newtown Harbour Water Framework Directive DIN and Ecological Impact Investigations, Monitoring Period 2007 to 2012. Environment Agency, South East Region, Marine Report No: 10308: Environment Agency.

Rees-Jones, S., Robinson, K., Udal, I. and Schroeder, S. 2014. Western Yar (IOW) Water Framework Directive DIN and Ecological Impact Investigations, Monitoring Period 2007 to 2012. Environment Agency, South East Region, Marine Report No: 10310: Environment Agency.

Roberts, N. and Edwards, T. 1996. Falmouth Bay and Estuaries A Nature Conservation Overview: Environmental Consultants (CTNC) Ltd.

Robins P. E., Skov M. W., Lewis M. J., Gimenez Luis, Davies A. G., Malham S. K., Neill S. P., McDonald J. E., Whitton T. A., Jackson S. E., Jago C. F. 2016. Impact of climate change on UK estuaries: A review of past trends and potential projections, Estuarine, Coastal and Shelf Science, 169, 119-135,

Rostron, D. 1987. Surveys of Harbours, rias and estuaries in southern Britain: the Helford River., Nature Conservancy Council (NCC).

Rostron, D. and Nature Conservancy Council 1986. Survey of Harbours, Rias and Estuaries in Southern Britain: Falmouth; Volume 1 Report, Nature Conservancy Council (NCC). http://books.google.co.uk/books?id=znMxMwEACAAJ Russel, T. and Selley, H. 2013. Lower Fal and Helford Intertidal SSSI Baseline Survey - Draft: Natural England Research Report.

Scanlan, C. M., Foden, J., Wells, E. and Best, M. A. 2007. The monitoring of opportunistic macroalgal blooms for the water framework directive. Marine Pollution Bulletin, 55, 162-171.

http://www.sciencedirect.com/science/article/pii/S0025326X06004115 Selley, H., Bailey, E. and McNair, S. 2014. Isles of Scilly SAC: Intertidal Underboulder Communities Survey 2011: Natural England (NE). http://publications.naturalengland.org.uk/publication/4790649433882624 Sheahan, D., Brook, S., Raffo, A., Smedley, C. and Law, R. 2007. A Review of Contaminant Status of SEA 8 covering the Western Approaches, Celtic Sea and English Channel: Centre for Environment, Fisheries and Aquaculture Science (Cefas).

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file /197007/SEA8_TechRep_Contaminants.pdf

Southern Inshore Fisheries Conservation Authority (SIFCA). 2017. Prohibition of Gathering (Sea Fisheries Resources) in Seagrass Beds [Online]. [Accessed 22/03/2017]. http://www.southern-ifca.gov.uk/byelaws

Prohibition of gathering (seafisheries resources) in Seagrass Beds

Spalding Associates. 2001. Mapping of saltmarsh in the Fal and Helford SAC (GIS only).

The Crown Estate, 2017, Marine Aggregates Capability & Portfolio 2017, https://www.thecrownestate.co.uk/media/2483/marineplusaggregates_2017_w eb.pdf

Thomas, P. M. D., Pears, S., Hubble, M. and Perez-Dominguez, R. 2016. Intertidal sediment surveys of Langstone Harbour SSSI, Ryde Sands and Wootton Creek SSSI and Newtown Harbour SSSI.: APEM.

http://publications.naturalengland.org.uk/publication/5671999146295296

Tompsett, P. E. 1997. Helford River Survey Monitoring Report No. 5 for 1996: Helford Voluntary Marine Conservation Area.

Tompsett, P. E. and H.M.V.C.A. Group. 2011. Helford River Survey, Helford Voluntary Marine Conservation Area, Monitoring Report No.6, Intertidal transect monitoring review incorporating data from 1986 to 1999: Helford Voluntary Marine Conservation Area Group.

Udal, I., Rees-Jones, S. and Robinson, K. 2014. Chichester Harbour Water Framework Directive DIN and Ecological Impact Investigations, Monitoring Period 2007 to 2012. Environment Agency, South East Region, Marine Report No: 10331: Environment Agency.

Uncles, R. J., Bloomer, N. J., Frickers, P. E., Griffiths, M. L., Harris, C., Howland, R. J. M., Morris, A. W., Plummer, D. H. and Tappin, A. D. 2000. Seasonal variability of salinity, temperature, turbidity and suspended chlorophyll in the Tweed Estuary. Science of the Total Environment, 251, 115-124.

Unicomarine. and Rees-Jones, S. 2004. Impact of Effluent Discharges on the Intertidal Benthic Community in the Solent Maritime European Site.: Environment Agency (EA).

University of Brighton. 2009. Intertidal Lee-on-the-Solent to Itchen Estuary, Medina Estuary, North Solent, Thanet Coast and Thorness Bay Sediment Survey Condition Assessment: University of Brighton.

URS. 2014. Estuary Characterisation Report, Solent Maritime Estuaries. Report by URS for Natural England, RP1661.: URS.

Walling, D. E., Owens, P. N., Waterfall, B. D., Leeks, G. J. L. and Wass, P. D. 2000. The particle size characteristics of fluvial suspended sediment in the Humber and Tweed catchments, UK. The Science of the Total Environment, 251/252, 205-222. Ware, S. and Meadows, B. 2011. Monitoring of Plymouth Sound and Estuaries SAC: CEFAS.

Williams, P. 2004. Solent CASI Survey, Environment Agency, Science Group - Technology: Environment Agency; Natural England.

Wood, C. A., Bishop, J. D. D., Nall, C. R. and Rennocks, I. 2017. Marine Biological Association: RAS 2016 Non-Native Species Rapid Assessment Surveys in English Marinas - NE and SW Coasts (June 2017): The Bromley

Trust.http://www.thebromleytrust.org.uk/index.php?/articles--documents/ Yarmouth Harbour (Isle of Wight) Commissioners and Isle of Wight Estuaries Project. 2004. Western Yar Estuary Baseline Document Volume I - 2011 Maintenance Dredging Protocol 2004.

Yates, M. G., Garbutt, R. A., Barratt, D. R., Turk, A., Brown, N. J., Rispin, W. E., McGrorty, S., le Vdit Durell, S. E. A. and Goss-Custard, J. D. 1999. Littoral sediments of the Wash and North Norfolk Coast SAC: The 1998 and 1999 surveys of intertidal sediment and invertebrates.

N.Ireland

McAdams Design, 2017. Dundrum Bay Inner Designated Shellfish Waters Catchment Investigation Final Report

DAERA, 2017. River Basin Management Plan WFD 2nd Cycle Classification Summary-Strangford Lough North. Internal Document

DAERA, 2017. River Basin Management Plan WFD 2nd Cycle Classification Summary-Strangford Lough South.Internal Document

DAERA, 2017. River Basin Management Plan WFD 2nd Cycle Classification Summary- Inner Dundrum Bay. Internal Document Scotland

Harries, D.B., Moore, C.G., Cook, R.L. & Brash, J. 2015. 2014 site check survey and biotope mapping of the intertidal sediment flats of the Loch Moidart and Shiel Woods SAC. Scottish Natural Heritage Commissioned Report No. 809.

Moore, C.G., Harries, D.B., Brash, J. & Tulbure, K.W. 2016. 2015 site condition monitoring survey and biotope mapping of the intertidal sediment flats of Loch Paible, North Uist (Balranald Bog and Loch nam Feithean SSSI). Scottish Natural Heritage Commissioned Report No. 922.

Moore, C.G., Harries, D.B., Lyndon, A.R., Mair, J.M., Tulbure, K.W., Saunders, G.R, Grieve, R. & Brash, J. 2016. 2015 site condition monitoring and site check surveys of marine sedimentary and reef habitats in the Loch nam Madadh SAC, Loch nam Madadh SSSI and Loch an Duin SSSI. Scottish Natural Heritage Commissioned Report No. 923.

Allen, J.H. 2018. Infaunal and PSA analyses of benthic samples collected from the South of Skye, Southannan Sands SSSI and Mousa SAC / MPA in 2016. Scottish Natural Heritage Commissioned Report No. 1037.

Schumacher, J., Dolch, T., & Reise, K. (2014). Transitions in sandflat biota since the 1930s: effects of sea-level rise, eutrophication and biological globalization in the tidal bay Konigshafen, northern Wadden Sea. Helgoland marine research, 68(2), 289.

Frid, C. L. J., Chandrasekara, W. U., & Davey, P. (1999). The restoration of mud flats invaded by common cord-grass (Spartina anglica, CE Hubbard) using mechanical disturbance and its effects on the macrobenthic fauna. Aquatic Conservation: Marine and Freshwater Ecosystems, 9(1), 47-61.

Gill, (2012) Processes influencing bird use of estuarine mudflats and saltmarshes in western Europe in: J. A. Fuller, R. J. (Ed.). (2012). Birds and habitat: relationships in changing landscapes. Cambridge University Press.

Tyler-Walters, H., & Arnold, C. (2008). Sensitivity of Intertidal Benthic Habitats to Impacts Caused by Access to Fishing Grounds.

Mossman, H., Grant, A., & Davy, A. J. (2013). Implications of climate change for coastal and inter-tidal habitats in the UK. University of East Anglia. Biodiversity Report Card paper 10.

Guy-Haim, T., Lyons, D. A., Kotta, J., Ojaveer, H., Queiros, A. M., Chatzinikolaou, E., & Orav-Kotta, H. (2018). Diverse effects of invasive ecosystem engineers on marine biodiversity and ecosystem functions: A global review and meta-analysis. Global change biology.

Blaber, S. J., Cyrus, D. P., Albaret, J. J., Ching, C. V., Day, J. W., Elliott, M., ... & Silvert, W. (2000). Effects of fishing on the structure and functioning of estuarine and nearshore ecosystems. ICES Journal of Marine Science, 57(3), 590-602. Ferns, P. N., Rostron, D. M., & Siman, H. Y. (2000). Effects of mechanical cockle harvesting on intertidal communities. Journal of Applied Ecology, 37(3), 464-474. Piersma, T., Koolhaas, A., Dekinga, A., Beukema, J. J., Dekker, R., & Essink, K. (2001). Long-term indirect effects of mechanical cockle-dredging on intertidal bivalve stocks in the Wadden Sea. Journal of Applied Ecology, 38(5), 976-990. Woolmer, Andrew. Appropriate assessment and shellfisheries: adaptive management protocol. Report to shellfish industry development strategy. Salacia-Marine Ltd (2009).

Shepherd, P. C., & Boates, J. S. (1999). Effects of a commercial baitworm harvest on semipalmated sandpipers and their prey in the Bay of Fundy hemispheric shorebird reserve. Conservation Biology, 13(2), 347-356.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., Editors. (2011). Scotland's Marine Atlas: information for the national marine plan. Marine Scotland, Edinburgh. Available from:

http://www.gov.scot/Topics/marine/science/atlas

Scotland's Dynamic Coast - National Coastal Change Assessment.

http://www.dynamiccoast.com/

Scottish Climate Change Adaptation Programme.

http://www.gov.scot/Resource/0045/00451392.pdf Wales

Atkins. 2010. SMP 19, Anchor Head to Lavernock Point (Severn Estuary) Shoreline Management Plan (SMP) Review.

Bergmann M, Gutow L, Klages M. 2015. Marine Anthropogenic Litter. https://link.springer.com/content/pdf/10.1007%2F978-3-319-16510-3.pdf Bohn K. 2014. The distribution and potential northwards spread of the invasive slipper limpet Crepidula fornicata in Wales, UK. NRW Evidence Report No: 40,

43pp, Natural Resources Wales, Bangor.

Brazier DP. 2013. Evaluating intertidal Zostera noltii beds - field survey vs remote sensing. CCW Marine Monitoring Report No. 103. CCW, Bangor

Brazier DP, Robinson K. In prep. Article 17 GIS processing notes for Mudflats and Sandflats. Draft internal report, NRW.

Davies J, Wray B, Brazier DP. 2017. Intertidal SAC monitoring of Zostera marina at Porth Dinllaen, Pen Llyn a'r Sarnau SAC, 2016. Natural Resources Wales Evidence Report No. 064, Bangor.

Duggan-Edwards M, Brazier DP. 2015. Intertidal SAC monitoring Zostera noltii in Angle Bay, Pembrokeshire Marine SAC 2013. NRW Evidence Report No: 55, 38pp + 'xi, Natural Resources Wales, Bangor.

Duigan CA, Rimington NA, Howe MA. (Eds). 2014. Coastal storms December 2013 & January 2014 - an assessment of environmental change. Natural Resources Wales Evidence Report No: 33, 122pp, Natural Resources Wales, Bangor.

Egerton J, Morris L, Goudge H, Brazier P. 2010. Intertidal Phase 1 mapping from Pen-ychain to Criccieth, Pen Llyn a'r Sarnau SAC CCW Science Report No 953. 30pp, Countryside Council for Wales, Bangor.

Edwards P. 2014. Nutrient concentrations in the Milford Haven catchment area. Tech. memo: TMW14-09 Natural Resources Wales. NRW.

Environmental Protection (Microbeads) (Wales) Regulations 2018 was voted on and passed by the Welsh Assembly in June 2018

(http://www.assembly.wales/laid documents/sub-ld11558-em/sub-ld11558-em-e.pdf) - Explanatory Memorandum prepared by the Department for Economy, Skills and Natural Resources and laid before the National Assembly for Wales on the 18th May 2018.

European Commission (1992) The Habitats Directive (1992)

http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en. htm

European Commission (2000) The EU Water Framework Directive

European Commission (2008) The Marine Strategy Framework Directive

http://ec.europa.eu/environment/water/water-framework/index en.html

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0056.

http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index en.htm

European Commission (2014) The Common Fisheries Policy (CFP)

https://ec.europa.eu/fisheries/cfp_en

Gall SC, Thompson RC. 2015. The impact of debris on marine life. Mar Pol Bull 92: 170-179.

Galloway TS, Lewis CN. 2016. Marine microplastics spell big problems for future generations. PNAS vol. 113 No. 9: 2331-2333.

Haines I, Edwards P. 2016. Evidence Review of the Trophic Status of the Milford Haven Waterway. NVZ review, Natural Resources Wales.

Halcrow. Group. 2012. SMP 20 Lavernock Point to St Ann's Head (South Wales) Shoreline Management Plan SMP2. Available from:

http://www.npt.gov.uk/ldpexamination/SWW03 Shoreline Management Plan 2

Main Document (2012).pdf.

Halcrow Group. 2012. SMP 22 Great Ormes Head to Scotland (North West England and North Wales) Shoreline Management Plan SMP2. Available from:

http://www.allerdale.gov.uk/downloads/nw_shoreline_management_plan_2.pdf

HM Government (1981) Wildlife and Countryside Act 1981

https://www.legislation.gov.uk/ukpga/1981/69/section/14

HM Government (1989) Electricity Act 1989 (Section 36)

https://www.legislation.gov.uk/ukpga/1989/29/section/36

HM Government (2008) Planning Act 2008

https://www.legislation.gov.uk/ukpga/2008/29/part/3/crossheading/energy

HM Government (2009) Marine and Coastal Access Act 2009

https://www.legislation.gov.uk/ukpga/2009/23/contents

HM Government (2010) The Scallop Fishing (Wales) (No.2) Order 2010:

http://www.legislation.gov.uk/wsi/2010/269/contents/made

HM Government (2017) Wales Act 2017

http://www.legislation.gov.uk/ukpga/2017/4/section/39/enacted

HM Government (2017) The Conservation of Habitats and Species Regulations

2017 http://www.legislation.gov.uk/uksi/2017/1012/contents/made

IMO. 2014. International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)

http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/Internatio nal-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-(BWM).aspx

Jones D, Bain V, Dawson S, Watt T. 2011. Assessing the vulnerability of marine habitats in Wales to the impacts of climate change. CCW contract science reports. Report No 969, 192pp, CCW, Bangor

Manuel Nicolaus EE, Barry J. 2015. Imposex in the dogwhelk (Nucella lapillus): 22-year monitoring around England and Wales. Environ Monit Assess (2015) 187:736).

Mercer TS. 2011. Across-Wales intertidal SAC monitoring, Pen Llyn a'r Sarnau SAC July 2010. CCW Marine. Monitoring Report No: 88, pp 70 + vii, Aquatic Survey & Monitoring Ltd. Bollihope, Co. Durham.

Mercer TS. 2013. Intertidal SAC monitoring, Pen Llyn a'r Sarnau SAC July 2012. CCW Marine Monitoring Report No: 102, pp 68 + x, Aquatic Survey & Monitoring Ltd. Bollihope, Co. Durham.

Mercer TS. 2016a. Intertidal monitoring, Pen Llyn a'r Sarnau SAC August 2013. NRW Evidence Report No. 58, pp 67 + x, Natural Resources Wales, Bangor. Mercer T S. 2016b. Across-Wales intertidal SAC monitoring, Pen Llyn a'r Sarnau SAC August 2014. NRW Evidence Report No: 75, pp 95 + vii, Aquatic Survey & Monitoring Ltd. Harehope Quarry, Co. Durham.

Mieszkowska N. 2014. MarClim Annual Welsh Intertidal Climate Monitoring Survey 2013. Report to Natural Resources Wales. NRW Evidence Report No 005, 30 +x pp, NRW, Bangor.

Mieszkowska N. 2015. MarClim Annual Welsh Intertidal Climate Monitoring Survey 2014. Natural Resources Wales Evidence Report No. 050. NRW, Bangor Mieszkowska N. 2017. MarClim Annual Welsh Intertidal Climate Monitoring Survey 2016. Natural Resources Wales Evidence Report No. 205 pp 27 + viii, Natural Resources Wales, Bangor.

Mieszkowska N. 2018. MarClim Annual Welsh Intertidal Climate Monitoring Survey 2017. Natural Resources Wales Evidence Report No. 256 pp 22 + x, Natural Resources Wales, Bangor. University, Bangor UK.

Mieszkowska N, Adam L, Sugden H. 2016. MarClim Annual Welsh Intertidal Climate Monitoring Survey 2015. Natural Resources Wales Evidence Report No.

161, pp 29 + xii, Natural Resources Wales, Bangor.

Moore J. 2012a. Surveys of cockle and mussel stocks in the Burry Inlet, 2009.

CCW Marine Monitoring Report No: 99, 36pp + iv, CCW, Bangor

Moore J. 2012b. Surveys of cockle and mussel stocks in the Burry Inlet, 2011. CCW Marine Monitoring Report No: 93, 25pp + iv.

Moore J, Brazier DP. 2013. Across-Wales intertidal SAC monitoring, Menai Strait & Conwy Bay SAC, July 2010. CCW Marine Monitoring Report No: 85, 85pp + vii, Countryside Council for Wales, Bangor

Moore J. In prep b. Menai Strait and Conwy Bay SAC intertidal monitoring, 2010 to 2016. NRW Evidence Report No: xxx, ix + ?pp, Natural Resources Wales, Bangor.

Nelms SE, Coombes C, Foster LC, Galloway TS, Godley BJ, Lindeque PL, Witt MJ. 2017. Marine anthropogenic litter on British beaches: a 10-year nationwide assessment using citizen science data. Sci. Total Environ. 579, 1399-1409.

NRW. 2013. H1140 Mudflats and sandflats 2013 Article 17 report WALES. Natural Resources Wales, Bangor.

NRW. 2014. Environmental Pressures on the Milford Haven Waterway. Report No. A&R/SW/14/1. Natural Resources Wales. Cardiff

NRW. 2015. Water Watch Wales maps gallery. Cycle 2 waterbodies and rivers. Available:

https://nrw.maps.arcgis.com/apps/webappviewer/index.html?id=2176397a06d6 4731af8b21fd69a143f6

NRW. 2015. LIFE N2K Thematic Action Plans,

https://naturalresources.wales/about-us/our-projects/nature-projects/life-n2k-wales/life-n2k-thematic-action-plans/?lang=en

NRW. 2018a. Indicative feature condition assessments for European marine sites (EMS). [Online]. Available from: https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/find-protected-areas-of-land-and-seas/indicative-feature-condition-assessments-for-european-marine-sites-ems/?lang=en

NRW. 2018b. Dee Estuary / Aber Dyfrdwy Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 229, 35pp, NRW, Bangor

NRW. 2018c. Glannau Mon: Cors heli / Anglesey Coast: Saltmarsh Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 225, 29pp, NRW, Bangor.

NRW. 2018d. Y Fenai a Bae Conwy / Menai Strait and Conwy Bay Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 232, 33pp, NRW, Bangor.

NRW. 2018e. Pen Llyn a'r Sarnau / Lleyn Peninsula and the Sarnau Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 234, 58pp, NRW, Bangor.

NRW. 2018f. Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 233, 67pp, NRW, Bangor.

NRW. 2018g. Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 227, 49pp, NRW, Bangor.

NRW. 2018h. Severn Estuary / Mor Hafren Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 235, 41pp, NRW, Bangor.

NRW. 2018j. Bae Cemlyn / Cemlyn Bay Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series,

Report No: 228, 22pp, NRW, Bangor.

Pears S. in prep. Milford Haven inlets infauna, sediment particle size and chemistry monitoring report. NRW Evidence Report No xx. Pp xx + xx. APEM.

Pears S. in prep. Three Rivers inlets infauna, sediment particle size and chemistry monitoring report. NRW Evidence Report No xx. Pp xx + xx. APEM.

Pembrokeshire Marine SAC (internet accessed 2018). Pembrokeshire Sustainable Shellfish Pilot Initiative: http://www.pembrokeshiremarinesac.org.uk/pssi.html Royal Haskoning. 2012. SMP 21 St Ann's Head to Great Ormes Head (West of Wales) Shoreline Management Plan 2. Available from:

http://www.westofwalessmp.org/.

Sambrook K, Griffith K, Jenkins SR. 2014. Review of Monitoring of Marine Nonnative Species in Great Britain and Evaluation of Gaps in Data Dissemination.

NRW Evidence Series. Report No: 20, 36 pp, NRW, Bangor.

The Sea Fish (Specified Sea Areas) (Prohibition of Fishing Method) (Wales) Order 2012 No. 2571).

The Single Use Carrier Bags Charge (Wales) Regulations 2010

(http://www.legislation.gov.uk/wsi/2010/2880/contents/made) came into force on the 1 October 2011 and brought into effect a charge of 5p for all plastic bags formerly given out for free by retailers.

Thomas R. 2014. Diffuse Water Pollution in Wales. Issues, solutions and engagement for action. Natural Resources Wales. Cardiff. Accessed 29/09/2015 https://naturalresources.wales/media/4059/diffuse-water-pollution-in-wales.pdf)

Tidal Lagoon Power http://www.tidallagoonpower.com/projects/swansea-bay/ Welsh National Marine Plan (draft). 2018. https://beta.gov.wales/draft-welsh-national-marine-plan.

Wyn G, Brazier P, Birch K, Bunker A, Cooke A, Jones M, Lough N, McMath A, Roberts S. 2006. Handbook for the marine intertidal phase 1 biotope mapping survey. ISBN: 1 86169 144 0

JNCC, 2018a. Marine Habitat Mapping Products. http://jncc.defra.gov.uk/page-6639

JNCC, 2018b. SACs with Marine Components. https://jncc.gov.uk/our-work/uk-marine-protected-area-datasets-for-download/#special-areas-of-conservation-with-marine-components-all-uk-waters

4. Range

4.1 Surface area (in km²)

4.2 Short-term trend Period

4.3 Short-term trend Direction

4.4 Short-term trend Magnitude

4.5 Short-term trend Method used

4.6 Long-term trend Period

4.7 Long-term trend Direction

4.8 Long-term trend Magnitude

4.9 Long-term trend Method used

4.10 Favourable reference range

3247

UK

2007-2018

Stable (0)

a) Minimum

b) Maximum

Based mainly on expert opinion with very limited data

3247

a) Minimum

b) Maximum

a) Area (km²)

b) Operator

c) Unknown No

d) Method

Range is determined by physical, rather than biological processes, therefore, the current range of mudflats and sandflats is considered the favourable reference range.

The known range has increased due to improved knowledge and this has led a change in the favourable reference range.

4.11 Change and reason for change in surface area of range

Improved knowledge/more accurate data

The change is mainly due to: Improved knowledge/more accurate data

4.12 Additional information

4.1- The range of mudflats and sandflats is determined by physical and geological processes and was not related to the biological communities or processes supported by them. Therefore, the range was considered equivalent to the surface area of the habitat.

4.3- As this feature is defined by substrate type rather by a specific biological community, its range is determined by physical and geological processes. Mudflats and sandflats are widespread along open coasts, bays and estuaries and encompass parts of the coasts where the sedimentary regime allows. The geographic range of mudflats and sandflats in the UK has remained relatively stable since the last ice age. Although the physical area of some individual sand and mudflats may have changed due to erosion, land claim or other anthropogenic pressures there is no evidence that this has significantly affected the range of the feature. The short-term trend is, therefore, thought to be stable. 4.11-As a result of improved mapping of the habitat, the surface area of range for UK mudflats and sandflats is larger than the figure that was reported in 2013 For further details on the approach taken please refer to JNCC website for 2019 UK Approach Document.

5. Area covered by habitat

5.1 Year or period	2006-2018		
5.2 Surface area (in km²)	a) Minimum	b) Maximum	c) Best single 3246.63 value
5.3 Type of estimate	Best estimate		varac

5.4 Surface area Method used

5.5 Short-term trend Period

5.6 Short-term trend Direction

5.7 Short-term trend Magnitude

5.8 Short-term trend Method used

5.9 Long-term trend Period

5.10 Long-term trend Direction

5.11 Long-term trend Magnitude

5.12 Long-term trend Method used

5.13 Favourable reference area

Based mainly on extrapolation from a limited amount of data

2007-2018

Uncertain (u)

a) Minimum b) Maximum

c) Confidence

interval

Insufficient or no data available

a) Minimum

b) Maximum

c) Confidence

interval

a) Area (km²) 3247

b) Operator

c) Unknown No

d) Method

There is no reason to believe that the current area of the feature is below that required to maintain viability, so the feature is considered at its favourable reference area. The known surface area has increased due to improved mapping and this had led to a change in the favourable reference area.

5.14 Change and reason for change in surface area of range

5.15 Additional information

Improved knowledge/more accurate data

The change is mainly due to: Improved knowledge/more accurate data

5.1- The data sources used to produce the surface area map ranged from 1996 to 2018.

5.4- The 2013 UK Article 17 area data for Annex I Mudflats and Sandflats was revised at a UK level by the JNCC following updates submitted by the UK Country Agencies. For further details see JNCC website (JNCC 2018a).

5.6-Expert judgement was used to determine the short-term trend direction at the UK-level. The largest proportion of this resource is in England inshore waters. There have been huge improvements to the mapping of this feature in England inshore waters, therefore, a spatial comparison against previous datasets is not possible.

The feature is thought to be stable in Scotland inshore waters and there are some known losses in Wales inshore waters.

5.14-As a result of improved mapping of the habitat, the surface area of UK mudflats and sandflats is larger than the figure reported in 2013.

For further details on the approach taken please refer to the JNCC website for the 2019 UK Approach Document.

6. Structure and functions

6.1 Condition of habitat

a) Area in good condition Minimum 1447.10917 Maximum 1447.10917 (km²)
b) Area in not-good Minimum 1256.1509 Maximum 1256.1509 condition (km²)
c) Area where condition is Minimum 543.36379 Maximum 543.36379 not known (km²)

6.2 Condition of habitat Method used

6.3 Short-term trend of habitat area in good condition Period

6.4 Short-term trend of habitat area in good condition Direction

6.5 Short-term trend of habitat area in good condition Method used

6.6 Typical species

6.7 Typical species Method used

6.8 Additional information

Based mainly on extrapolation from a limited amount of data

2007-2018

Decreasing (-)

Based mainly on expert opinion with very limited data

Has the list of typical species changed in comparison to the previous No reporting period?

6.1-The area of habitat in 'good' (favourable) 'not good (unfavourable) and unknown condition was assessed in each of the four countries and the results were summed. 39% of the habitat is thought to be in unfavourable (not good) condition, 45% of the habitat is thought to be in favourable (good condition) and 17% of the habitat is in unknown condition. The structure and functions conservation status is, therefore, unfavourable-bad, it was also unfavourable-bad in 2013.

6.4-The short-term trend of habitat in good condition was assessed by the four countries and the results were aggregated (see 2019 UK Approach Document). The short-term trend has changed from improving in 2013 to decreasing in 2019 as a result of coastal squeeze in England, where the highest proportion of UK Mudflats and Sandflats are found.

For details on the approach taken to assess the condition of the habitat and the short-term trend in condition please refer to the JNCC website for 2019 UK

Approach Document and country-level reporting information.

7. Main pressures and threats

7.1 Characterisation of pressures/threats	
Pressure	Ranking
Agricultural activities generating marine pollution (A28)	M
Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging) (E03)	M
Sports, tourism and leisure activities (F07)	M
Modification of coastline, estuary and coastal conditions for development, use and protection of residential, commercial, industrial and recreational infrastructure and areas (including sea defences or coastal protection works and infrastructures) (F08)	Н
Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations and disturbance of species (G01)	H
Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats (G03)	Н
Introduction and spread of species (including GMOs) in marine aquaculture (G17)	M
Other invasive alien species (other then species of Union concern) (IO2)	Н
Mixed source marine water pollution (marine and coastal) (J02)	Н
Sea-level and wave exposure changes due to climate change (NO4)	M
Threat	Ranking
Wind, wave and tidal power, including infrastructure (D01)	M
Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging) (E03)	M
Sports, tourism and leisure activities (F07)	M
Modification of coastline, estuary and coastal conditions for development, use and protection of residential, commercial, industrial and recreational infrastructure and areas (including sea defences or coastal protection works and infrastructures) (F08)	H
Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations and disturbance of species (G01)	Н
Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats (G03)	M
Introduction and spread of species (including GMOs) in marine aquaculture (G17)	M

Other invasive alien species (other then species of Union concern) (IO2)	Н
Mixed source marine water pollution (marine and coastal) (J02)	M
Sea-level and wave exposure changes due to climate change (N04)	Н

7.2 Sources of information

7.3 Additional information

There were often more than ten pressures, threats (of high or medium importance), or conservation measures identified, and an aggregation method was used to identify the top ten of each. As a result the top ten lists for the habitat may not correspond with each other. For example, a pressure may be in the reported top ten list, but the corresponding conservation measure might not appear in the top ten list of conservation measures. This does not mean that the measure is not in place, but instead it is in the extended list of measures that did not make the top ten but are detailed in the additional information section.

The following pressures were also identified as medium importance, however, only a maximum of 10 could be reported: F20- Residential or recreational activities and structures generating marine pollution (excl. marine macro- and micro-particular pollution), G11-Illegal harvesting, collecting and taking, D05-Development and operation of energy production plants (including bioenergy plants, fossil and nuclear energy plants), F22-Residential or recreational activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam),D06-Transmission of electricity and communications (cables),F28-Modification of flooding regimes, flood protection for residential or recreational development,F23-Industrial or commercial activities and structures generating marine macro- and micro-particulate pollution (e.g. plastic bags, Styrofoam).

The following threats were also identified as medium importance, however, a maximum of 10 could be reported: F04-Construction or modification of commercial / industrial infrastructure in existing commercial / industrial areas,F20-Residential or recreational activities and structures generating marine pollution (excl. marine macro- and micro-particular pollution),G11-Illegal harvesting, collecting and taking, G19-Other impacts from marine aquaculture, including infrastructure, A28-Agricultural activities generating marine pollution, D05-Development and operation of energy production plants (including bioenergy plants, fossil and nuclear energy plants),F06-Development and maintenance of beach areas for tourism and recreation incl. beach nourishment and beach cleaning, F22-Residential or recreational activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam), D06-Transmission of electricity and communications (cables),F28-Modification of flooding regimes, flood protection for residential or recreational development, NO1-Temperature changes (e.g. rise of temperature & extremes) due to climate change, NO5-Change of habitat location, size, and / or quality due to climate change, NO8-Change of species distribution (natural newcomers) due to climate change, F23-Industrial or commercial activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam). For details on approaches taken in this section please refer to the JNCC website for 2019 UK Approach Document and country-level reporting information.

8. Conservation measures

8.1 Status of measures	a) Are measures needed?	Yes
	b) Indicate the status of measures	Measures identified and taken
8.2 Main purpose of the measures taken	Maintain the current range, populat	ion and/or habitat for the species
8.3 Location of the measures taken	Both inside and outside Natura 2000)
8.4 Response to the measures	Medium-term results (within the nex	xt two reporting periods, 2019-2030)
8.5 List of main conservation measures		

Reduce/eliminate marine pollution from agricultural activities (CA13)

Adapt/manage renewable energy installation, facilities and operation (CC03)

Reduce impact of transport operation and infrastructure (CE01)

Reduce impact of outdoor sports, leisure and recreational activities (CF03)

Reduce/eliminate marine pollution from industrial, commercial, residential and recreational areas and activities (CF07)

Reduce/eliminate marine contamination with litter (CF08)

Manage changes in hydrological and coastal systems and regimes for construction and development (CF10)

Management of professional/commercial fishing (including shellfish and seaweed harvesting) (CG01)

Management of hunting, recreational fishing and recreational or commercial harvesting or collection of plants (CG02)

Early detection and rapid eradication of invasive alien species of Union concern (ClO1)

8.6 Additional information

There were often more than ten pressures, threats (of high or medium importance), or conservation measures identified, and an aggregation method was used to identify the top ten of each. As a result the top ten lists for the habitat may not correspond with each other. For example, a pressure may be in the reported top ten list, but the corresponding conservation measure might not appear in the top ten list of conservation measures. This does not mean that the measure is not in place, but instead it is in the extended list of measures that did not make the top ten but are detailed in the additional information section. 8.5- The following conservation measures were also identified, however, a maximum of 10 could be listed: CN02- Implement climate change adaptation measures, CG09- Other measures to reduce impacts from marine aquaculture infrastructures and operation, CG08- Reduce/eliminate marine pollution from marine aquaculture, CF01- Manage conversion of land for construction and development of infrastructure, CJO1- Reduce impact of mixed source pollution, CF02- Habitat restoration of areas impacted by residential, commercial, industrial and recreational infrastructure, operations and activities, CF12- Other measures related to residential, commercial, industrial and recreational infrastructures, operations and activities, CG15- Other measures related to exploitation of species, CG04- Control/eradication of illegal killing, fishing and harvesting, CC06- Reduce impact of service corridors and networks. For further details on methods used please see JNCC website for 2019 UK Approach Document and country-level reporting information.

9. Future prospects

9.1 Future prospects of parameters

a) Range Good b) Area Bad c) Structure and functions Bad

9.2 Additional information

Future trends for each parameter were selected by the four countries and then aggregated to give a future trend for the UK (see 2019 UK Approach Document). Table 32 in the EU Guidelines was used to bring the future trend and conservation status of each parameter together to conclude on future prospects. 9.1a) Future prospects are good because the future trend of range is overall stable and the conclusion for range is Favourable. Future prospects were also good in 2013.

9.1b) Future prospects are bad because the future trend of area is very negative and the conclusion for area is Unknown. Future prospects were unknown in 2013.

9.1c) Future prospects are bad because the future trend is very negative and the conclusion for the parameter is Unfavourable-bad. Future prospects were also bad in 2013.

For further details on the approach taken to identify future prospects please see JNCC website for 2019 UK Approach Document and country-level reporting information.

10. Conclusions

10.1. Range

10.2. Area

10.3. Specific structure and functions (incl. typical species)

10.4. Future prospects

10.5 Overall assessment of Conservation Status

10.6 Overall trend in Conservation Status

10.7 Change and reasons for change in conservation status and conservation status trend

Favourable (FV)

Unknown (XX)

Unfavourable - Bad (U2)

Unfavourable - Bad (U2)

Unfavourable - Bad (U2)

Unknown (x)

a) Overall assessment of conservation status

No change

The change is mainly due to:

b) Overall trend in conservation status

Improved knowledge/more accurate data

Use of different method

The change is mainly due to: Improved knowledge/more accurate data

10.1-Conclusion on Range reached because: (i) the short-term trend direct

10.1-Conclusion on Range reached because: (i) the short-term trend direction in Range surface area is stable and (ii) the current Range surface area is not less than the Favourable Reference Range.

10.2-Conclusion on Area covered by habitat reached because: (i) the short-term trend direction in Area is uncertain (ii) the current area is approximately equal to the Favourable Reference Area.

10.3-Conclusion on Structure and functions reached because habitat condition data indicates that more than 25% of the habitat is in unfavourable (not good) condition. 39% of the habitat is thought to be unfavourable (not good) condition, 45% of the habitat is thought to be in favourable (good) condition and 17% of the habitat is in unknown condition.

10.8 Additional information

10.4-Conclusion on Future prospects reached because: (i) the Future prospects for Range are good; (ii) the Future prospects for Area covered by habitat are bad; and (iii) the Future prospects for Structure and functions are bad.

10.5-Overall assessment of Conservation Status is Unfavourable-bad because two of the conclusions are Unfavourable-bad.

10.6-Overall trend in Conservation Status is based on the combination of the short-term trends for Range - stable, Area covered by habitat - uncertain, and Structure and functions - decreasing.

10.7-The Overall Trend in Conservation Status has changed between 2013 (improving) and 2019 (unknown). This is a methodological change because of the removal of the Future Prospects trend from the 2019 method used to assess Overall Trend and also because the short-term trend for structures and functions has changed from improving to decreasing. 2013: Range = stable, Area = unknown, S&F = improving, FP = unknown. 2019: Range=stable, Area = uncertain, S&F = decreasing, [FP not included].

For detailed methods see JNCC website for 2019 UK Approach Document and country-level reporting information.

11. Natura 2000 (pSCIs, SCIs, SACs) coverage for Annex I habitat types

11.1 Surface area of the habitat type inside the pSCIs, SCIs and SACs network (in km² in biogeographical/marine region)

11.2 Type of estimate

11.3 Surface area of the habitat type inside the network Method used

11.4 Short-term trend of habitat area in good condition within the network Direction

11.5 Short-term trend of habitat area in good condition within network Method used

11.6 Additional information

a) Minimum

b) Maximum

c) Best single value 2038.53459

Best estimate

Based mainly on extrapolation from a limited amount of data

Decreasing (-)

Based mainly on expert opinion with very limited data

11.3-The mudflats and sandflats surface area map was intersected with all Natura 2000 sites that contain qualifying marine habitats or species (JNCC, 2018b). The cut-off used for SAC designations was Tranche 56 in November 2017. For further details on the approaches taken in this section please see JNCC website for the 2019 UK Approach Document and country-level reporting information.

12. Complementary information

12.1 Justification of % thresholds for trends

12.2 Other relevant information

Distribution Map

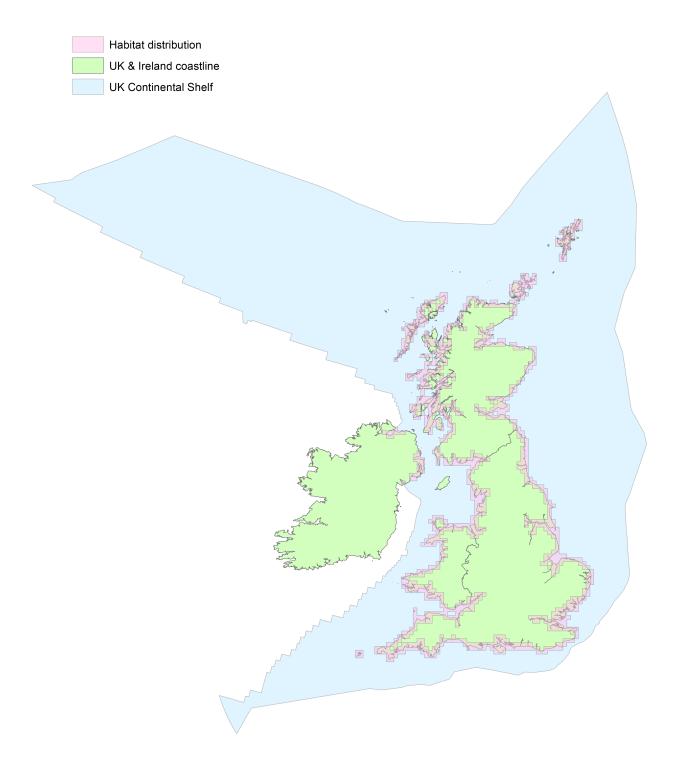


Figure 1: UK distribution map for H1140 - Mudflats and sandflats not covered by seawater at low tide.

The 10km grid square distribution map is based on available habitat records which are considered to be representative of the distribution within the current reporting period. For further details see the 2019 Article17 UK Approach document.

Range Map

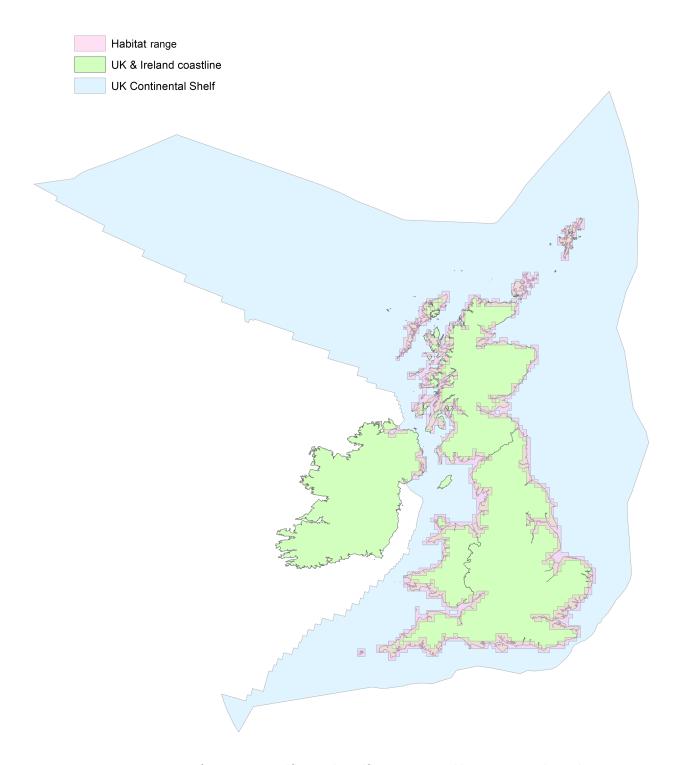


Figure 2: UK range map for H1140 - Mudflats and sandflats not covered by seawater at low tide.

The range of mudflats and sandflats is determined by physical and geological processes and was not related to the biological communities or processes supported by them. Therefore, the range was considered equivalent to the surface area of the habitat.

Explanatory Notes

Habitat code: 1140	
Field label	Note
2.1 Year or period	The data sources used to produce this map ranged from 1996 to 2018
2.3 Distribution map; Method used	The surface area map was gridded to create the distribution map. The 2013 UK Article 17 area data for Annex I Mudflats and sandflats was revised at a UK level by the JNCC following updates submitted by the UK Country Agencies. For further details see JNCC website (JNCC 2018a).
Habitat code: 1140 Region cod	de: MATL
Field label	Note
4.1 Surface area	The range of mudflats and sandflats is determined by physical and geological processes and was not related to the biological communities or processes supported by them. Therefore, the range was considered equivalent to the surface area of the habitat.
4.3 Short term trend; Direction	As this feature is defined by substrate type rather by a specific biological community, its range is determined by physical and geological processes. Mudflats and sandflats are widespread along open coasts, bays and estuaries and encompass parts of the coasts where the sedimentary regime allows. The geographic range of mudflats and sandflats in the UK has remained relatively stable since the last ice age. Although the physical area of some individual sand and mudflats may have changed due to erosion, land claim or other anthropogenic pressures there is no evidence that this has significantly affected the range of the feature. The short-term trend is, therefore, thought to be stable.
4.5 Short term trend; Method used	See 4.3
4.11 Change and reason for change in surface area of range	As a result of improved mapping of the habitat, the surface area of range for UK mudflats and sandflats is larger than the figure that was reported in 2013.
5.1 Year or period	The data sources used to produce the surface area map ranged from 1996 to 2018.
5.4 Surface area; Method used	The 2013 UK Article 17 area data for Annex I Mudflats and Sandflats was revised at a UK level by the JNCC following updates submitted by the UK Country Agencies. For further details see JNCC website (JNCC 2018a).
5.6 Short term trend; Direction	Expert judgement was used to determine the short-term trend direction at the UK-level. The largest proportion of this resource is in England inshore waters. There have been huge improvements to the mapping of this feature in England inshore waters, therefore, a spatial comparison against previous datasets is not possible. The feature is thought to be stable in Scotland inshore waters and there are some known losses in Wales inshore waters.
5.8 Short term trend; Method used	See 5.6
5.14 Change and reason for change in surface area	As a result of improved mapping of the habitat, the surface area of UK mudflats and sandflats is larger than the figure reported in 2013.
6.1 Condition of habitat	The area of habitat in 'good' (favourable) 'not good (unfavourable) and unknown condition was assessed in each of the four countries and the results were summed. 39% of the habitat is thought to be in unfavourable (not good) condition, 45% of the habitat is thought to be in favourable (good condition) and 17% of the habitat is in unknown condition. The structure and functions conservation status is, therefore, unfavourable-bad, it was also unfavourable-bad in 2013.

6.4 Short term trend of habitat area in good condition; Direction	The short-term trend of habitat in good condition was assessed by the four countries and the results were aggregated (see 2019 UK Approach Document). The short-term trend has changed from improving in 2013 to decreasing in 2019 as a result of coastal squeeze in England, where the highest proportion of UK Mudflats and Sandflats are found.
9.1 Future prospects of parameters	Future trends for each parameter were selected by the four countries and then aggregated to give a future trend for the UK (see 2019 UK Approach Document). Table 32 in the EU Guidelines was used to bring the future trend and conservation status of each parameter together to conclude on future prospects.
9.1a Future prospects of parameters - Range	Future prospects are good because the future trend of range is overall stable and the conclusion for range is Favourable. Future prospects were also good in 2013.
9.1b Future prospects of parameters - Area	Future prospects are bad because the future trend of area is very negative and the conclusion for area is Unknown. Future prospects were unknown in 2013.
9.1c Future prospects of parameters - Structure and functions	Future prospects are bad because the future trend is very negative and the conclusion for the parameter is Unfavourable-bad. Future prospects were also bad in 2013.
11.3 Surface area of the habitat type inside the network; Method used	The mudflats and sandflats surface area map was intersected with all Natura 2000 sites that contain qualifying marine habitats or species (JNCC, 2018b). The cut-off used for SAC designations was Tranche 56 in November 2017.