

## Appendices

**Appendix 1.** Coordinates and environmental data for the eight study sites. Exposure was determined based on wave fetch values extracted from (Burrows 2020).

| Site        | Latitude  | Longitude | Wave Fetch<br>(log <sub>10</sub> of 3-cell average) |
|-------------|-----------|-----------|-----------------------------------------------------|
| St. Abbs    | 55.899967 | -2.130000 | 4.23                                                |
| Berwick     | 55.779417 | -1.992850 | 4.30                                                |
| Seahouses   | 55.576833 | -1.636667 | 4.40                                                |
| Boulmer     | 55.419705 | -1.573108 | 4.36                                                |
| Cresswell   | 55.237567 | -1.533167 | 4.33                                                |
| Cullercoats | 55.038217 | -1.427360 | 4.34                                                |
| Whitburn    | 54.944567 | -1.356617 | 4.31                                                |
| Saltburn    | 54.589167 | -0.955200 | 4.26                                                |

**Appendix 2.** Pairwise post hoc comparisons for the univariate percent cover of kelp (a), and kelp length (bi and bii) and age (c) across sites (colours) and species (*Ae* = *A. esculenta*, *Ld* = *L. digitata*, *Lh* = *L. hyperborea*, *Sl* = *S. latissima*). Circles (•) indicate where significant ( $p < 0.05$ ) comparisons occurred, crosses (X) indicate non-significant pairwise comparisons, and colours (site) and letters (species) indicate the direction (i.e. greater value) of the difference.

**a.**

|             |           | St. Abbs  |           |           |           | Berwick   |           |           |           | Seahouses |           |           |           | Boulmer   |           |           |           | Cresswell |           |           |           | Cullercoats |           |           |           | Whitburn  |           |           |           | Saltburn  |           |           |           |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|             |           | <i>Ae</i> | <i>Ld</i> | <i>Lh</i> | <i>Sl</i> | <i>Ae</i> | <i>Ld</i> | <i>Lh</i> | <i>Sl</i> | <i>Ae</i> | <i>Ld</i> | <i>Lh</i> | <i>Sl</i> | <i>Ae</i> | <i>Ld</i> | <i>Lh</i> | <i>Sl</i> | <i>Ae</i> | <i>Ld</i> | <i>Lh</i> | <i>Sl</i> | <i>Ae</i>   | <i>Ld</i> | <i>Lh</i> | <i>Sl</i> | <i>Ae</i> | <i>Ld</i> | <i>Lh</i> | <i>Sl</i> | <i>Ae</i> | <i>Ld</i> | <i>Lh</i> | <i>Sl</i> |
| St. Abbs    | <i>Ae</i> |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Ld</i> | •         |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Lh</i> | •         | X         |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Sl</i> |           | •         | •         |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
| Berwick     | <i>Ae</i> | X         |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Ld</i> |           | •         |           |           | •         |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Lh</i> |           |           | •         |           | X         | •         |           |           |           |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Sl</i> |           |           |           |           | •         | •         | X         |           |           |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
| Seahouses   | <i>Ae</i> | X         |           |           |           | X         |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Ld</i> |           | X         |           |           | X         |           |           |           | •         |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Lh</i> |           |           | X         |           |           |           | X         |           | X         | •         |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Sl</i> |           |           |           | X         |           |           |           | X         | X         | •         | •         |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
| Boulmer     | <i>Ae</i> |           |           |           |           | X         |           |           |           | X         |           |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Ld</i> |           | X         |           |           | X         |           |           |           |           |           |           | •         |           |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Lh</i> |           |           | X         |           |           |           | X         |           |           |           | X         | X         | X         |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Sl</i> |           |           |           |           |           |           |           |           |           |           |           | X         | •         | X         |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
| Cresswell   | <i>Ae</i> | X         |           |           |           | X         |           |           |           | X         |           |           |           | X         |           |           |           |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Ld</i> |           | X         |           |           | •         |           |           |           | X         |           |           |           | X         |           |           | •         |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Lh</i> |           |           | X         |           |           |           | X         |           |           |           | X         |           |           | X         |           | X         | X         |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Sl</i> |           |           |           |           |           |           |           |           |           |           |           | X         |           |           |           | X         | •         | •         |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
| Cullercoats | <i>Ae</i> |           |           |           |           | X         |           |           |           | •         |           |           |           |           |           |           | X         |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Ld</i> |           | X         |           |           | X         |           |           |           | X         |           |           | X         |           | X         |           |           | X         |           | •         |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Lh</i> |           |           | X         |           |           |           | X         |           |           |           | X         |           |           | X         |           | X         |           | •         | X         |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Sl</i> |           |           |           | X         |           |           |           | X         |           |           | X         |           |           | X         |           | X         |           | X         | •         | •         |             |           |           |           |           |           |           |           |           |           |           |           |
| Whitburn    | <i>Ae</i> |           |           |           |           | X         |           |           |           | X         |           |           |           |           |           |           | X         |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Ld</i> |           | X         |           |           | •         |           |           |           | X         |           |           | X         |           | X         |           |           | X         |           |           | X         |             |           |           |           | •         |           |           |           |           |           |           |           |
|             | <i>Lh</i> |           |           | X         |           |           |           | X         |           |           |           | X         |           |           | X         |           | X         |           |           | X         |           |             |           | X         | •         | X         |           |           |           |           |           |           |           |
|             | <i>Sl</i> |           |           |           | X         |           |           |           | X         |           |           | X         |           | X         |           | X         |           | X         |           | X         |           |             | X         | X         | •         | X         |           |           |           |           |           |           |           |
| Saltburn    | <i>Ae</i> |           |           |           |           | X         |           |           |           | X         |           |           |           |           |           |           | X         |           |           |           |           |             |           |           |           |           |           |           |           |           |           |           |           |
|             | <i>Ld</i> |           | X         |           |           | •         |           |           |           | X         |           |           | X         |           | X         |           | X         |           |           | X         |           |             | X         |           |           | X         |           |           |           |           | •         |           |           |
|             | <i>Lh</i> |           |           | •         |           |           |           | X         |           |           |           | X         |           |           | X         |           | X         |           |           | X         |           |             | X         |           |           | X         |           | X         | •         |           |           |           |           |
|             | <i>Sl</i> |           |           |           | •         |           |           |           | •         |           |           | X         |           |           | X         |           |           | •         |           |           | •         |             |           |           |           | X         | •         | •         | •         |           |           |           |           |

| <b>b. i</b> | St. Abbs | Berwick | Seahouses | Boulmer | Cresswell | Cullercoats | Whitburn | Saltburn |
|-------------|----------|---------|-----------|---------|-----------|-------------|----------|----------|
| St. Abbs    |          |         |           |         |           |             |          |          |
| Berwick     | .        |         |           |         |           |             |          |          |
| Seahouses   | .        | .       |           |         |           |             |          |          |
| Boulmer     | .        | X       | .         |         |           |             |          |          |
| Cresswell   | X        | .       | .         | .       |           |             |          |          |
| Cullercoats | X        | .       | .         | .       | X         |             |          |          |
| Whitburn    | X        | .       | .         | X       | X         | X           |          |          |
| Saltburn    | X        | X       | X         | .       | X         | X           | X        |          |

| <b>b. ii</b>         | <i>A. esculenta</i> | <i>L. digitata</i> | <i>L. hyperborea</i> | <i>S. latissima</i> |
|----------------------|---------------------|--------------------|----------------------|---------------------|
| <i>A. esculenta</i>  |                     |                    |                      |                     |
| <i>L. digitata</i>   | X                   |                    |                      |                     |
| <i>L. hyperborea</i> | X                   | .                  |                      |                     |
| <i>S. latissima</i>  | X                   | .                  | .                    |                     |

c.

| c.          |    | St. Abbs |    |    |    | Berwick |    |    |    | Seahouses |    |    |    | Boulmer |    |    |    | Cresswell |    |    |    | Cullercoats |    |    |    | Whitburn |    |    |    | Saltburn |  |  |  |
|-------------|----|----------|----|----|----|---------|----|----|----|-----------|----|----|----|---------|----|----|----|-----------|----|----|----|-------------|----|----|----|----------|----|----|----|----------|--|--|--|
|             |    | Ae       | Ld | Lh | Sl | Ae      | Ld | Lh | Sl | Ae        | Ld | Lh | Sl | Ae      | Ld | Lh | Sl | Ae        | Ld | Lh | Sl | Ae          | Ld | Lh | Sl | Ae       | Ld | Lh | Sl |          |  |  |  |
| St. Abbs    | Ae |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Ld |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Lh |          | X  |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Sl |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
| Berwick     | Ae |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Ld |          | •  |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Lh |          |    | X  |    |         | •  |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Sl |          |    |    |    |         | X  | •  |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
| Seahouses   | Ae |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Ld |          | X  |    |    |         | X  |    |    | •         |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Lh |          |    | •  |    |         |    | •  |    | •         | X  |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Sl |          |    |    |    |         |    |    | •  | X         | •  | •  |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
| Boulmer     | Ae |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Ld |          | •  |    |    |         | X  |    |    |           | X  |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Lh |          |    | X  |    |         |    | X  |    |           |    | X  |    |         | X  |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Sl |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
| Cresswell   | Ae |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Ld |          | •  |    |    |         | •  |    |    |           | •  |    |    | X       |    |    | •  |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Lh |          |    | X  |    |         |    | X  |    |           |    | •  |    | X       |    | •  | •  |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Sl |          |    |    |    |         |    | •  |    |           | X  |    |    |         |    | X  | •  | •         |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
| Cullercoats | Ae |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Ld |          | X  |    |    |         | X  |    |    | X         |    |    | •  |         |    | •  |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Lh |          |    | X  |    |         |    | X  |    |           | •  |    |    | X       |    |    | X  |           |    | X  |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Sl |          |    |    |    |         |    | •  |    |           |    | X  |    |         |    |    |    | X         |    | •  | •  |             |    |    |    |          |    |    |    |          |  |  |  |
| Whitburn    | Ae |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Ld |          | X  |    |    |         | X  |    |    | X         |    |    | •  |         |    | •  |    |           | X  |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Lh |          |    | X  |    |         |    | X  |    |           | •  |    |    | X       |    |    | X  |           |    | X  |    |             |    | X  |    |          |    |    |    |          |  |  |  |
|             | Sl |          |    |    |    |         |    | •  |    |           |    | X  |    |         |    |    |    | X         |    |    | X  |             |    | X  |    | •        | •  |    |    |          |  |  |  |
| Saltburn    | Ae |          |    |    |    |         |    |    |    |           |    |    |    |         |    |    |    |           |    |    |    |             |    |    |    |          |    |    |    |          |  |  |  |
|             | Ld |          | X  |    |    |         | X  |    |    | X         |    |    | •  |         |    | X  |    |           | X  |    |    |             | X  |    |    |          |    |    |    |          |  |  |  |
|             | Lh |          |    | X  |    |         | •  |    |    |           | X  |    |    | X       |    |    | X  |           |    | X  |    |             | X  |    |    | X        |    |    |    |          |  |  |  |
|             | Sl |          |    |    |    |         |    | •  |    |           |    | •  |    |         |    |    |    | •         |    | •  |    |             |    |    |    | •        | •  |    |    |          |  |  |  |

**Appendix 3.** List of the sessile (a) and mobile (b) species associated with kelp microhabitats. ‘X’ denotes where a species was present.

| <b>a. SESSILE</b>               |                 |              |              |
|---------------------------------|-----------------|--------------|--------------|
|                                 | <b>Holdfast</b> | <b>Stipe</b> | <b>Blade</b> |
| <b>Phylum: Bryozoa</b>          |                 |              |              |
| <i>Alcyonidium gelatinosum</i>  | X               |              |              |
| <i>Cryptosula pallasiana</i>    | X               | X            |              |
| <i>Electra pilosa</i>           | X               | X            | X            |
| <i>Membranipora membranacea</i> | X               | X            | X            |
| <b>Phylum: Chlorophyta</b>      |                 |              |              |
| <i>Cladophora rupestris</i>     | X               | X            | X            |
| <i>Ulva intestinalis</i>        |                 | X            | X            |
| <i>Ulva lactuca</i>             |                 | X            | X            |
| <i>Ulva linza</i>               |                 | X            |              |
| <i>Ulva</i> spp.                |                 | X            |              |
| <b>Phylum: Cnidaria</b>         |                 |              |              |
| <i>Dynamea pumila</i>           | X               | X            |              |
| <i>Obelia geniculata</i>        | X               |              | X            |
| <i>Sertularella gayi</i>        | X               |              |              |
| <i>Tubularia indivisa</i>       | X               |              |              |
| <b>Phylum: Ochrophyta</b>       |                 |              |              |
| <i>Cladostephus spongiosus</i>  | X               | X            | X            |
| <i>Dictyota dichotoma</i>       |                 |              | X            |
| <i>Ectocarpus</i> spp.          | X               | X            | X            |
| <i>Fucus serratus</i>           |                 |              | X            |
| <i>Hilmonthalia elongata</i>    | X               |              |              |
| <i>Laminaria digitata</i>       | X               |              |              |
| <i>Laminaria hyperborea</i>     | X               |              |              |
| <i>Saccharina latissima</i>     | X               |              |              |
| <b>Phylum: Porifera</b>         |                 |              |              |
| <i>Grantia compressa</i>        | X               | X            |              |
| <i>Halichondria panicea</i>     | X               | X            |              |
| <b>Phylum: Rhodophyta</b>       |                 |              |              |
| <i>Ahnfeltia plicata</i>        | X               |              |              |
| <i>Ceramium</i> spp.            | X               | X            | X            |
| <i>Chondrus crispus</i>         | X               | X            | X            |
| <i>Corallina officinalis</i>    | X               |              | X            |
| <i>Dilsea carnosa</i>           | X               | X            | X            |
| <i>Dumontia contorta</i>        |                 |              | X            |
| <i>Fucellaria lumbricalis</i>   |                 |              | X            |
| <i>Gracilaria gracilis</i>      | X               |              |              |
| <i>Heterosiphonia plumosa</i>   |                 |              | X            |
| <i>Laurencia obtusata</i>       | X               |              |              |
| <i>Lithothamnion</i> spp.       | X               | X            |              |
| <i>Lomentaria articulata</i>    | X               |              |              |
| <i>Mastocarpus stellatus</i>    | X               | X            |              |
| <i>Membranoptera alata</i>      | X               | X            | X            |
| <i>Odonthalia dentata</i>       | X               |              |              |
| <i>Osmundia pinnatifida</i>     | X               | X            |              |
| <i>Palmaria palmata</i>         | X               | X            | X            |
| <i>Phycodrys rubens</i>         | X               |              | X            |
| <i>Plocamium cartilagineum</i>  | X               | X            | X            |
| <i>Plumaria plumosa</i>         | X               |              |              |
| <i>Polysiphonia</i> spp.        | X               | X            | X            |
| <i>Ptilota gunneri</i>          | X               | X            |              |
| <i>Rhodomela confervoides</i>   | X               |              |              |

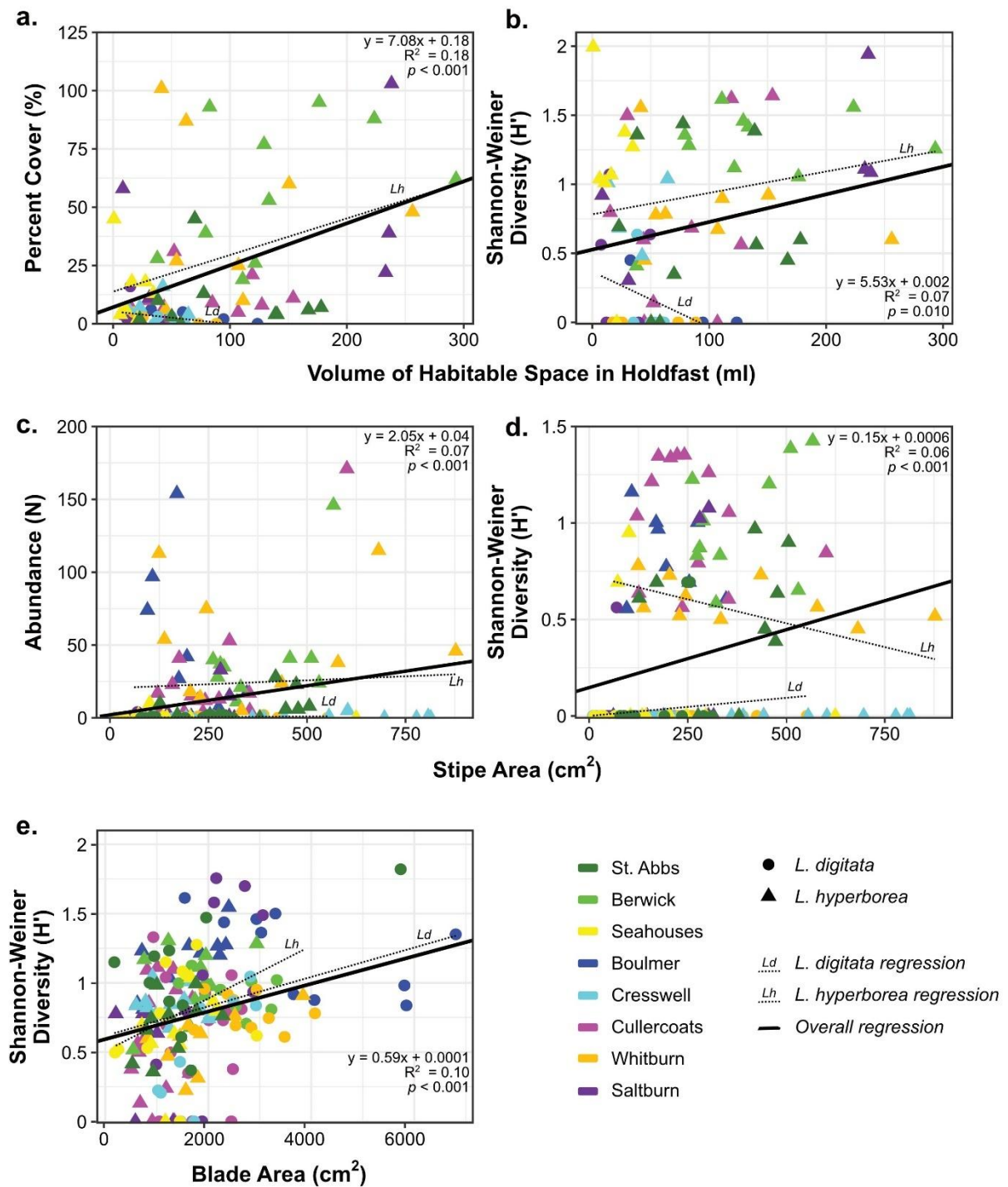
| b. MOBILE                                |          |       |       |
|------------------------------------------|----------|-------|-------|
|                                          | Holdfast | Stipe | Blade |
| <b>Phylum: Annelida</b>                  |          |       |       |
| <i>Eulalia bilineata</i>                 | X        |       |       |
| <i>Eulalia viridis</i>                   | X        |       |       |
| <i>Eumida sanguinea</i>                  | X        |       |       |
| <i>Glycera</i> spp.                      | X        | X     |       |
| <i>Harmothoe</i> spp.                    | X        |       |       |
| <i>Hesionidae</i> spp.                   | X        |       |       |
| <i>Nereimyra punctata</i>                | X        |       |       |
| <i>Nereis pelagica</i>                   | X        |       |       |
| <i>Nereis</i> spp.                       | X        |       |       |
| <i>Nereis viriens</i>                    |          |       | X     |
| <i>Nereis zonata</i>                     | X        |       |       |
| <i>Perinereis cultrifera</i>             | X        |       |       |
| <i>Phyllodoce laminosa</i>               | X        |       |       |
| <i>Polynoinae</i> spp.                   | X        |       | X     |
| <i>Pomotoceros lamarkii</i>              | X        |       |       |
| <i>Pomotoceros triqueter</i>             | X        |       |       |
| <i>Sabellaria aveolata</i>               | X        |       |       |
| <i>Sabellaria spinulosa</i>              | X        |       |       |
| <i>Sabellidae</i> spp.                   | X        |       |       |
| <i>Spincula</i> spp.                     | X        |       |       |
| <i>Spionidae</i> spp.                    | X        |       |       |
| <i>Spirobidae</i> spp.                   | X        |       |       |
| <i>Spirorbis (Spirorbis) tridentatus</i> | X        |       |       |
| <i>Spirorbis spirorbis</i>               | X        | X     | X     |
| <i>Syllidae</i> spp.                     | X        |       |       |
| Unidentified - clustering tube worm 1    | X        |       |       |
| Unidentified - pale pod worm 1           | X        |       |       |
| <b>Phylum: Arthropoda</b>                |          |       |       |
| <i>Achelia echinata</i>                  | X        |       |       |
| <i>Ameronothridae</i> spp.               | X        |       |       |
| <i>Amphilocheidae</i> spp.               | X        |       |       |
| <i>Amphipoda</i> spp.                    |          | X     | X     |
| <i>Ampithoe rubricata</i>                | X        |       |       |
| <i>Ampithoidae</i> spp.                  | X        |       |       |
| <i>Apherusa jurinei</i>                  |          |       | X     |
| <i>Balanus crenatus</i>                  | X        |       |       |
| <i>Bathyporeia</i> spp.                  | X        |       |       |
| <i>Bodotria scorpioides</i>              | X        |       |       |
| <i>Calliopiidae</i> spp.                 | X        |       |       |
| <i>Calliopus laeviusculus</i>            | X        |       |       |
| <i>Cancer pagarus</i>                    | X        |       |       |
| <i>Caprella acanthifera</i>              | X        |       |       |
| <i>Carcinus maenas</i>                   | X        |       | X     |
| <i>Caridea</i> spp.                      |          | X     |       |
| <i>Corophiidae</i> spp.                  | X        |       |       |
| <i>Corystes cassivelaunus</i>            | X        |       |       |
| Decapod zoea                             | X        |       |       |
| <i>Ericthonius punctatus</i>             | X        |       |       |
| <i>Euphausiidae</i> spp.                 |          |       | X     |
| <i>Galathea squamata</i>                 | X        |       |       |
| <i>Galathea strigosa</i>                 | X        |       |       |
| <i>Gammaropsis maculata</i>              | X        |       |       |
| <i>Gammarus locustus</i>                 | X        |       | X     |
| <i>Gammarus</i> spp.                     | X        |       | X     |
| <i>Gitana sarsi</i>                      | X        |       |       |
| <i>Hyale nilssoni</i>                    | X        |       |       |
| <i>Ideotea</i> spp.                      | X        | X     | X     |

|                                |   |   |   |
|--------------------------------|---|---|---|
| <i>Idotea baltica</i>          |   | X |   |
| <i>Idotea granulosa</i>        | X | X | X |
| <i>Idotea neglecta</i>         | X | X | X |
| <i>Idotea pelagica</i>         | X |   |   |
| <i>Ischyroceridae</i> spp.     | X |   |   |
| <i>Isochyrocerus anguipes</i>  | X |   |   |
| <i>Jassa falcata</i>           | X | X | X |
| <i>Lembos websteri</i>         | X |   |   |
| <i>Leptomysis lingvura</i>     | X |   |   |
| <i>Lysianassidae</i> spp.      | X |   |   |
| <i>Lysianassa caesarea</i>     |   |   | X |
| <i>Nototropis swammerdamei</i> | X |   |   |
| <i>Nymphon gracile</i>         | X |   |   |
| <i>Pagarus bernhardus</i>      | X |   |   |
| <i>Pirimela denticulata</i>    | X |   |   |
| <i>Pisidia longicornis</i>     | X |   |   |
| <i>Portumnus latipes</i>       | X |   |   |
| <i>Semibalanus balanoides</i>  | X |   |   |
| <i>Sunamphitoe pelagica</i>    | X |   |   |
| <i>Tanais dulongii</i>         | X |   |   |
| <i>Verrucoa stoemia</i>        | X |   |   |
| <b>Phylum: Cnidaria</b>        |   |   |   |
| <i>Actinia equina</i>          | X |   |   |
| <b>Phylum: Echinodermata</b>   |   |   |   |
| <i>Amphipholis squamata</i>    | X |   |   |
| <i>Asterias rubens</i>         | X |   |   |
| <i>Echinus esculentus</i>      | X |   |   |
| <i>Henricia sanguinolenta</i>  | X |   |   |
| <i>Ophiothrix fragilis</i>     | X |   |   |
| <i>Ophiura affinis</i>         | X |   |   |
| <i>Ophiura ophiura</i>         | X |   |   |
| <b>Phylum: Mollusca</b>        |   |   |   |
| <i>Acanthochitona crinitus</i> | X |   |   |
| <i>Alvania semistriata</i>     | X | X | X |
| <i>Anomia ephippium</i>        | X |   |   |
| <i>Cardiidae</i> spp.          |   |   | X |
| <i>Cingula trifasciata</i>     | X |   |   |
| <i>Crassostrea gigas</i>       | X |   |   |
| <i>Dikoleps nitens</i>         | X |   |   |
| <i>Hiatella artica</i>         | X |   |   |
| <i>Hinia incrassata</i>        | X |   |   |
| <i>Hinia reticulata</i>        | X |   |   |
| <i>Hydrobia neglecta</i>       | X |   |   |
| <i>Lacuna pallidula</i>        | X |   |   |
| <i>Lacuna parva</i>            | X |   | X |
| <i>Lacuna vincta</i>           | X | X | X |
| <i>Littorina fabalis</i>       | X | X | X |
| <i>Littorina littorea</i>      | X |   |   |
| <i>Littorina neglecta</i>      | X |   | X |
| <i>Littorina obtusata</i>      | X | X | X |
| <i>Modiolis modiolis</i>       | X | X | X |
| <i>Modiolula phaseolina</i>    | X | X | X |
| <i>Musculus discors</i>        | X |   |   |
| <i>Mya truncata</i>            | X |   |   |
| <i>Mytilus</i> spp.            | X | X | X |
| <i>Nucella lapillus</i>        | X |   |   |
| <i>Onoba semicostata</i>       | X |   |   |
| <i>Ostrea edulis</i>           | X |   |   |
| <i>Patella pellucida</i>       | X | X | X |
| <i>Patella vulgata</i>         | X |   |   |
| <i>Pecten maximus</i>          | X |   |   |

|                                    |   |   |   |
|------------------------------------|---|---|---|
| <i>Rissoa parva</i>                | X | X | X |
| <i>Rissoa parva var interrupta</i> | X |   |   |
| <i>Rissoa sarsii</i>               | X | X | X |
| <i>Skenea serpuloides</i>          | X | X |   |
| <i>Steromphala cinnerarea</i>      | X |   | X |
| <i>Tectura virginea</i>            | X |   |   |
| <i>Tellimya ferruginosa</i>        | X |   |   |
| <i>Boreochiton ruber</i>           | X |   |   |
| <i>Trivia monacha</i>              | X |   |   |
| <i>Turtonia minuta</i>             | X | X | X |
| <i>Vitreolina philippi</i>         | X |   |   |
| <b>Phylum: Nemotoda</b>            |   |   |   |
| <i>Nematoda spp.</i>               | X |   |   |
| <b>Phylum: Nematera</b>            |   |   |   |
| <i>Emplectonema gracile</i>        | X |   |   |
| <i>Linues longisimus</i>           | X |   |   |



**Appendix 4.** Relationship between the percent cover (a), abundance (c), and Shannon index (b, d, e) of sessile holdfast-associated assemblages (a, b), mobile stipe-associated assemblages (c, d), and mobile blade-associated assemblages (e) and the volume or area of habitable space per corresponding microhabitat, per kelp species.



**Appendix 5.** Pairwise post hoc comparisons for the univariate percent cover/abundance of sessile (a) and mobile (b) taxa found associated with kelp (*Ld* = *L. digitata*, *Lh* = *L. hyperborea*) holdfasts across sites (colours). Circles (•) indicate where significant ( $p < 0.05$ ) comparisons occurred, crosses (X) indicate non-significant pairwise comparisons, and colours (site) and letters (species) indicate the direction (i.e. greater value) of the difference.

|             |          |         |           |         |           |             |          |          |
|-------------|----------|---------|-----------|---------|-----------|-------------|----------|----------|
| a.          | St. Abbs | Berwick | Seahouses | Boulmer | Cresswell | Cullercoats | Whitburn | Saltburn |
| St. Abbs    |          |         |           |         |           |             |          |          |
| Berwick     | •        |         |           |         |           |             |          |          |
| Seahouses   | X        | •       |           |         |           |             |          |          |
| Boulmer     |          |         |           |         |           |             |          |          |
| Cresswell   | X        | •       | X         | X       |           |             |          |          |
| Cullercoats | X        | •       | X         |         | X         |             |          |          |
| Whitburn    | •        | X       | •         | X       | X         | •           |          |          |
| Saltburn    | •        | X       | •         | X       | •         | •           | X        |          |

b.

|             |           | St. Abbs             | Berwick              | Seahouses            | Boulmer              | Cresswell            |                      | Cullercoats          | Whitburn             |                      | Saltburn             |                      |
|-------------|-----------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|             |           | <i>L</i><br><i>h</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>h</i> |
| St. Abbs    | <i>Lh</i> |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Berwick     | <i>Lh</i> | X                    |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Seahouse    | <i>Lh</i> | X                    | X                    |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Boulmer     | <i>Ld</i> |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Cresswell   | <i>Ld</i> |                      |                      |                      | •                    |                      |                      |                      |                      |                      |                      |                      |
|             | <i>Lh</i> | •                    | •                    | X                    |                      | • <i>Ld</i>          |                      |                      |                      |                      |                      |                      |
| Cullercoats | <i>Lh</i> | X                    | X                    | X                    |                      |                      | •                    |                      |                      |                      |                      |                      |
| Whitburn    | <i>Ld</i> |                      |                      |                      | •                    | •                    |                      |                      |                      |                      |                      |                      |
|             | <i>Lh</i> | X                    | •                    | X                    |                      |                      | •                    | X                    | • <i>Lh</i>          |                      |                      |                      |
| Saltburn    | <i>Ld</i> |                      |                      |                      | X                    | X                    |                      |                      | •                    |                      |                      |                      |
|             | <i>Lh</i> | X                    | X                    | X                    |                      |                      | •                    | X                    |                      | •                    | X                    |                      |

**Appendix 6.** Pairwise post hoc comparisons for the univariate Shannon index of sessile (a) and mobile (b) taxa found associated with kelp (*Ld* = *L. digitata*, *Lh* = *L. hyperborea*) holdfasts across sites (colours). Circles (•) indicate where significant ( $p < 0.05$ ) comparisons occurred, crosses (X) indicate non-significant pairwise comparisons, and colours (site) and letters (species) indicate the direction (i.e. greater value) of the difference.

|             |          |         |           |         |           |             |          |          |
|-------------|----------|---------|-----------|---------|-----------|-------------|----------|----------|
| a.          | St. Abbs | Berwick | Seahouses | Boulmer | Cresswell | Cullercoats | Whitburn | Saltburn |
| St. Abbs    |          |         |           |         |           |             |          |          |
| Berwick     | X        |         |           |         |           |             |          |          |
| Seahouses   | X        | •       |           |         |           |             |          |          |
| Boulmer     | X        | •       | X         |         |           |             |          |          |
| Cresswell   | X        | •       | X         | X       |           |             |          |          |
| Cullercoats | X        | X       | X         | X       | X         |             |          |          |
| Whitburn    | X        | •       | •         | •       | X         | X           |          |          |
| Saltburn    | X        | X       | X         | •       | X         | X           | X        |          |

b.

|             |       | St. Abbs | Berwick | Seahouses | Boulmer | Cresswell |       | Cullercoats | Whitburn |       | Saltburn |       |
|-------------|-------|----------|---------|-----------|---------|-----------|-------|-------------|----------|-------|----------|-------|
|             |       | $L_h$    | $L_h$   | $L_h$     | $L_d$   | $L_d$     | $L_h$ | $L_h$       | $L_d$    | $L_h$ | $L_d$    | $L_h$ |
| St. Abbs    | $L_h$ |          |         |           |         |           |       |             |          |       |          |       |
| Berwick     | $L_h$ | X        |         |           |         |           |       |             |          |       |          |       |
| Seahouse    | $L_h$ | X        | X       |           |         |           |       |             |          |       |          |       |
| Boulmer     | $L_d$ |          |         |           |         |           |       |             |          |       |          |       |
| Cresswell   | $L_d$ |          |         |           | •       |           |       |             |          |       |          |       |
|             | $L_h$ | •        | •       | X         |         | • $L_d$   |       |             |          |       |          |       |
| Cullercoats | $L_h$ | X        | X       | •         |         |           | •     |             |          |       |          |       |
| Whitburn    | $L_d$ |          |         |           | X       | •         |       |             |          |       |          |       |
|             | $L_h$ | •        | X       | X         |         |           | X     | X           | • $L_h$  |       |          |       |
| Saltburn    | $L_d$ |          |         |           | X       | •         |       |             | X        |       |          |       |
|             | $L_h$ | •        | •       | X         |         |           | X     | •           |          | X     | X        |       |

**Appendix 7.** Pairwise post hoc comparisons for the multivariate structure of sessile (a) and mobile (b) taxa found associated with kelp (*Ld* = *L. digitata*, *Lh* = *L. hyperborea*) holdfasts across sites (colours). Circles (•) indicate where significant ( $p < 0.05$ ) comparisons occurred, crosses (x) indicate non-significant pairwise comparisons. Grey shading indicates where no test was performed.

**a.**

|             |           | St. Abbs             | Berwick              | Seahouses            | Boulmer              | Cresswell            |                      | Cullercoats          | Whitburn             |                      | Saltburn             |                      |
|-------------|-----------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|             |           | <i>L</i><br><i>h</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>h</i> |
| St. Abbs    | <i>Lh</i> |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Berwick     | <i>Lh</i> | •                    |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Seahouses   | <i>Lh</i> | X                    | •                    |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Boulmer     | <i>Ld</i> |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Cresswell   | <i>Ld</i> |                      |                      |                      | X                    |                      |                      |                      |                      |                      |                      |                      |
|             | <i>Lh</i> | •                    | •                    | X                    |                      | •                    |                      |                      |                      |                      |                      |                      |
| Cullercoats | <i>Lh</i> | •                    | •                    | •                    |                      |                      | •                    |                      |                      |                      |                      |                      |
| Whitburn    | <i>Ld</i> |                      |                      |                      | X                    | X                    |                      |                      |                      |                      |                      |                      |
|             | <i>Lh</i> | •                    | X                    | •                    |                      |                      | •                    | •                    | •                    |                      |                      |                      |
| Saltburn    | <i>Ld</i> |                      |                      |                      | X                    | X                    |                      |                      | X                    |                      |                      |                      |
|             | <i>Lh</i> | •                    | •                    | •                    |                      |                      | •                    | •                    |                      | X                    | •                    |                      |

b.

|             |           | St. Abbs             | Berwick              | Seahouses            | Boulmer              | Cresswell            |                      | Cullercoats          | Whitburn             |                      | Saltburn             |                      |
|-------------|-----------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|             |           | <i>L</i><br><i>h</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>h</i> | <i>L</i><br><i>d</i> | <i>L</i><br><i>h</i> |
| St. Abbs    | <i>Lh</i> |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Berwick     | <i>Lh</i> | •                    |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Seahouses   | <i>Lh</i> | •                    | •                    |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Boulmer     | <i>Ld</i> |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Cresswell   | <i>Ld</i> |                      |                      |                      | •                    |                      |                      |                      |                      |                      |                      |                      |
|             | <i>Lh</i> | •                    | •                    | •                    |                      | •                    |                      |                      |                      |                      |                      |                      |
| Cullercoats | <i>Lh</i> | •                    | •                    | •                    |                      |                      | •                    |                      |                      |                      |                      |                      |
| Whitburn    | <i>Ld</i> |                      |                      |                      | •                    | •                    |                      |                      |                      |                      |                      |                      |
|             | <i>Lh</i> | •                    | •                    | •                    |                      |                      | •                    | •                    | •                    |                      |                      |                      |
| Saltburn    | <i>Ld</i> |                      |                      |                      | •                    | •                    |                      |                      | •                    |                      |                      |                      |
|             | <i>Lh</i> | •                    | •                    | •                    |                      |                      | •                    | •                    |                      | •                    | •                    |                      |

**Appendix 8.** SIMPER analysis (40% cumulative contribution cut-off) showing percentage contributions of individual taxa to observed differences in sessile (a) and mobile (b) assemblages associated with the holdfast of different kelp species. Data were square-root transformed prior to analysis.

**a. Sessile**

|                                     | Taxa                         | Av.<br>Abund  | Av.<br>Abund  | Av.<br>Diss | Diss/<br>SD | Contrib<br>.% | Cum.<br>% |
|-------------------------------------|------------------------------|---------------|---------------|-------------|-------------|---------------|-----------|
| Average<br>dissimilarity<br>= 93.44 |                              | <i>L. dig</i> | <i>L. hyp</i> |             |             |               |           |
|                                     | <i>Electra pilosa</i>        | 0.21          | 2.66          | 24.24       | 1.18        | 25.94         | 25.94     |
|                                     | <i>Palmaria palmata</i>      | 0.21          | 1.13          | 11.48       | 0.68        | 12.29         | 38.23     |
|                                     | <i>Corallina officinalis</i> | 0.22          | 0.66          | 9.94        | 0.58        | 10.63         | 48.87     |

**b. Mobile**

|                                     | Taxa                        | Av.<br>Abund  | Av.<br>Abund  | Av.<br>Diss | Diss/<br>SD | Contrib<br>.% | Cum.<br>% |
|-------------------------------------|-----------------------------|---------------|---------------|-------------|-------------|---------------|-----------|
| Average<br>dissimilarity<br>= 78.08 |                             | <i>L. dig</i> | <i>L. hyp</i> |             |             |               |           |
|                                     | <i>Mytilus spp.</i>         | 5.84          | 5.65          | 10.81       | 1.11        | 13.85         | 13.85     |
|                                     | <i>Turtonia minuta</i>      | 7.62          | 1.39          | 7.37        | 0.60        | 9.45          | 23.29     |
|                                     | <i>Rissoa parva</i>         | 4.11          | 1.67          | 4.91        | 1.19        | 6.28          | 29.58     |
|                                     | <i>Modiolula phaseolina</i> | 3.30          | 1.61          | 4.35        | 1.33        | 5.57          | 35.15     |
|                                     | <i>Anomia ephippium</i>     | 1.27          | 2.75          | 4.22        | 1.05        | 5.40          | 40.55     |



**a.**

[illegible]

b.

|             |           | St. Abbs  |           | Berwick   |           | Seahouses   |           | Boulmer     |           | Cresswell |           | Cullercoats |           | Whitburn    |           | Saltburn    |           |
|-------------|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-------------|-----------|-----------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|
|             |           | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> |
| St. Abbs    | <i>Ld</i> |           |           |           |           |             |           |             |           |           |           |             |           |             |           |             |           |
|             | <i>Lh</i> | X         |           |           |           |             |           |             |           |           |           |             |           |             |           |             |           |
| Berwick     | <i>Ld</i> | X         |           |           |           |             |           |             |           |           |           |             |           |             |           |             |           |
|             | <i>Lh</i> |           | X         | X         |           |             |           |             |           |           |           |             |           |             |           |             |           |
| Seahouses   | <i>Ld</i> | X         |           | X         |           |             |           |             |           |           |           |             |           |             |           |             |           |
|             | <i>Lh</i> |           | X         |           | X         | • <i>Lh</i> |           |             |           |           |           |             |           |             |           |             |           |
| Boulmer     | <i>Ld</i> | X         |           | X         |           |             |           |             |           |           |           |             |           |             |           |             |           |
|             | <i>Lh</i> |           | X         |           | X         |             | •         | • <i>Lh</i> |           |           |           |             |           |             |           |             |           |
| Cresswell   | <i>Ld</i> | X         |           | X         |           |             |           |             |           |           |           |             |           |             |           |             |           |
|             | <i>Lh</i> |           | •         |           | X         |             | X         |             | X         | X         |           |             |           |             |           |             |           |
| Cullercoats | <i>Ld</i> | •         |           | X         |           |             |           |             |           |           |           |             |           |             |           |             |           |
|             | <i>Lh</i> |           | •         |           | X         |             | •         |             | X         |           | •         | X           |           |             |           |             |           |
| Whitburn    | <i>Ld</i> | X         |           | X         |           | X           |           | X           |           | X         |           | •           |           |             |           |             |           |
|             | <i>Lh</i> |           | •         |           | X         |             | •         |             | X         |           | •         |             | X         | • <i>Lh</i> |           |             |           |
| Saltburn    | <i>Ld</i> | X         |           | X         |           | X           |           | X           |           | X         |           | X           |           | X           |           |             |           |
|             | <i>Lh</i> |           | X         |           | X         |             | •         |             | X         |           | X         |             | X         |             | X         | • <i>Lh</i> |           |

**Appendix 10.** Pairwise post hoc comparisons for the univariate diversity of sessile (a) and mobile (b) taxa found associated with kelp (*Ld* = *L. digitata*, *Lh* = *L. hyperborea*) stipes across sites (colours). Circles (•) indicate where significant ( $p < 0.05$ ) comparisons occurred, crosses (X) indicate non-significant pairwise comparisons, and colours (site) and letters (species) indicate the direction (i.e. greater value) of the difference.

| a.          |           | St. Abbs       |           | Berwick     |           | Seahouses   |           | Boulmer   |           | Cresswell   |           | Cullercoats |           | Whitburn  |           | Saltburn    |           |
|-------------|-----------|----------------|-----------|-------------|-----------|-------------|-----------|-----------|-----------|-------------|-----------|-------------|-----------|-----------|-----------|-------------|-----------|
|             |           | <i>Ld</i>      | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> |
| St. Abbs    | <i>Ld</i> |                |           |             |           |             |           |           |           |             |           |             |           |           |           |             |           |
|             | <i>Lh</i> | •<br><i>Lh</i> |           |             |           |             |           |           |           |             |           |             |           |           |           |             |           |
| Berwick     | <i>Ld</i> |                |           |             |           |             |           |           |           |             |           |             |           |           |           |             |           |
|             | <i>Lh</i> |                | X         | • <i>Lh</i> |           |             |           |           |           |             |           |             |           |           |           |             |           |
| Seahouses   | <i>Ld</i> |                |           |             |           |             |           |           |           |             |           |             |           |           |           |             |           |
|             | <i>Lh</i> |                | X         |             | X         | • <i>Lh</i> |           |           |           |             |           |             |           |           |           |             |           |
| Boulmer     | <i>Ld</i> |                |           |             |           |             |           |           |           |             |           |             |           |           |           |             |           |
|             | <i>Lh</i> |                | •         |             | •         |             | •         | X         |           |             |           |             |           |           |           |             |           |
| Cresswell   | <i>Ld</i> |                |           |             |           |             |           |           |           |             |           |             |           |           |           |             |           |
|             | <i>Lh</i> |                | X         |             | X         |             | X         |           | •         | • <i>Lh</i> |           |             |           |           |           |             |           |
| Cullercoats | <i>Ld</i> |                |           |             |           |             |           |           |           |             |           |             |           |           |           |             |           |
|             | <i>Lh</i> |                | •         |             | •         |             | X         |           | X         |             | •         | • <i>Lh</i> |           |           |           |             |           |
| Whitburn    | <i>Ld</i> | X              |           | X           |           | X           |           | X         |           | X           |           | X           |           |           |           |             |           |
|             | <i>Lh</i> |                | •         |             | •         |             | X         |           | X         |             | •         |             | X         | X         |           |             |           |
| Saltburn    | <i>Ld</i> | •              |           | X           |           | •           |           | •         |           | •           |           | •           |           | X         |           |             |           |
|             | <i>Lh</i> |                | X         |             | X         |             | X         |           | •         |             | X         |             | •         |           | •         | • <i>Lh</i> |           |

[illegible][illegible]

**a.**

[illegible]

b.

|             |           | St. Abbs  |           | Berwick   |           | Seahouses |           | Boulmer   |           | Cresswell |           | Cullercoats |           | Whitburn  |           | Saltburn  |           |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|-----------|-----------|-----------|
|             |           | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> |
| St. Abbs    | <i>Ld</i> |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> | x         |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |
| Berwick     | <i>Ld</i> | x         |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | x         | •         |           |           |           |           |           |           |           |             |           |           |           |           |           |
| Seahouses   | <i>Ld</i> | x         |           | x         |           |           |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | •         |           | •         | •         |           |           |           |           |           |             |           |           |           |           |           |
| Boulmer     | <i>Ld</i> | x         |           | x         |           |           |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | x         |           | x         |           | •         | •         |           |           |           |             |           |           |           |           |           |
| Cresswell   | <i>Ld</i> | x         |           | x         |           |           |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | •         |           | •         |           | x         |           | •         | x         |           |             |           |           |           |           |           |
| Cullercoats | <i>Ld</i> | •         |           | x         |           |           |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | •         |           | x         |           | •         |           | x         |           | •         | •           |           |           |           |           |           |
| Whitburn    | <i>Ld</i> | x         |           | x         |           | x         |           | x         |           | x         |           | x           |           |           |           |           |           |
|             | <i>Lh</i> |           | •         |           | x         |           | •         |           | x         |           | •         |             | x         | •         |           |           |           |
| Saltburn    | <i>Ld</i> | x         |           | x         |           | x         |           | x         |           | x         |           | x           |           |           |           |           |           |
|             | <i>Lh</i> |           | x         |           | x         |           | x         |           | x         |           | x         |             | •         |           | •         | •         |           |

**Appendix 12.** SIMPER analysis (cumulative contribution cut-off 90% and 70% respectively) showing percentage contributions of individual taxa to observed differences in sessile (a) and mobile (b) assemblages associated with the stipe of different kelp species. Data were square-root transformed prior to analysis.

**a. Sessile**

|                                     | Taxa                                | Av.<br>Abund  | Av.<br>Abund  | Av.<br>Diss | Diss/<br>SD | Contrib<br>.% | Cum.<br>% |
|-------------------------------------|-------------------------------------|---------------|---------------|-------------|-------------|---------------|-----------|
| Average<br>dissimilarity<br>= 92.66 |                                     | <i>L. dig</i> | <i>L. hyp</i> |             |             |               |           |
|                                     | <i>Palmaria palmata</i>             | 0.45          | 6.50          | 60.16       | 2.37        | 64.93         | 64.93     |
|                                     | <i>Electra pilosa</i>               | 0.06          | 2.38          | 17.86       | 1.09        | 19.27         | 84.20     |
|                                     | <i>Membranipora<br/>membranacea</i> | 0.10          | 0.55          | 3.19        | 0.40        | 3.44          | 87.64     |

**b. Mobile**

|                                     | Taxa                     | Av.<br>Abund  | Av.<br>Abund  | Av.<br>Diss | Diss/<br>SD | Contrib<br>.% | Cum.<br>% |
|-------------------------------------|--------------------------|---------------|---------------|-------------|-------------|---------------|-----------|
| Average<br>dissimilarity<br>= 96.44 |                          | <i>L. dig</i> | <i>L. hyp</i> |             |             |               |           |
|                                     | <i>Lacuna vineta</i>     | 0.09          | 2.69          | 40.48       | 1.74        | 41.98         | 41.98     |
|                                     | <i>Patella pellucida</i> | 0.11          | 1.42          | 22.81       | 1.01        | 23.65         | 65.63     |
|                                     | <i>Idotea granulosa</i>  | 0             | 0.73          | 9.24        | 0.90        | 9.59          | 75.22     |

**a.**

[illegible]



| b.          | St. Abbs | Berwick | Seahouses | Boulmer | Cresswell | Cullercoats | Whitburn | Saltburn |
|-------------|----------|---------|-----------|---------|-----------|-------------|----------|----------|
| St. Abbs    |          |         |           |         |           |             |          |          |
| Berwick     | .        |         |           |         |           |             |          |          |
| Seahouses   | .        | X       |           |         |           |             |          |          |
| Boulmer     | X        | .       | .         |         |           |             |          |          |
| Cresswell   | .        | X       | X         | .       |           |             |          |          |
| Cullercoats | .        | .       | .         | .       | .         |             |          |          |
| Whitburn    | X        | X       | X         | .       | X         | .           |          |          |
| Saltburn    | .        | .       | .         | .       | .         | X           | .        |          |

**Appendix 14.** Pairwise post hoc comparisons for the univariate diversity of sessile (a) and mobile (b) taxa found associated with kelp (*Ld* = *L. digitata*, *Lh* = *L. hyperborea*) blades across sites (colours). Circles (•) indicate where significant ( $p < 0.05$ ) comparisons occurred, crosses (X) indicate non-significant pairwise comparisons, and colours (site) and letters (species) indicate the direction (i.e. greater value) of the difference.

| a.          | St. Abbs | Berwick | Seahouses | Boulmer | Cresswell | Cullercoats | Whitburn | Saltburn |
|-------------|----------|---------|-----------|---------|-----------|-------------|----------|----------|
| St. Abbs    |          |         |           |         |           |             |          |          |
| Berwick     | X        |         |           |         |           |             |          |          |
| Seahouses   | X        | X       |           |         |           |             |          |          |
| Boulmer     | •        | •       | •         |         |           |             |          |          |
| Cresswell   | X        | X       | X         | •       |           |             |          |          |
| Cullercoats | X        | X       | X         | •       | X         |             |          |          |
| Whitburn    | X        | X       | X         | •       | X         | X           |          |          |
| Saltburn    | •        | X       | X         | X       | X         | X           | •        |          |

b.

|             |           | St. Abbs       |           | Berwick   |           | Seahouses |           | Boulmer   |           | Cresswell      |           | Cullercoats |           | Whitburn  |           | Saltburn  |           |
|-------------|-----------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|-----------|-------------|-----------|-----------|-----------|-----------|-----------|
|             |           | <i>Ld</i>      | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i>      | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> |
| St. Abbs    | <i>Ld</i> |                |           |           |           |           |           |           |           |                |           |             |           |           |           |           |           |
|             | <i>Lh</i> | •<br><i>Ld</i> |           |           |           |           |           |           |           |                |           |             |           |           |           |           |           |
| Berwick     | <i>Ld</i> | X              |           |           |           |           |           |           |           |                |           |             |           |           |           |           |           |
|             | <i>Lh</i> |                | •         | X         |           |           |           |           |           |                |           |             |           |           |           |           |           |
| Seahouses   | <i>Ld</i> | X              |           | X         |           |           |           |           |           |                |           |             |           |           |           |           |           |
|             | <i>Lh</i> |                | X         |           | •         | X         |           |           |           |                |           |             |           |           |           |           |           |
| Boulmer     | <i>Ld</i> | X              |           | •         |           | •         |           |           |           |                |           |             |           |           |           |           |           |
|             | <i>Lh</i> |                | •         |           | X         |           | •         | X         |           |                |           |             |           |           |           |           |           |
| Cresswell   | <i>Ld</i> | •              |           | •         |           | •         |           | •         |           |                |           |             |           |           |           |           |           |
|             | <i>Lh</i> |                | X         |           | X         |           |           |           | •         | •<br><i>Lh</i> |           |             |           |           |           |           |           |
| Cullercoats | <i>Ld</i> | •              |           | •         |           | X         |           | •         |           | X              |           |             |           |           |           |           |           |
|             | <i>Lh</i> |                | X         |           | X         |           | X         |           | •         |                | X         | X           |           |           |           |           |           |
| Whitburn    | <i>Ld</i> | •              |           | X         |           | X         |           | •         |           | X              |           | X           |           |           |           |           |           |
|             | <i>Lh</i> |                | X         |           | •         |           | X         |           | •         |                | •         |             | X         | X         |           |           |           |
| Saltburn    | <i>Ld</i> | X              |           | X         |           | X         |           | X         |           | •              |           | X           |           | X         |           |           |           |
|             | <i>Lh</i> |                | X         |           | •         |           | X         |           | •         |                | •         |             | X         |           | •         | X         |           |

**a.**

**a.**

b.

|             |           | St. Abbs  |           | Berwick   |           | Seahouses |           | Boulmer   |           | Cresswell |           | Cullercoats |           | Whitburn  |           | Saltburn  |           |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-----------|-----------|-----------|-----------|-----------|
|             |           | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i>   | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> | <i>Ld</i> | <i>Lh</i> |
| St. Abbs    | <i>Ld</i> |           |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> | X         |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |
| Berwick     | <i>Ld</i> | •         |           |           |           |           |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | •         | X         |           |           |           |           |           |           |           |             |           |           |           |           |           |
| Seahouses   | <i>Ld</i> | X         |           | X         |           |           |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | •         |           | X         | X         |           |           |           |           |           |             |           |           |           |           |           |
| Boulmer     | <i>Ld</i> | •         |           | •         |           | •         |           |           |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | •         |           | •         |           | •         | X         |           |           |           |             |           |           |           |           |           |
| Cresswell   | <i>Ld</i> | •         |           | •         |           | •         |           | •         |           |           |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | X         |           | •         |           | X         |           | •         | •         |           |             |           |           |           |           |           |
| Cullercoats | <i>Ld</i> | •         |           | •         |           | •         |           | •         |           | •         |           |             |           |           |           |           |           |
|             | <i>Lh</i> |           | •         |           | X         |           | •         |           | •         |           | •         | X           |           |           |           |           |           |
| Whitburn    | <i>Ld</i> | •         |           | X         |           | •         |           | •         |           | •         |           | •           |           |           |           |           |           |
|             | <i>Lh</i> |           | X         |           | •         |           | •         |           | •         |           | X         |             | •         | •         |           |           |           |
| Saltburn    | <i>Ld</i> | •         |           | •         |           | •         |           | •         |           | •         |           | X           |           | •         |           |           |           |
|             | <i>Lh</i> |           | •         |           | X         |           | X         |           | •         |           | •         |             | •         |           | •         | X         |           |

**Appendix 16.** SIMPER analysis (60% cumulative contribution cut-off) showing percentage contributions of individual taxa to observed differences in sessile (a) and mobile (b) assemblages associated with the blades of different kelp species. Data were square-root transformed prior to analysis.

**a. Sessile**

|                                     | Taxa                                | Av.<br>Abund  | Av.<br>Abund  | Av.<br>Diss | Diss/<br>SD | Contrib<br>.% | Cum.<br>% |
|-------------------------------------|-------------------------------------|---------------|---------------|-------------|-------------|---------------|-----------|
| Average<br>dissimilarity<br>= 97.96 |                                     | <i>L. dig</i> | <i>L. hyp</i> |             |             |               |           |
|                                     | <i>Membranipora<br/>membranacea</i> | 0.17          | 0.24          | 22.24       | 0.61        | 22.71         | 22.71     |
|                                     | <i>Palmaria palmata</i>             | 0.07          | 0.16          | 18.43       | 0.59        | 18.82         | 41.52     |
|                                     | <i>Ceramium spp.</i>                | 0.01          | 0.03          | 9.63        | 0.36        | 9.84          | 51.37     |
|                                     | <i>Electra pilosa</i>               | 0.02          | 0.09          | 8.23        | 0.38        | 8.41          | 59.77     |

**b. Mobile**

|                                     | Taxa                     | Av.<br>Abund  | Av.<br>Abund  | Av.<br>Diss | Diss/<br>SD | Contrib<br>.% | Cum.<br>% |
|-------------------------------------|--------------------------|---------------|---------------|-------------|-------------|---------------|-----------|
| Average<br>dissimilarity<br>= 50.19 |                          | <i>L. dig</i> | <i>L. hyp</i> |             |             |               |           |
|                                     | <i>Lacuna vineta</i>     | 3.01          | 3.83          | 14.17       | 1.25        | 28.23         | 28.23     |
|                                     | <i>Patella pellucida</i> | 3.91          | 4.33          | 12.77       | 1.20        | 25.44         | 53.67     |