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Outer Dowsing Offshore Wind Farm

Appendix C2 to the Natural England Deadline 3 Submission

Natural England's Potential Evidence Based Approach to Defining Supporting Habitats for *Sabellaria spinulosa* Reef v1.0

For:

The construction and operation of Outer Dowsing Offshore Wind Farm located approximately 54 km from the Lincolnshire Coast in the Southern North Sea.

Planning Inspectorate Reference EN010130

13th December 2024

Appendix C2: A Potential Evidence-based Approach to Defining Supporting Habitats for *Sabellaria Spinulosa* Reef

Overview

This document has been drafted to assist applications proposing activities within the marine subtidal environment where there is a potential risk of hindering a restore conservation objective for Annex I *Sabellaria spinulosa* reef within designated sites. It is intended to support consideration of a less precautionary approach to impact assessments, inform a more targeted use of the mitigation hierarchy, and ultimately assist the Competent Authority in their decision making, by using an evidence-based approach to refine down potential areas of supporting habitats for *S. spinulosa* reef, rather than assume that reef could arise across any area of suitable sedimentary habitat.

1. *Sabellaria spinulosa* Growth Forms and Environmental Requirements

1.1 Growth forms

Sabellaria spinulosa is a tube-building polychaete which can develop extensive biogenic reefs extending 20+ km^2 (Pearce *et al*., 2011). However, 'reef' formation (as defined by Gubbay, 2007) is not an obligate growth form and *S. spinulosa* populations are often present in numbers which are not sufficient to develop reef structures. Throughout most of the UK's *S. spinulosa* geographic range, the species is found inhabiting sediments as a component of the infaunal communities present, or encrusting mixed sediments, shell and bedrock (OSPAR, 2010). Crusts or veneers (<2cm elevation) can also form over extensive areas, but these may only last for a season before being broken up by winter storms and reforming the next spring through new larval settlements (JNCC, 2016).

S. spinulosa aggregations, whether reef forming or encrusting, are often described as ephemeral, exhibiting highly variable temporal stability capable of forming, disintegrating and disappearing on an inter-annual basis (Limpenny *et al*., 2010; Jackson & Hiscock, 2003; Jones *et al*., 2000); this means their presence can be highly variable both spatially and temporally. However, when conditions are favourable (including where pressures have been removed) dense aggregations may be found to persist over several years (Roberts *et al*., 2016) forming biogenic reefs up to 60cm in elevation (OSPAR, 2010) and extending over large areas of seabed. Reports of reef extent range from 'several hectares' to 'tens of kilometres squared' (OSPAR, 2010, Pearce *et al*., 2011).

1.2 Measuring Extent and Distribution

To address challenges associated with spatially describing, managing and providing nature conservation advice on *S. spinulosa* reef, Natural England developed a 'core reef' approach to map the distribution of the reef in the '2010 Wash *S. spinulosa* synthesis' study (Bussell & Saunders, 2010). This approach utilised a 'reef index' which appraised and synthesised historic data, assessing the techniques used to determine the presence of *S. spinulosa* and crediting results with a confidence score. Areas which most consistently supported reef, evidenced by datasets with the highest confidence, were identified as 'core reef', and this information was used to inform management.

The work of Bussell & Saunders (2010) has since been further developed in a Natural England research report (Roberts *et al*., 2016) which further describes the process involved in identifying areas of core reef. Roberts *et al*., (2016) concluded that the core reef approach provides a useful tool for mapping areas likely to support reef and informing management, noting that the method requires historical datasets of suitable confidence. However, Roberts *et al*., (2016) also concluded that the uncertainty associated with detecting and mapping *S. spinulosa* reef raises questions as to how appropriate it is to target management at specific, small-scale patches of reef and suggests that it would be more appropriate to use reef index outputs to identify wider areas that consistently support reef, and target management at this broader scale.

Recognising that the availability of temporal data sets is often limited, Natural England has developed the conclusions of Roberts *et al.,* (2016) further and have sought protection of these 'wider areas' of reef-supporting sediments through conservation advice. The approach is intended to allow the natural cycle of reef development to occur, and to facilitate restore conservation targets where the feature is considered to be in unfavourable condition.

NB: To date, the adoption of the 'core reef' approach has only been viable in The Wash where the datasets have been gathered at different points in time and also spatially overlap, thus facilitating the temporal analysis necessary to implement the core reef approach. Attempts to adopt this approach at other sites has led to more precautionary approaches being identified due to gaps in spatial and/or temporal overlap in the available datasets.

1.3 Existing pressures and effects on reef

Although it is acknowledged the reefs are the least common growth form, it is not clear to what extent the ephemeral nature, and fewer observations of 'reef' growth form may be skewed due to ongoing pressures. Currently, it is uncertain whether low-lying structures constitute a separate or sub-habitat type, a phase in the development of a reef, or a reef which is developmentally moderated by one or more environmental or anthropogenic stressors (NRW, 2019). Trawling for oysters and mussels, trawling for shrimp or fin fish, net fishing and potting can all cause physical damage to erect *S. spinulosa* reef communities (JNCC, 2008).

The physical impact of the mobile gear breaks down the reef structures, damaging and removing the niches and habitat complexity required for the establishment of rich infaunal and epifaunal communities. It is these rich communities associated with the biogenic reef which form the rationale for the protection of reef under the Habitats Regulations (2017). Aggregate dredging also often takes place and targets removal of substrate in areas of mixed sediment where *S. spinulosa* reefs occur. Such activities are conducted within licenced areas and therefore impacts on areas of existing *S. spinulosa* reef are mitigated to some degree via licence conditions. However, there is the risk that mitigation does not extend to the protection of areas with the potential to support *S. spinulosa* reef, which may also already be subject to fishing pressures.

In recognition of the benthic impacts caused by specific types of fishing gear within Inner Dowsing Race Bank North Ridge (IDRBNR) Special Area of Conservation (SAC), the MMO implemented a prohibited fishing gears byelaw which was specifically aimed at limiting fishing impacts on benthic features including *S. spinulosa* reef (MMO, 2022). An aggregates monitoring report for a site within IDRBNR SAC reports that "the Side Scan Sonar (SSS) data clearly shows trawl scars through reefs and the ground-truth data acquired after the geophysical survey shows damaged and fragmented *S. spinulosa* tubes and small reef clumps with areas of mobile sand". The location the report refers to is outside of the areas which are now protected by the byelaws (MarineSpace, 2013).

1.4 Environmental requirements

Sabellaria spinulosa requires only a few environmental conditions to be met in order to proliferate. There is accumulating evidence that dense *S. spinulosa* reefs might favour a combination of a suitable substratum for settlement, together with a supply of sand for tube building (UK Biodiversity Group, 1999). Sand is suspended in the water column by strong water movement, and whilst the relative importance of tidal versus wave induced movements is unclear (Connor *et al*., 1997), *S. spinulosa* reef communities are typically associated with moderately strong tidal flows (Jones *et al*., 2001).

Accordingly, evidence suggests that *S. spinulosa* aggregations appear more prevalent in locations such as the periphery of sandbanks in the southern North Sea (Limpenny *et al*., 2010), and within areas of sandwaves and/or sandbanks (Foster-Smith, 2001, Karin *et al*., 2019). Karine *et al*.,(2019) went further to report that *S. spinulosa* reefs were found within the sandbank troughs specifically, and that the depressions in between sandwaves both offer suitable substrate for settlement of *S. spinulosa* larvae and refuge from abrasion by fishing activities, enabling reefs to persist despite high fishing intensities. Thus, gravel ribbons next to mobile sand features, thin veneers of mobile sand over gravel lags and sides of shelly sand banks, all appear to favour the development of dense *S. spinulosa* (Limpenny *et al*., 2010). These observations are supported by the results of analysis of fauna from different topographic areas within, and beyond, designated sandbanks within Haisborough Hammond and Winterton Special Area of Conservation (HHW SAC). The analysis demonstrated that, despite intentional avoidance of reef within grabbing surveys, the data from grabs demonstrated an apparent preference by *S. spinulosa* to inhabit medium to coarse sand dominated areas within the more stable 'beyond sandbank' areas (where 'beyond sandbank' was defined as between 600m and 1600m beyond designated sandbank boundaries (Natural England, In draft 2024).

1.5 Substrate

Numerous studies have reported on the sediment characteristics of areas observed to support *S. spinulosa* reef. These are listed in Table A below, together with the sediment characteristics described as supporting reef in each study. The evidence shows that *S. spinulosa* reef can develop on a broad range of sediment substrates ranging from medium sand to coarse mixed sediments. This supports the hypothesis that other environmental factors, such as supply of sand, are likely to be more important than specific in-situ particle size ranges.

It is likely that the stability of reefs is to some degree a function of stability of the substratum (Connor *et al*., 1997, Holt *et al*., 1997 Holt *et al*., 1998 and Foster-Smith and Hendrick 2003); it therefore follows that the longevity, quality (elevation etc.) and associated ecological value of reef could be enhanced by more stable substrates. However, Pearce *et al*., (2011c) found that in the East Coast Regional Environmental Characterisation (REC) study area, *S. spinulosa* reefs on sand provided an attachment surface which facilitated colonisation by epifauna such as blue mussel *Mytilus edulis*, which could not otherwise exist in the sand dominated habitats. George and Warwick (1985) found that enhancement of diversity within the sandy sediments of the Bristol Channel was far greater than that reported by Pearce *et al*., (2007), who assessed changes in diversity associated with *S. spinulosa* reefs on mixed sediments.

Although a degree of firmness/stability in the substrate is likely required for the establishment of a colony (Foster-Smith and Hendrick, 2003), reef can subsequently increase in extent by more *S. spinulosa* larvae attaching to the existing tubes rather than requiring secondary anchor points, allowing the colony to extend over large areas of sediment in some cases (Holt *et al*., 1997; JNCC, 2016). Several studies have reported extensive *S. spinulosa* colonies in essentially sandy areas (Schäfer, 1972; Warren, 1973; Warren and Sheldon, 1967). Sand stabilised by the sand mason *Lanice conchilega* creates an environment stable enough for colonisation by *Sabellaria alveolate in the intertidal*, and Foster-Smith and Hendrick (2003) postulate that the same stabilisation process for reef formation may also be provided by *L. conchilega* in the subtidal environment, as *L. conchilega* and *S. spinulosa* are sometimes found to co-exist (Holt *et al*., 1997).

A final, but important note to consider is that although *S. spinulosa* larvae will settle on any suitable substrate after 2 – 3 months (JNCC, 2008), larvae are strongly stimulated to settle on both living or dead *S. spinulosa* colonies in response to proteins released by adult worms (Wilson, 1970). This chemical attractant remains present and active even in the absence of live worms and as such, small satellites of reef, or areas outlying the main reef, may act as reef precursors (JNCC and NE, 2010).

Table A. Review of sediment characteristics reported to support *S. spinulosa* reef

Sediment character	Reference
"Mixed sediment"	• Connor *et al*., (1997) • Gibb et al., (2014) • OSPAR (2010) • NRW (2019)
"Typically shell (especially oyster valves), sandy gravel"	• Rees and Dare (1993)
"Sandy gravel"	• Newell *et al*.. (2001) • Seiderer and Newell (1999)
"Sandy and mixed coarser sediments"	• Gubbay (2007)
"Essentially sandy"	• Schäfer (1972) • Warren (1973) • Warren and Sheldon (1967)
"Medium fine sand, but favours silty, cobble/gravel habitats[1]rather than purely sandy habitats" ***"Gravel ribbons next to mobile sand features, thin veneers of mobile sand over gravel lags and sides of shelly sand banks"***	• Limpenny *et al.,* (2010)
"Medium to coarse sand dominated"	• Natural England *In draft* (Due for publication 2025)
"Sandy and coarse sediments"	• Natural England (2019)

[1] Limpenny *et al*., (2010) postulated that *S. spinulosa* may not necessarily favour silty environments for settlement and growth, but create the silt once established, these results should therefore be treated with caution.

2. Defining Supporting Habitat for *Sabellaria spinulosa*

In considering the review of evidence and information presented in the preceding sections of this document, Natural England considers that any area of sediment within a Marine Protected Area (MPA) which has *S. spinulosa* reef listed as a feature/sub-feature, could be considered likely to support Annex I *S. spinulosa* reef where: ***BOTH of the 'essential'* environmental parameters listed below are present *together with at least one* of the 'optional' parameters** (Please see footnotes for further information and/or rationale). Note that the greater the number of additional 'optional' parameters met within a given area, the higher the quality the supporting habitat is likely to be.

- **ESSENTIAL** - Location is subject to moderate to strong tidal flows/wave action.
- **ESSENTIAL** - Sediment character meets one or more of the descriptions within Table A above.
- ***OPTIONAL*** – Location is within an area of sand waves/sandbanks OR within 2 km of sandbanks in any direction OR within 3km in direction of tidal stream, whichever is the greater[2].
- ***OPTIONAL*** – Location is within an area where *S. spinulosa* reef may currently be absent, but where reef OR the SS.SBR.PoR.SspiMx biotope (EUNIS A5.611) has been previously identified in one or more sampling events (with a moderate or high level of confidence).
- ***OPTIONAL*** - Individual *S. spinulosa* count is >375 per 0.1m^2 within a given sediment type polygon[3,4]
- ***OPTIONAL*** – Location is within an area/polygon mapped as the SS.SBR.PoR.SspiMx biotope(EUNIS A5.611) [5].
- ***OPTIONAL*** - Elevation of dead OR living tubes is ≥ 5cm (average) but where reef has not been defined, owing to low percentage cover/patchiness [6].
- ***OPTIONAL*** – Where extent of encrusting *S. spinulosa* tubes (dead OR alive) are >10,000m^2 but where average elevation has not been sufficient to categorise the area as Annex I reef according to Gubbay (2007)[7].

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[2] These distances have been based on results from a review of sandy sediment transport studies conducted by Spearman (2015), as well as the results of data analysis within HHW SAC (Natural England, 2024 – In draft).
[3] Abundance threshold has been based on a study by Envision in The Wash (Foster-Smith and Sotheran, 1999 *in* Limpenny *et al*., 2010) which reported that reef structures were associated with samples containing densities of *S. spinulosa* individuals greater than 375 per 0.1m^2.
[4] Count data should <u>not</u> be overruled by DDV evidence because positional accuracy during surveys is highly unlikely to be sufficient to permit a direct cross reference between the data generated from the two different survey methods.
[5] Where the SS.SBR.PoR.SspiMx (EUNIS A5.611) biotope appears transitional and/or questionable, the precautionary approach should be applied and the area should be considered potentially supporting if the 'essential' parameters above are present.
[6] This optional parameter has been added on the basis that areas of reef which are sufficiently elevated to qualify as reef according to Gubbay (2007) but demonstrate a high degree of patchiness could represent areas of reef that have been moderated by fishing impacts. Greater elevation suggests greater potential as high quality supporting habitat.
[7] This optional parameter has been added on the basis that extensive areas of encrusting *S. Spinulosa* may suggest that the location has good potential as supporting habitat in the absence of anthropogenic pressures. However, we suggest that at least one other 'Optional' parameter would also be required to provide the necessary weight to any decision making.

3. Conclusion

Natural England hopes that this document provides a robust and common basis from which *S. spinulosa* reef supporting processes including areas with conditions suitable for reef formation can be defined. To mitigate impacts and avoid hindering designated sites conservation objectives, it is anticipated that this approach to defining supporting habitat would be used to further consider, and where relevant, amend project design parameters within applications.

We are keen that the definition is precautionary and protects relevant areas based on their ecological merit, but is also practical to implement, and as such, this document is likely to evolve as the parameters listed in Section 2 above are applied within casework, and any ambiguities teased out. Natural England therefore welcomes any feedback, on the usefulness and application of this document.

4. References

- Connor, D.W., Dalkin, M.J., Hill, T.O., Holt, R.H.F. & Sanderson, W.G. (1997). Marine Nature Conservation Review: marine biotope classification for Britain and Ireland. Volume 2. Sublittoral biotopes (Version 97.06). JNCC Report No. 230, JNCC, Peterborough, ISSN 0963-8091.
- JNCC (2008). UK Biodiversity Action Plan Priority Habitat Descriptions *Sabellaria spinulosa* Reefs. [Online] URL: https://jncc.gov.uk/our-work/uk-bap-priority-habitats/. Accessed 06.12.24
- JNCC and NE (2010). Inner Dowsing, Race Bank and North Ridge Selection Assessment Document Version 5.0. [Online] URL: https://data.jncc.gov.uk/data/a29c186f-6241-47dd-8077-58bbb0819522/IDRBNR-SAC-selection-assessment-v5-0.pdf
- Karin J. Van Der Reijden*, Leo Koop, Sarah O'flynn, Silvia Garcia, Oscar Bos, Christiaan van Sluis, David J. Maaholm, Peter M.J. Herman, Dick G. Simons, Han Olff, Tom Ysebaert, Mirjam Snellen, Laura L. Govers, Adriaan D. Rijnsdorp, Ricardo Aguilar (2019). Discovery of Sabellaria spinulosa reefs in an intensively fished area of the Dutch Continental Shelf, North Sea. [Online] URL: https://research.wur.nl/en/publications/discovery-of-sabellaria-spinulosa-reefs-in-an-intensively-fished-. Accessed 06.012.24
- Gibb, N., Tillin, H.M., Pearce, B. & Tyler-Walters H. (2014). Assessing the sensitivity of Sabellaria spinulosa to pressures associated with marine activities. JNCC report No. 504
- Gubbay, S., (2007. Defining and managing *Sabellaria spinulosa* reefs. JNNC Report No. 405 [Online] URL: https://data.jncc.gov.uk/data/ecdbc5ba-e200-47e3-b7c6-adf464287712/JNCC-Report-405-FINAL-WEB.pdf. Accessed 06.12.24
- Holt, T., Rees, E.I., Hawkins, S., & Seed, R. (1998). *Biogenic Reefs (volume IX): an overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Oban, Scottish Association for Marine Science (UK Marine SACs Project).*

- Limpenny D.S., Foster-Smith, R.L., Edwards, T.M., Hendrick, V.J., Diesing, M., Eggleton, J.D., Meadows, W.J., Crutchfield, Z., Pfeifer, S. and Reach, I.S. (2010). Best methods for identifying and evaluating *Sabellaria spinulosa* and cobble reef, Marine Aggregate Levy Sustainability Fund
- MarineSpace Ltd (2013). Area 480 Annual Monitoring Review – Year 4, 2012.
- Natural England (*in draft* – due March 20205). The Extent of Annex I Sandbank Habitat in Haisborough, Hammond and Winterton SAC Evidence Review.
- Natural England (2019)> Definition of Favourable Conservation Status for Reefs Defining Favourable Conservation Status Project. [Online] URL: [redacted]. Accessed 06.12.24.
- Newell, R.C., Seiderer, L.J., & Robinson, J.E. (2001). Animal: sediment relationships in coastal deposits of the eastern English Channel. Journal of the Marine Biological Association of the United Kingdom, 81(1), 1-9.
- NRW (2019). [Online] URL:[redacted] Accessed 06.12.24
- OSPAR (2010). *Sabellaria spinulosa* Reefs – List of Threatened and/or declining habitats. [Online] URL: [redacted]. Accessed 06.12.24
- Pearce, B., Hill, J.M., Wilson, C., Griffin, R., Earnshaw, S. & Pitts, J. (2011). Sabellaria spinulosa Reef Ecology and Ecosystem Services. The Crown Estate. [Online] URL: [redacted] Accessed 06.12.24.
- Pearce, B., Hil,l J., Grubb, L., & Harper, G. (2011). Impacts of Marine Aggregate Dredging on Adjacent *Sabellaria spinulosa* Aggregations and other benthic fauna.[Online] URL: [redacted]Accessed 06.12.24.
- Rees, H.L. & Dare P.J. (1993) Sources of mortality and associated life-cycle traits of selected benthic species: a review. MAFF Fisheries Research Data Report, no. 33. Publisher: Lowestoft: MAFF Directorate of Fisheries Research.
- Roberts, G., Edwards, N., Neachtain, A., Richardson, H. & Watt, C. (2016). Core reef approach to *Sabellaria spinulosa* reef management in The Wash and North Norfolk Coast SAC and The Wash approaches. Natural England Research Reports, Number 065.
- Schafer, W. (1972). Ecology and Palaeoecology of Marine Environments. Chicago: University of Chicago Press IN Holt, T., Hartnoll, R. & Hawkins, S. 1997. Sensitivity and vulnerability to

man-induced change of selected communities: intertidal brown algal shrubs, Zostera bedsand Sabellaria spinulosa reefs. English Nature Research Reports, No. 234.

- Seiderer, L. J. and Newell, R. C. (1999). Analysis of the relationship between sediment composition and benthic community structure in coastal deposits: Implications for marine aggregate dredging. – ICES Journal of Marine Science, 56: 757–765.
- Warren, P. (1973). The fishery for the pink shrimp Pandalus montagui of the Wash. Laboratory Leaflet (New Series) No. 28. Lowestoft, Ministry of Agriculture, Fisheries and Food IN Holt, T., Hartnoll, R. & Hawkins, S. 1997. Sensitivity and vulnerability to man-induced change of selected communities: intertidal brown algal shrubs, Zostera bedsand Sabellaria spinulosa reefs. English Nature Research Reports, No. 234.
- Warren, P and Sheldon, R. (1967). Feeding and migration patterns of the pink shrimp Pandalus montagui in the estuary of the River Crouch, England. Journal of Fisheries Research. Canada 24, 569-580. IN Holt, T., Hartnoll, R. & Hawkins, S. 1997. Sensitivity and vulnerability to man-induced change of selected communities: intertidal brown algal shrubs, Zostera bedsand Sabellaria spinulosa reefs. English Nature Research Reports, No. 234.