

# UK TECHNICAL ADVISORY GROUP ON THE WATER FRAMEWORK DIRECTIVE

## Type Specific Reference Condition Descriptions for Transitional and Coastal Waters for the UK

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| <b>This Guidance Paper is a working draft defined by the UKTAG. It documents the principles to be adopted by agencies responsible for implementing the Water Framework Directive (WFD) in the UK. This method will evolve as it is tested, with this working draft amended accordingly.</b> |                                                                                           |                      |                              |
| <b>Working Paper Version:</b>                                                                                                                                                                                                                                                               | TAG 2004 WP8a(03) Reference Conditions for Transitional and Coastal Waters (v2. 02/08/04) | <b>Status:</b>       | Public Working Draft (PR 01) |
| <b>WFD Requirement:</b>                                                                                                                                                                                                                                                                     | Article 5, Transitional and Coastal Waters, reference conditions                          | <b>UKTAG Review:</b> | July 2004                    |
|                                                                                                                                                                                                                                                                                             |                                                                                           | <b>Author:</b>       | MTT                          |

### 1. Purpose of this Paper

- 1.1 The paper sets out UKTAG's guidance outlining the **type specific reference condition descriptions for transitional and coastal waters**.

### 2. The Directive's requirements

- 2.1 Under Annex II of the Directive, reference condition for each type of surface water body need to be developed.
- 2.2 This guidance was produced by the Marine Task Team in consultation with other UKTAG Task Teams.

### 3. Content of this Guidance

- 3.1 The guidance contains:
- an outline of the approach to developing reference conditions (refer section 4)
  - the type descriptions (refer section 5)

### 4. Approach to developing the type specific reference conditions

- 4.1 Type specific reference condition descriptions have been developed for inclusion in Article 5 report.
- 4.2 This report should be read in conjunction with TAG WP2a(02) Marine Typology Final (P2 v12 14-4-04) which describes 6 transitional and 12 coastal types. However only 11 of the physical coastal types actually occur within the UK.
- 4.3 General descriptions are provided for 6 transitional and 11 coastal types covering the UK and contain:
- Type Overview description
  - Reference Condition Quality Elements description/s.
- 4.4 Reference conditions have been developed by the MTT's working groups for the biological quality elements. The descriptions are necessarily qualitative at this

stage and will be the subject of further review and validation in the future. This document must be seen as a first working draft.

## **5 Type Specific Reference Conditions**

### **5.1 Coastal Type 1**

#### **General Description**

Type 1 is restricted to the coastal and offshore waters of Cornwall, Devon and Somerset in SW England, the south coast of Wales and the north west coast of Anglesey. This group describes euhaline regions that are macrotidal, and exposed.

#### **Occurrence**

Ecoregion 4 (Atlantic) e.g. North Cornwall Coast, Carmarthen Bay

| Reference Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <p><b>Phytoplankton</b></p> <p><b>Pelagic water column (A7.3, A7.8, A7.9)</b></p> <p>Species richness high. Normal patterns of seasonal growth, biomass and succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent and inter-bloom periods low compared with local background.</p>                                                                                                                                                                                                                                                                                                                    |
| <p><b>Macroalgae</b></p> <p><b>Littoral rock, sub-littoral rock and other hard substrate (A1.1, A1.5; A3.1, A3.5)</b></p> <p>A diverse community of red, green and brown seaweeds. These will be reduced in size and cover and may be patchy but the intertidal species richness is still &gt;65. There is clear zonation whereby <i>Himanthalia elongata</i> may be dominant on the lower shore and may replace <i>Fucus serratus</i>. Sessile invertebrates may also be dominant or co-dominant. The sublittoral fringe is dominated by <i>Alaria esculenta</i> and the sublittoral forest dominated by <i>Alaria esculenta</i> or <i>Laminaria hyperborea</i> with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.</p> <p><b>Littoral sediment, sub-littoral sediment (A2, A4)</b></p> <p>No perennial (long-lived) macroalgae expected.<br/>Absence of opportunistic (short-lived) macroalgae expected.</p> |
| <p><b>Marine Angiosperms</b></p> <p>No marine angiosperm community expected. Possibility of limited communities in extremely sheltered locations within this water body, e.g. North Haven, Skomer.</p> <p><b>Saltmarsh</b></p> <p><b>EUNIS Classification:</b> No salt marsh community expected.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

## Benthic Macroinvertebrates

### Sand shores (A2.24)

Shores comprised predominantly of clean sands (coarse, medium or fine-grained) with little gravel or mud. The mobile sand shores are relatively impoverished. The more stable finer sand habitats on the lower shore support communities of robust amphipods, polychaetes and venerid bivalves. A strandline of talitrid amphipods typically develops at the top of the shore.

### Sublittoral fine sands (A4.21, A4.22, A4.23)

Fine sands in the shallow sublittoral, may be characterised by the polychaete *Nephtys cirrosa* and amphipod *Bathyporeia* spp. The diversity can be reduced due to physical disturbance from strong tidal streams or wave action. In more compacted sands venerid bivalves such as *Chamelea gallina* may dominate. The bivalve *Fabulina fabula* and the polychaete *Magelona mirabilis* may also be characteristic.

### Littoral rock very exposed to wave action (A1.1, A1.11)

Communities dominated by barnacles and limpets *Patella* spp. cover extensive areas of the upper and mid shore on very exposed to moderately exposed rocky shores.

There is much regional variation with regards to the zonation of barnacles and the species present. On very exposed shores the mid to lower shore is typically characterised by patches of mussels, *Mytilus edulis* interspersed with barnacles.

## Physico-Chemical Characteristics

### Nutrients

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

### Dissolved Oxygen

Dissolved O<sub>2</sub> annual range is 80 – 120%, with a mean of 100%. Range 2 – 9 mg l<sup>-1</sup> (temperature & salinity dependent).

### Temperature

Temperature range is typically between 5 and 15 C with a maximum range of 0.8 to 21 C. Mean temperature is approximately 10 C although this is dependent on latitude.

### Transparency

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

## Hydromorphological Characteristics

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

## 5.2 Coastal Type 2

### General Description

Type 2 is widespread in the west coast of Scotland and Ireland, the north-east coast of Scotland and the south-west English channel coast. These waters are euhaline, and generally mesotidal and exposed.

### Occurrence

Ecoregion 4 (Atlantic) e.g. Sea of the Hebrides, Scilly Isles, Poole Bay.

| Reference Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <p><b>Phytoplankton</b></p> <p><b>Pelagic water column (A7.3, A7.8, A7.9)</b></p> <p>Species richness high. Normal patterns of seasonal growth, biomass and succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent and inter-bloom periods low compared with local background.</p>                                                                                                                                                                                                                                                                                                                    |
| <p><b>Macroalgae</b></p> <p><b>Littoral rock, sub-littoral rock and other hard substrate (A1.1, A1.5; A3.1, A3.5)</b></p> <p>A diverse community of red, green and brown seaweeds. These will be reduced in size and cover and may be patchy but the intertidal species richness is still &gt;65. There is clear zonation whereby <i>Himanthalia elongata</i> may be dominant on the lower shore and may replace <i>Fucus serratus</i>. Sessile invertebrates may also be dominant or co-dominant. The sublittoral fringe is dominated by <i>Alaria esculenta</i> and the sublittoral forest dominated by <i>Alaria esculenta</i> or <i>Laminaria hyperborea</i> with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.</p> <p><b>Littoral sediment, sub-littoral sediment (A2, A4)</b></p> <p>No perennial (long-lived) macroalgae expected.<br/>Absence of opportunistic (short-lived) macroalgae expected.</p> |
| <p><b>Marine Angiosperms</b></p> <p>No marine angiosperm community expected.</p> <p><b>Saltmarsh</b></p> <p><b>EUNIS Classification:</b> No salt marsh community expected.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## Benthic Macroinvertebrates

### Sand shores (A2.24)

Shores comprised predominantly of clean sands (coarse, medium or fine-grained) with little gravel or mud. The mobile sand shores are relatively impoverished. The more stable finer sand habitats on the lower shore support communities of robust amphipods, polychaetes and venerid bivalves. A strandline of talitrid amphipods typically develops at the top of the shore.

### Sublittoral fine sands (A4.21, A4.22, A4.23)

Fine sands in the shallow sublittoral, may be characterised by the polychaete *Nephtys cirrosa* and amphipod *Bathyporeia* spp. The diversity can be reduced due to physical disturbance from strong tidal streams or wave action. In more compacted sands venerid bivalves such as *Chamelea gallina* may dominate. The bivalve *Fabulina fabula* and the polychaete *Magelona mirabilis* may also be characteristic.

### Littoral rock very exposed to wave action (A1.1, A1.11)

Communities dominated by barnacles and limpets *Patella* spp. cover extensive areas of the upper and mid shore on very exposed to moderately exposed rocky shores. There is much regional variation with regards to the zonation of barnacles and the species present. On very exposed shores the mid to lower shore is typically characterised by patches of mussels, *Mytilus edulis* interspersed with barnacles.

## Physico-Chemical Characteristics

### Nutrients

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

### Dissolved Oxygen

Dissolved oxygen levels exceed 5.7mg/l 95% of the time in marine conditions (salinity 33).

### Temperature

Temperature range is typically between 5 and 15 C with a maximum range of 0.8 to 21 C. Mean temperature is approximately 10 C although this is dependent on latitude.

### Transparency

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

## Hydromorphological Characteristics

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

### 5.3 Coastal Type 3

#### General Description

Type 3 waters are euhaline, microtidal and exposed, with a predominantly gravel substrate. Within the UK this type is restricted to three water bodies between Islay and the Mull of Kintyre in Scotland.

#### Occurrence

Ecoregion 4 (Atlantic)

| Reference Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Phytoplankton</b></p> <p><b>Pelagic water column (A7.3, A7.8, A7.9)</b></p> <p>Species richness high. Normal patterns of seasonal growth, biomass and succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent and inter-bloom periods low compared with local background.</p>                                                                                                                                                                                                                                                                                                                    |
| <p><b>Macroalgae</b></p> <p><b>Littoral rock, sub-littoral rock and other hard substrate (A1.1, A1.5; A3.1, A3.5)</b></p> <p>A diverse community of red, green and brown seaweeds. These will be reduced in size and cover and may be patchy but the intertidal species richness is still &gt;65. There is clear zonation whereby <i>Himanthalia elongata</i> may be dominant on the lower shore and may replace <i>Fucus serratus</i>. Sessile invertebrates may also be dominant or co-dominant. The sublittoral fringe is dominated by <i>Alaria esculenta</i> and the sublittoral forest dominated by <i>Alaria esculenta</i> or <i>Laminaria hyperborea</i> with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.</p> <p><b>Littoral sediment, sub-littoral sediment (A2, A4)</b></p> <p>No perennial (long-lived) macroalgae expected.<br/>Absence of opportunistic (short-lived) macroalgae expected.</p> |
| <p><b>Marine Angiosperms</b></p> <p>No marine angiosperm community expected.</p> <p><b>Saltmarsh</b></p> <p><b>EUNIS Classification:</b> No salt marsh community expected.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p><b>Benthic Macroinvertebrates</b></p> <p><b>Sand shores (A2.24)</b></p> <p>Shores comprised predominantly of clean sands (coarse, medium or fine-grained) with little gravel or mud. The mobile sand shores are relatively impoverished. The more stable finer sand habitats on the lower shore support communities of robust amphipods, polychaetes and venerid bivalves. A strandline of talitrid amphipods typically develops at the top of the shore.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**Sublittoral fine sands (A4.21, A4.22, A4.23)**

Fine sands in the shallow sublittoral, may be characterised by the polychaete *Nephtys cirrosa* and amphipod *Bathyporeia* spp. The diversity can be reduced due to physical disturbance from strong tidal streams or wave action. In more compacted sands venerid bivalves such as *Chamelea gallina* may dominate. The bivalve *Fabulina fabula* and the polychaete *Magelona mirabilis* may also be characteristic.

**Littoral rock very exposed to wave action (A1.1, A1.11)**

Communities dominated by barnacles and limpets *Patella* spp. cover extensive areas of the upper and mid shore on very exposed to moderately exposed rocky shores. There is much regional variation with regards to the zonation of barnacles and the species present. On very exposed shores the mid to lower shore is typically characterised by patches of mussels, *Mytilus edulis* interspersed with barnacles.

**Physico-Chemical Characteristics****Nutrients**

Nutrient concentrations in undisturbed conditions will be a function ( $\pm x\%$ ) of Atlantic Shelf nutrient concentrations. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

**Dissolved Oxygen**

Dissolved O<sub>2</sub> annual range is 80 – 120%, with a mean of 100%. Range 2 – 9 mg l<sup>-1</sup> (temperature & salinity dependent).

**Temperature**

Maximum temperature range is 0 – 24.5°C, but typically between 5 and 15°C (mean 10°C), depending on latitude.

**Transparency**

Light availability will range from clear to highly turbid, depending on type-specific conditions. This may be a natural function of phytoplankton blooms and other organic and inorganic components.

**Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

**5.4 Coastal Type 4****General Description**

Type 4 waters are euhaline, macrotidal and moderately exposed. They occur on the north-west coast of England, the east Anglian, Kent and Sussex coasts.

**Occurrence**

Ecoregion 1 (North Sea), ecoregion 4 (Atlantic) e.g. Morecambe Bay, Outer Wash

**Reference Conditions**

**Phytoplankton****Pelagic water column (A7.3, A7.8, A7.9)**

Species richness high. Normal patterns of seasonal growth, biomass and succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent and inter-bloom periods low compared with local background.

**Macroalgae****Littoral rock, sub-littoral rock and other hard substrate (A1.2, A1.5; A3.2, A3.6)**

A diverse community of red, green and brown seaweeds with a mosaic pattern of various seaweeds and sessile invertebrates cover, but there is no one dominant algal species or pattern. The intertidal species richness is >65. Fucoids and red algae are present in scattered clumps with a less clear zonation pattern. The sublittoral fringe is dominated by *Laminaria digitata* and the sublittoral forest dominated by *Laminaria hyperborea* with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.

**Littoral sediment, sub-littoral sediment (A2, A4)**

No perennial (long-lived) macroalgae expected.  
Absence of opportunistic (short-lived) macroalgae with total cover not exceeding 10%.

**Marine Angiosperms**

No marine angiosperm community expected. Possibility of limited communities in extremely sheltered locations within this water body, e.g. Walney Channel, North Morecambe Bay.

**Saltmarsh**

**EUNIS Classification:** No salt marsh community expected.



## **Benthic Macroinvertebrates**

### **Sublittoral fine sands (A4.21, A4.22, A4.23)**

Fine sands in the shallow sublittoral, may be characterised by the polychaete *Nephtys cirrosa* and amphipod *Bathyporeia* spp. The diversity can be reduced due to physical disturbance from strong tidal streams or wave action. In more compacted sands venerid bivalves such as *Chamelea gallina* may dominate. The bivalve *Fabulina fabula* and the polychaete *Magelona mirabilis* may also be characteristic.

### **Animal communities in fully marine shallow-water muddy sands (A4.25)**

Moderately exposed muddy sand habitats, extending from the extreme lower shore down to about 15-20m, may support a community comprised of echinoderms, such as *Amphiura* and *Echinocardium*, gastropod *Turritella*, bivalves *Thysira* and *Nucula* and polychaetes *Nephtys* and *Terebellides*.

### **Moderately exposed circalittoral rock (A3.62)**

Circalittoral rock or mixed substrata in moderately exposed conditions typically support a prominent turf of bryozoans and hydroids. Bryozoans; such as *Flustra foliacea*, *Alcyonidium diaphanum* can form a turf on the rock. The hydroids *Sertularia* spp. and *Hydrallmania falcata* can also be characteristic of this habitat.

### **Littoral rock moderately exposed to wave action (A1.26)**

On moderately exposed shores, where there is a plentiful supply of sediment, the tube forming polychaete worm *Sabellaria alveolata* may form honeycomb reefs on boulders and low-lying bedrock on the mid to lower shore. Other species which may be found include the barnacles *Semibalanus balanoides*, *Balanus crenatus* and *Elminius modestus* and the molluscs *Patella vulgata*, *Littorina littorea*, *Nucella lapillus* and *Mytilus edulis*.

## **Physico-Chemical Characteristics**

### **Nutrients**

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

### **Dissolved Oxygen**

Dissolved oxygen levels exceed 5.7mg/l 95% of the time in marine conditions (salinity 33).

### **Temperature**

Temperature range is typically between 5 and 15 C with a maximum range of 0.8 to 21 C. Mean temperature is approximately 10 C although this is dependent on latitude.

### **Transparency**

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

## **Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

## 5.5 Coastal Type 5

### General Description

Type 5 is widespread around the coasts of the whole of the UK and the RoI. These areas are euhaline, mesotidal and moderately exposed.

### Occurrence

Ecoregion 4 (Atlantic) e.g. Caernarfon Bay, Northumbria Coast

| Reference Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| <p><b>Phytoplankton</b></p> <p><b>Pelagic water column (A7.3, A7.8, A7.9)</b><br/> Species richness high. Normal patterns of seasonal growth, biomass and succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent and inter-bloom periods low compared with local background.</p>                                                                                                                                                                                                                                                                          |
| <p><b>Macroalgae</b></p> <p><b>Littoral rock, sub-littoral rock and other hard substrate (A1.1, A1.5; A3.3, A3.6)</b><br/> A diverse community of red, green and brown seaweeds with a mosaic pattern of various seaweeds and sessile invertebrates cover, but there is no one dominant algal species or pattern. The intertidal species richness is &gt;65. Fucoids and red algae are present in scattered clumps with a less clear zonation pattern. The sublittoral fringe is dominated by <i>Laminaria digitata</i> and the sublittoral forest dominated by <i>Laminaria hyperborea</i> with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.</p> <p><b>Littoral sediment, sub-littoral sediment (A2, A4)</b><br/> No perennial (long-lived) macroalgae expected.<br/> Absence of opportunistic (short-lived) macroalgae with total cover not exceeding 10%.</p> |
| <p><b>Marine Angiosperms</b></p> <p>No marine angiosperm community expected. Possibility of limited communities in extremely sheltered locations within this water body, e.g. Plymouth Sound.</p> <p><b>Saltmarsh</b><br/> <b>EUNIS Classification:</b> No salt marsh community expected.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Benthic Macroinvertebrates

### Sublittoral fine sands (A4.21, A4.22, A4.23)

Fine sands in the shallow sublittoral, may be characterised by the polychaete *Nephtys cirrosa* and amphipod *Bathyporeia* spp. The diversity can be reduced due to physical disturbance from strong tidal streams or wave action. In more compacted sands venerid bivalves such as *Chamelea gallina* may dominate. The bivalve *Fabulina fabula* and the polychaete *Magelona mirabilis* may also be characteristic.

### Animal communities in fully marine shallow-water muddy sands (A4.25)

Moderately exposed muddy sand habitats, extending from the extreme lower shore down to about 15-20m, may support a community comprised of echinoderms, such as *Amphiura* and *Echinocardium*, gastropod *Turritella*, bivalves *Thysira* and *Nucula* and polychaetes *Nephtys* and *Terebellides*.

### Moderately exposed circalittoral rock (A3.62)

Circalittoral rock or mixed substrata in moderately exposed conditions typically support a prominent turf of bryozoans and hydroids. Bryozoans; such as *Flustra foliacea*, *Alcyonidium diaphanum* can form a turf on the rock. The hydroids *Sertularia* spp. and *Hydrallmania falcata* can also be characteristic of this habitat.

### Littoral rock moderately exposed to wave action (A1.26)

On moderately exposed shores, where there is a plentiful supply of sediment, the tube forming polychaete worm *Sabellaria alveolata* may form honeycomb reefs on boulders and low-lying bedrock on the mid to lower shore. Other species which may be found include the barnacles *Semibalanus balanoides*, *Balanus crenatus* and *Elminius modestus* and the molluscs *Patella vulgata*, *Littorina littorea*, *Nucella lapillus* and *Mytilus edulis*.

## Physico-Chemical Characteristics

### Nutrients

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

### Dissolved Oxygen

Dissolved oxygen levels exceed 5.7mg/l 95% of the time in marine conditions (salinity 33).

### Temperature

Temperature range is typically between 5 and 15 C with a maximum range of 0.8 to 21 C. Mean temperature is approximately 10 C although this is dependent on latitude.

### Transparency

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

## Hydromorphological Characteristics

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

## 5.6 Coastal Type 6

### General Description

Group 6 occurs only in Scotland in waters between Islay and the Mull of Kintyre and on the east coast of the RoI. These areas are euhaline, microtidal and moderately exposed.

### Occurrence

Ecoregion 4 (Atlantic) e.g. Sound of Jura

| Reference Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Phytoplankton</b></p> <p><b>Pelagic water column (A7.3, A7.8, A7.9)</b><br/> Species richness high. Normal patterns of seasonal growth, biomass and succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent and inter-bloom periods low compared with local background.</p>                                                                                                                                                                                                                                                                          |
| <p><b>Macroalgae</b></p> <p><b>Littoral rock, sub-littoral rock and other hard substrate (A1.1, A1.5; A3.3, A3.6)</b><br/> A diverse community of red, green and brown seaweeds with a mosaic pattern of various seaweeds and sessile invertebrates cover, but there is no one dominant algal species or pattern. The intertidal species richness is &gt;65. Furoids and red algae are present in scattered clumps with a less clear zonation pattern. The sublittoral fringe is dominated by <i>Laminaria digitata</i> and the sublittoral forest dominated by <i>Laminaria hyperborea</i> with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.</p> <p><b>Littoral sediment, sub-littoral sediment (A2, A4)</b><br/> No perennial (long-lived) macroalgae expected.<br/> Absence of opportunistic (short-lived) macroalgae with total cover not exceeding 10%.</p> |
| <p><b>Marine Angiosperms</b></p> <p>No marine angiosperm community expected.</p> <p><b>Saltmarsh</b><br/> <b>EUNIS Classification:</b> No salt marsh community expected.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p><b>Benthic Macroinvertebrates</b></p> <p><b>Sublittoral fine sands (A4.21, A4.22, A4.23)</b><br/> Fine sands in the shallow sublittoral, may be characterised by the polychaete <i>Nephtys cirrosa</i> and amphipod <i>Bathyporeia</i> spp. The diversity can be reduced due to physical disturbance from strong tidal streams or wave action. In more compacted sands venerid bivalves such as <i>Chamelea gallina</i> may dominate. The bivalve</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

*Fabulina fabula* and the polychaete *Magelona mirabilis* may also be characteristic.

#### **Animal communities in fully marine shallow-water muddy sands (A4.25)**

Moderately exposed muddy sand habitats, extending from the extreme lower shore down to about 15-20m, may support a community comprised of echinoderms, such as *Amphiura* and *Echinocardium*, gastropod *Turritella*, bivalves *Thysira* and *Nucula* and polychaetes *Nephtys* and *Terebellides*.

#### **Moderately exposed circalittoral rock (A3.62)**

Circalittoral rock or mixed substrata in moderately exposed conditions typically support a prominent turf of bryozoans and hydroids. Bryozoans; such as *Flustra foliacea*, *Alcyonidium diaphanum* can form a turf on the rock. The hydroids *Sertularia* spp. and *Hydrallmania falcata* can also be characteristic of this habitat.

#### **Littoral rock moderately exposed to wave action (A1.26)**

On moderately exposed shores, where there is a plentiful supply of sediment, the tube forming polychaete worm *Sabellaria alveolata* may form honeycomb reefs on boulders and low-lying bedrock on the mid to lower shore. Other species which may be found include the barnacles *Semibalanus balanoides*, *Balanus crenatus* and *Elminius modestus* and the molluscs *Patella vulgata*, *Littorina littorea*, *Nucella lapillus* and *Mytilus edulis*.

### **Physico-Chemical Characteristics**

#### **Nutrients**

Nutrient concentrations in undisturbed conditions will be a function ( $\pm x\%$ ) of Atlantic Shelf nutrient concentrations. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

#### **Dissolved Oxygen**

Dissolved O<sub>2</sub> annual range is 80 – 120%, with a mean of 100%. Range 2 – 9 mg l<sup>-1</sup> (temperature & salinity dependent).

#### **Temperature**

Maximum temperature range is 0 – 24.5°C, but typically between 5 and 15°C (mean 10°C), depending on latitude.

#### **Transparency**

Light availability will range from clear to highly turbid, depending on type-specific conditions. This may be a natural function of phytoplankton blooms and other organic and inorganic components.

### **Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

## **5.7 Coastal Type 7**

### **General Description**

Group 7 occurs only in small areas of North and South Wales and the Bristol Channel. These areas are euhaline, macrotidal and sheltered.

**Occurrence**

Ecoregion 4 (Atlantic) e.g. Conwy Bay

**Reference Conditions****Phytoplankton****Pelagic water column (A7.3, A7.8, A7.9)**

Species richness high. Normal patterns of seasonal growth, biomass and succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent and inter-bloom periods low compared with local background.

**Macroalgae****Littoral and sub-littoral rock (A1.3, A1.5; A3.3, A3.7)**

A diverse community of red, green and brown seaweeds with a more or less continuous cover of large seaweeds and intertidal species richness of >65. *Ascophyllum nodosum* is both large and abundant and there is a clear zonation of fucoid algae with respect to height on the shore. The sublittoral fringe is dominated by *Laminaria digitata* and the sublittoral forest dominated by *Laminaria saccharina* with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.

**Littoral and sub-littoral sediment (A2, A4)**

No normal flora or zonation pattern (except where odd hard substrate outcrops are present). Opportunistic green, brown or red algae may occur on soft surfaces but there will be a general absence of opportunistic macroalgal blooms with total cover not exceeding 10%.

**Marine Angiosperms****Seagrass beds on littoral and sublittoral sediments (A2.7, A4.5)**

Sedimentary littoral or sublittoral substrata, sheltered or extremely sheltered from strong tides and currents, can support beds of seagrass. Littoral sediments support beds of *Zostera noltii* and/or *Zostera angustifolia* and sublittoral sediments support *Zostera marina*. In existent seagrass beds mean density of healthy shoots is high. There may be a naturally high percentage cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected < 15%. Stable seagrass bed area with no loss or loss of area attributable to natural environmental events. There may be temporal variation in the abundance of seagrass in intertidal areas as seagrass will die back during cold winters.

**Saltmarsh****EUNIS Classification: A2 (A2.6)**

Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered



coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. They are not likely to be extensive in these higher salinity areas unless there is some local freshwater influences. Where they occur they would be expected to cover at least 75% of suitable habitat and not show significant decline in aerial extent over a 5 year rolling mean.

### **Benthic Macroinvertebrates**

#### **Sublittoral muddy sand (A4.271, A4.272)**

Muddy sands or slightly mixed sediments in sheltered environments, may support communities comprised of bivalves such as *Abra*, *Nucula* and *Corbula*, and polychaetes, *Lagis* and *Nephtys*. Where the sediment is slightly sandier, the urchin *Echinocardium cordatum* and the brittlestar *Amphiura filiformis* may also be present.

#### **Sheltered Muddy Sand Shores (A2.25)**

In sheltered areas, the substrate will typically be fine muddy sand which remains saturated throughout the tidal cycle. The community consists of abundant polychaetes and bivalves and less commonly, oligochaetes and the amphipod *Bathyporeia sarsi*. Polychaetes include *Nephtys hombergii*, *Scoloplos armiger*, *Pygospio elegans* and *Spio filicornis*. In more sheltered areas the community is less diverse, consisting of the amphipods *Bathyporeia pilosa*, *Corophium arenarium* and *Corophium volutator*, the spire shell *Hydrobia ulvae* and a limited abundance of polychaetes and the bivalve, *Macoma balthica*.

#### **Shallow fully marine mud communities (A4.31)**

Shallow sublittoral muds, extending from the extreme lower shore to about 15 m depth in fully marine or near marine conditions. Populations of seapens *Virgularia mirabilis* may be dense, with anemones, brittlestars (e.g. *Amphiura* spp.), the opisthobranch *Philine aperta* and synaptid holothurians are also characteristic of shallow muds. In some cases dense aggregations of the holothurian *Ocnus planci* develop.

#### **Sheltered Littoral Rock (A1.31)**

Bedrock, stable boulders or cobbles on upper to lower shore will support different invertebrate communities depending on shore height and the zoning of the dominant macroalgae of the fucoid community with which they are associated.

Upper shore in the *Pelvetia canaliculata* zone, the winkle *Littorina saxatilis* occurs frequently, as do a variety of amphipods. Beneath the canopies of *Fucus spiralis*, *Fucus vesiculosus*, *Fucus serratus* and *Ascophyllum nodosum*, are communities consisting of the limpet *Patella vulgata*, winkles such as *Littorina saxatilis* and *Littorina littorea*, the whelk, *Nucella lapillus* and barnacles. In moist cracks or overhangs of this zone, the sponge *Halichondria panicea* can be present. The mussel, *Mytilus edulis* occasionally occurs in pits and crevices, and the crab *Carcinus maenas* may be found underneath boulders or among seaweeds.

On the bedrock beneath the *A. nodosum* canopy, the anemone *Actinia equina* and polychaete *Spirorbis* spp. may be found. Colonies of the hydroid *Dynamena pumila* are occasionally present on the wracks.

### **Physico-Chemical Characteristics**

#### **Nutrients**

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates

and phosphates correspond totally or nearly totally to regional undisturbed conditions.

#### **Dissolved Oxygen**

Dissolved oxygen levels exceed 5.7mg/l 95% of the time in marine conditions (salinity 33).

#### **Temperature**

Temperature range is typically between 5 and 15 C with a maximum range of 0.8 to 21 C. Mean temperature is approximately 10 C although this is dependent on latitude.

#### **Transparency**

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

#### **Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

### **5.8 Coastal Type 8**

#### **General Description**

This coastal type is euhaline, mesotidal and sheltered. It is uncommon in the United Kingdom and is restricted to small areas of Scottish and Irish coastal waters and a small number of bays or straits in England and Wales.

#### **Occurrence**

Ecoregion 4 (Atlantic) e.g. Poole Harbour, Menai Strait, Firth of Clyde

#### **Reference Conditions**

##### **Phytoplankton**

##### **Pelagic water column (A7.3, A7.8, A7.9)**

Species richness high. Normal patterns of seasonal growth, biomass and succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent and inter-bloom periods low compared with local background.



## Macroalgae

### Littoral and sub-littoral rock (A1.3, A1.5; A3.3, A3.7)

A diverse community of red, green and brown seaweeds with a more or less continuous cover of large seaweeds and intertidal species richness of >65. *Ascophylum nodosum* is both large and abundant and there is a clear zonation of fucoid algae with respect to height on the shore. The sublittoral fringe is dominated by *Laminaria digitata* and the sublittoral forest dominated by *Laminaria saccharina* with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.

### Littoral and sub-littoral sediment (A2, A4)

No normal flora or zonation pattern (except where odd hard substrate outcrops are present). Opportunistic green, brown or red algae may occur on soft surfaces but there will be a general absence of opportunistic macroalgal blooms with total cover not exceeding 10%.

## Marine Angiosperms

### Seagrass beds on littoral and sublittoral sediments (A2.7, A4.5)

Sedimentary littoral or sublittoral substrata, sheltered or extremely sheltered from strong tides and currents, can support beds of seagrass. Littoral sediments support beds of *Zostera noltii* and/or *Zostera angustifolia* and sublittoral sediments support *Zostera marina*. In existent seagrass beds mean density of healthy shoots is high. There may be a naturally high percentage cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected < 15%. Stable seagrass bed area with no loss or loss of area attributable to natural environmental events. There may be temporal variation in the abundance of seagrass in intertidal areas as seagrass will die back during cold winters.

### Saltmarsh

#### EUNIS Classification: A2 (A2.6)

Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. They are not likely to be extensive in these higher salinity areas unless there is some local freshwater influences. Where they occur they would be expected to cover at least 75% of suitable habitat and not show significant decline in aerial extent over a 5 year rolling mean.

## Benthic Macroinvertebrates

### Sublittoral muddy sand (A4.271, A4.272)

Muddy sands or slightly mixed sediments in sheltered environments, may support communities comprised of bivalves such as *Abra*, *Nucula* and *Corbula*, and polychaetes, *Lagis* and *Nephtys*. Where the sediment is slightly sandier, the urchin *Echinocardium cordatum* and the brittlestar *Amphiura filiformis* may also be present.

### Sheltered Muddy Sand Shores (A2.25)

In sheltered areas, the substrate will typically be fine muddy sand which remains saturated throughout the tidal cycle. The community consists of abundant polychaetes and bivalves and less commonly, oligochaetes and the amphipod

*Bathyporeia sarsi*. Polychaetes include *Nephtys hombergii*, *Scoloplos armiger*, *Pygospio elegans* and *Spio filicornis*. In more sheltered areas the community is less diverse, consisting of the amphipods *Bathyporeia pilosa*, *Corophium arenarium* and *Corophium volutator*, the spire shell *Hydrobia ulvae* and a limited abundance of polychaetes and the bivalve, *Macoma balthica*.

#### **Shallow fully marine mud communities (A4.31)**

Shallow sublittoral muds, extending from the extreme lower shore to about 15 m depth in fully marine or near marine conditions. Populations of seapens *Virgularia mirabilis* may be dense, with anemones, brittlestars (e.g. *Amphiura* spp.), the opisthobranch *Philine aperta* and synaptid holothurians are also characteristic of shallow muds. In some cases dense aggregations of the holothurian *Ocnus planci* develop.

#### **Sheltered Littoral Rock (A1.31)**

Bedrock, stable boulders or cobbles on upper to lower shore will support different invertebrate communities depending on shore height and the zoning of the dominant macroalgae of the fucoid community with which they are associated.

Upper shore in the *Pelvetia canaliculata* zone, the wrinkle *Littorina saxatilis* occurs frequently, as do a variety of amphipods. Beneath the canopies of *Fucus spiralis*, *Fucus vesiculosus*, *Fucus serratus* and *Ascophyllum nodosum*, are communities consisting of the limpet *Patella vulgata*, wrinkles such as *Littorina saxatilis* and *Littorina littorea*, the whelk, *Nucella lapillus* and barnacles. In moist cracks or overhangs of this zone, the sponge *Halichondria panicea* can be present. The mussel, *Mytilus edulis* occasionally occurs in pits and crevices, and the crab *Carcinus maenas* may be found underneath boulders or among seaweeds.

On the bedrock beneath the *A. nodosum* canopy, the anemone *Actinia equina* and polychaete *Spirorbis* spp. may be found. Colonies of the hydroid *Dynamena pumila* are occasionally present on the wracks.

### **Physico-Chemical Characteristics**

#### **Nutrients**

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

#### **Dissolved Oxygen**

Dissolved oxygen levels exceed 5.7mg/l 95% of the time in marine conditions (salinity 33).

#### **Temperature**

Temperature range is typically between 5 and 15 C with a maximum range of 0.8 to 21 C. Mean temperature is approximately 10 C although this is dependent on latitude.

#### **Transparency**

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

### **Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

## **5.9 Coastal Type 10**

### **General Description**

Coastal Lagoons. Euhaline and sheltered.

### **Occurrence**

Widespread around UK coasts.

### **Reference Conditions**

#### **Phytoplankton**

**EUNIS Classification: A7 (A7.3, A7.8, A7.9)**

#### **Pelagic water column**

Species richness high. Normal patterns of seasonal growth, biomass & succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent & inter-bloom periods low compared with local background.

#### **Macroalgae**

**EUNIS Classification: A2, A4**

#### **Littoral and sub-littoral sediment**

No normal flora or zonation pattern of perennial (long-lived) macroalgae expected in littoral or sub-littoral, except where odd hard substrate outcrops are present. Opportunistic (short-lived) macroalgae is likely to be absent or occur at very low abundance in littoral or sub-littoral fringe, with total cover not exceeding 10%. Where macrophytes are present in the littoral or sub-littoral, e.g. *Zostera* spp., opportunistic macroalgae may be present epiphytically, e.g. *Pilayella* spp.

#### **Marine Angiosperms**

**EUNIS Classification: A2 (A2.7) A4 (A4.5)**

On fully saline, sedimentary substrata, sheltered or extremely sheltered from strong tides and currents, 1 or more species of seagrass may be found.

Littoral sediments: *Zostera noltii* and or *Zostera angustifolia*

Sublittoral sediments: *Zostera marina*

In existent seagrass beds high mean density of healthy shoots. May be naturally high % cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected < 15%.

Stable seagrass bed area with no loss or loss of area attributable to natural environmental events.

#### **Saltmarsh**

**EUNIS Classification: A2 (A2.6)**

Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. They are not likely to be extensive in these higher salinity areas unless there is some local freshwater influences. Where they occur they would be expected to cover at least 75% of suitable habitat and not show significant decline in aerial extent over a 5 year rolling mean.

### **Benthic Macroinvertebrates**

Examples of the specialised habitats found in coastal lagoons are represented in EUNIS types (e.g. A4.312, A1.274)

Coastal lagoon benthic fauna are essentially sublittoral and are tolerant of a wide range of salinity (e.g. 10-45). Lagoonal specialists include sea fans, anemones, sea mats, polychaete worms, sea slugs, snails, bivalves and shrimps (Bamber *et al.*, 2001).

Very common specialists include the lagoon cockle, *Cerastoderma glaucum*, the lagoon slater, *Idotea chelipes* and the snakelocks anemone - *Anemone viridis*. In very shallow extremely sheltered very soft muds, *Arenicola marina* may form very conspicuous casts (Bamber *et al.*, 2001).

### **Physico-Chemical Characteristics**

#### **Nutrients**

Nutrient concentrations in undisturbed conditions will be a function ( $\pm x\%$ ) of Atlantic Shelf nutrient concentrations. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

#### **Temperature**

Maximum temperature range is 0 – 24.5°C, but typically between 5 and 15°C (mean 10°C), depending on latitude.

#### **Dissolved Oxygen**

Dissolved O<sub>2</sub> annual range is 80 – 120%, with a mean of 100%. Range 2 – 9 mg l<sup>-1</sup> (temperature & salinity dependent).

#### **Transparency**

Light availability will range from clear to highly turbid, depending on type-specific conditions. This may be a natural function of phytoplankton blooms and other organic and inorganic components.

### **Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

## **5.10 Coastal Type 11**

### **General Description**

Shallow Sea Lochs. Euhaline, mesotidal and sheltered.

**Occurrence**

Scotland. e.g. Busta Voe, Loch Ryan, Loch Indaal and Loch Skipport.

| Reference Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Phytoplankton</b></p> <p><b>EUNIS Classification: A7 (A7.3, A7.8, A7.9)</b></p> <p><b>Pelagic water column</b></p> <p>Species richness high. Normal patterns of seasonal growth, biomass &amp; succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent &amp; inter-bloom periods low compared with local background.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>Macroalgae</b></p> <p><b>EUNIS Classification: A2, A4</b></p> <p><u>Littoral and sub-littoral sediment</u></p> <p>No normal flora or zonation pattern of perennial (long-lived) macroalgae expected in littoral or sub-littoral, except where odd hard substrate outcrops are present. Opportunistic (short-lived) macroalgae is likely to be absent or occur at very low abundance in littoral or sub-littoral fringe, with total cover not exceeding 10%. Where macrophytes are present in the littoral or sub-littoral, e.g. <i>Zostera</i> spp., opportunistic macroalgae may be present epiphytically, e.g. <i>Pilayella</i> spp.</p> <p><b>Littoral and sub-littoral rock (A1.3, A1.5; A3.3, A3.7)</b></p> <p>A diverse community of red, green and brown seaweeds with a more or less continuous cover of large seaweeds and intertidal species richness of &gt;65. <i>Ascophylum nodosum</i> is both large and abundant and there is a clear zonation of fucoid algae with respect to height on the shore. The sublittoral fringe is dominated by <i>Laminaria digitata</i> and the sublittoral forest dominated by <i>Laminaria saccharina</i> with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.</p> |
| <p><b>Marine Angiosperms</b></p> <p><b>EUNIS Classification: A2 (A2.7) A4 (A4.5)</b></p> <p>On fully saline, sedimentary substrata, sheltered or extremely sheltered from strong tides and currents, 1 or more species of seagrass may be found.</p> <p>Littoral sediments: <i>Zostera noltii</i> and or <i>Zostera angustifolia</i></p> <p>Sublittoral sediments: <i>Zostera marina</i></p> <p>In existent seagrass beds high mean density of healthy shoots. May be naturally high % cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected &lt; 15%.</p> <p>Stable seagrass bed area with no loss or loss of area attributable to natural environmental events.</p> <p><b>Saltmarsh</b></p> <p><b>EUNIS Classification: A2 (A2.6)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                            |

Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. They are not likely to be extensive in these higher salinity areas unless there is some local freshwater influences. Where they occur they would be expected to cover at least 75% of suitable habitat and not show significant decline in aerial extent over a 5 year rolling mean.

### **Benthic Macroinvertebrates**

#### **Shallow fully marine mixed sediments and mud communities (A4.42, A4.313)**

Shallow sea lochs typically support species characteristic of mixed sediments. Due to the quite variable nature of the sediment type, a widely variable array of communities may be found, including those characterised by bivalves, anemones and file shells.

Where physically very stable muds extend from the extreme lower shore to about 15m depth, the biotopes can be more specific; anemones, brittlestars (e.g. *Amphiura*, *Ophiura*), the opisthobranch gastropod *Philine* and synaptid holothurians being characteristic of shallow muds.

Where small stones and shells are abundant on the sediment surface, these can provide a substratum for hydroids, ascidians and other epifauna to attach (Connor *et al.*, 1998).

### **Physico-Chemical Characteristics**

#### **Nutrients**

Nutrient concentrations in undisturbed conditions will be a function ( $\pm x\%$ ) of Atlantic Shelf nutrient concentrations. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

#### **Temperature**

Maximum temperature range is 0 – 24.5°C, but typically between 5 and 15°C (mean 10°C), depending on latitude.

#### **Dissolved Oxygen**

Dissolved O<sub>2</sub> annual range is 80 – 120%, with a mean of 100%. Range 2 – 9 mg l<sup>-1</sup> (temperature & salinity dependent).

#### **Transparency**

Light availability will range from clear to highly turbid, depending on type-specific conditions. This may be a natural function of phytoplankton blooms and other organic and inorganic components.

### **Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

## **5.11 Coastal Type 12**

### **General Description**

Deep Sea Lochs. Euhaline, mesotidal and sheltered.



**Occurrence**

Scotland. e.g. Loch Long, Loch Torridon, Firth of Clyde, Loch Fyne and Loch Nevis.

| Reference Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| <p><b>Phytoplankton</b></p> <p><b>EUNIS Classification: A7 (A7.3, A7.8, A7.9)</b></p> <p><b>Pelagic water column</b></p> <p>Species richness high. Normal patterns of seasonal growth, biomass &amp; succession, i.e. diatom dominated spring bloom and low summer biomass. Diatoms persist throughout growth-period. Increasing numbers of dinoflagellates from late spring. Transition from heterotrophic to autotrophic dinoflagellates from summer to autumn. Autumnal bloom dominated by diatoms or autotrophic dinoflagellates. Nuisance/toxic species at persistently low levels compared with local background levels. Peaks in chlorophyll infrequent &amp; inter-bloom periods low compared with local background.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>Macroalgae</b></p> <p><b>EUNIS Classification: A2, A4</b></p> <p><u>Littoral and sub-littoral sediment</u></p> <p>No normal flora or zonation pattern of perennial (long-lived) macroalgae expected in littoral or sub-littoral, except where odd hard substrate outcrops are present. Opportunistic (short-lived) macroalgae is likely to be absent or occur at very low abundance in littoral or sub-littoral fringe, with total cover not exceeding 10%. Where macrophytes are present in the littoral or sub-littoral, e.g. <i>Zostera</i> spp., opportunistic macroalgae may be present epiphytically, e.g. <i>Pilayella</i> spp.</p> <p><b>Littoral and sub-littoral rock (A1.3, A1.5; A3.3, A3.7)</b></p> <p>A diverse community of red, green and brown seaweeds with a more or less continuous cover of large seaweeds and intertidal species richness of &gt;65. <i>Ascophylum nodosum</i> is both large and abundant and there is a clear zonation of fucoid algae with respect to height on the shore. The sublittoral fringe is dominated by <i>Laminaria digitata</i> and the sublittoral forest dominated by <i>Laminaria saccharina</i> with a diverse range of subsidiary species. There should be an absence of opportunistic macroalgal blooms with total cover not exceeding 10%.</p> |
| <p><b>Marine Angiosperms</b></p> <p><b>EUNIS Classification: A2 (A2.7) A4 (A4.5)</b></p> <p>On fully saline, sedimentary substrata, sheltered or extremely sheltered from strong tides and currents, 1 or more species of seagrass may be found.</p> <p>Littoral sediments: <i>Zostera noltii</i> and or <i>Zostera angustifolia</i></p> <p>Sublittoral sediments: <i>Zostera marina</i></p> <p>In existent seagrass beds high mean density of healthy shoots. May be naturally high % cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected &lt; 15%.</p> <p>Stable seagrass bed area with no loss or loss of area attributable to natural environmental events.</p> <p><b>SALTMARSH</b></p> <p><b>EUNIS Classification:</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                      |

Salt marshes are unlikely to be found in this habitat.

### **Benthic Macroinvertebrates**

#### **Animal communities of circalittoral muds (A4.36, A4.362)**

Typically, undisturbed circalittoral fine mud is found in deep sea lochs. These habitats are heavily bioturbated by megafaunal burrowers, such as *Nephrops norvegicus*. The infauna may contain populations of polychaetes such as, *Pholoe*, *Glycera*, *Nephtys*, *Pectinaria* and *Terebellides*, bivalves such as, *Nucula*, *Corbula* and *Thyasira*, and echinoderms such as, *Amphiura* and *Brissopsis*. The gastropod *Turritella* may also be present in large numbers. Epibenthos such as *Asterias rubens*, *Pagurus bernhardus* and *Liocarcinus depurator* may also be present. Habitats such as A4.362 may occur, which is characterised by conspicuous populations of sea pens such as *Funiculina quadrangularis*, *Virgularia mirabilis* and *Pennatula phosphorea*.

### **Physico-Chemical Characteristics**

#### **Nutrients**

Nutrient concentrations in undisturbed conditions will be a function ( $\pm x\%$ ) of Atlantic Shelf nutrient concentrations. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

#### **Temperature**

Maximum temperature range is 0 – 24.5°C, but typically between 5 and 15°C (mean 10°C), depending on latitude.

#### **Dissolved Oxygen**

Dissolved O<sub>2</sub> annual range is 80 – 120%, with a mean of 100%. Range 2 – 9 mg l<sup>-1</sup> (temperature & salinity dependent).

#### **Transparency**

Light availability will range from clear to highly turbid, depending on type-specific conditions. This may be a natural function of phytoplankton blooms and other organic and inorganic components.

### **Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.

Morphological conditions. The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.

## **5.12 Transitional Type 1**

### **General Description**

Type 1 transitional waters are partly mixed or stratified, with a tendency for salinity to be mesohaline or polyhaline. They are strongly macrotidal. They are sheltered, intertidal or shallow subtidal estuaries that have a predominantly sand and mud substratum.

### **Occurrence**

Ecoregion 1 (North Sea), ecoregion 4 (Atlantic) e.g. Parrett Estuary

### **Reference Conditions**



**Phytoplankton****EUNIS Classification: A7 (A7.4, A7.6)**

TWs prone to higher levels of production compared with CWs, though light availability, salinity and hydrological effects may naturally temper this. Patterns of seasonal growth and succession are similar to coastal dynamics but demonstrate greater variability, in peak duration and composition.

Nuisance/toxic species are at persistently low levels compared with local background levels. Peaks in chlorophyll-a, used as a proxy for phytoplankton bloom biomass, are infrequent and inter-bloom periods are low compared with background levels.

**Macroalgae****EUNIS Classification – A1 (A1.3), A3 (A3.3)****Littoral rock, sub-littoral rock and other hard sediment**

There is a graded distribution from mouth to head whereby species richness declines upstream due to naturally selective attenuation firstly of red and then of brown algae. The outer (or lower) zones consist of a reduced version of coastal shore flora and zonation, with general fucoid domination and species richness generally in the range of 10 – 50 species depending on position along the transitional water gradient. The inner (or upper) zones are dominated by mat forming green algae, *Vaucheria* and cyanobacteria, displaying local variations with around 10 species and the extent of fucoid penetration is likely to be dependent on the salinity regime. The sub-littoral flora is naturally very reduced or absent. There should also be an absence of excessive opportunistic algal growth or the presence of macroalgal blooms.

**EUNIS Classification: A2, A4**Littoral and sub-littoral sediment

No normal flora or zonation pattern (except where odd hard substrate outcrops are present). Opportunistic green, brown or red algae may occur on soft surfaces but there will be a general absence of opportunistic macroalgal blooms with total cover not exceeding 10%.

**Marine Angiosperms****EUNIS Classification: A2 (A2.7) A4 (A4.5)**

On clean, fine sedimentary substrata, of variable salinity, sheltered or extremely sheltered from strong tides and currents, 1 or more species of seagrass may be found.

Littoral sediments: *Zostera noltii* and/or *Zostera angustifolia*

Sublittoral sediments: *Zostera marina* and/or, very rarely *Ruppia* spp (extremely sheltered, weak tidal streams brackish muddy sand or mud).

In existent seagrass beds high mean density of healthy shoots. May be naturally high % cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected < 15%.

Stable seagrass bed area with no loss or loss of area attributable to natural environmental events.

**Saltmarsh****EUNIS Classification: A2 (A2.6)**

Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. Where they occur they would be expected to cover at least 75% of suitable

habitat and not show significant decline in aerial extent over a 5 year rolling mean.

### **Benthic Macroinvertebrates**

A mosaic of habitats occur within transitional waters, influenced by tidal streams, sediment deposition and salinity ranges, and a wide variety of benthic invertebrate communities exist; within this mosaic typical habitats include:

#### **Variable salinity sublittoral sediments (A4.32, A4.43, A4.24)**

Shallow sublittoral muds, extending from the extreme lower shore to about 15m depth in estuarine conditions. Such habitats typically support communities of oligochaetes and polychaetes such as *Aphelocheata*. At the higher salinity end of mesohaline conditions, communities comprised of bivalves such as *Abra*, *Corbula* and *Nucula* and the polychaete *Nephtys* are possible.

#### **Shallow sublittoral mixed sediments (A4.43, A4.431, A4.432, A4.433)**

Variable salinity, mixed sediments, often with surface shells or stones enable the development of epifaunal communities, such as solitary ascidians, or molluscs such as *Mytilus edulis*, as well as infaunal communities such as the polychaete *Polydora*, and bivalve *Mya truncata*.

#### **Variable salinity mud and fine sand communities (A4.32, A2.23)**

Intertidal and shallow subtidal mesohaline/polyhaline mud communities which extend from the extreme lower shore may support communities comprised of bivalves such as *Macoma*, *Mya*, *Cerastoderma* and polychaete *Arenicola*, of these genera deposit feeders would dominate mud sediments, the suspension feeders favouring sandier conditions.

### **Fish**

**EUNIS CLASSIFICATION** – A1, A2, A3, A4, A7.

Currently there is some data available to the fish team to take this classification further. Fish species will utilise a range of habitat types dependent upon state of tide, season and life stage. A full literature search is required in order to associate habitat type with fish species.

Salinity regime and stratification of transitional water suggests that the functional guilds are comprised mainly of marine species. There is a shift within these guilds from meso-haline to poly-haline habitats. Numbers of freshwater species tend to be low and concentrated towards the transitional water/river interface. Sites tend to be dominated by an influx of marine juveniles in winter e.g *Gadus morhua*, *Sprattus sprattus*, *Clupea harengus* & *Merlangius merlangus* and marine adventitious during summer e.g. *Liza ramada*, *Chelon labrosus*, & *Dicentrarchus labrax*. Diadromous species such as *Salmo salar* & *Salmo trutta* are also common.

## Physico-Chemical Characteristics

### Nutrients

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

### Dissolved Oxygen

Dissolved oxygen levels exceed 7mg/l 95% of the time in freshwater conditions (salinity 0). Dissolved oxygen in more saline waters will exceed the appropriate equivalent concentration, as calculated using the UNESCO equation for solubility of oxygen in salt water.

### Temperature

Mean temperature is typically between 5 and 16°C with a maximum range of 0.8 – 21°C, dependent on latitude. Temperature should rarely exceed 21.5°C.

### Transparency

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

## Hydromorphological Characteristics

Tidal regime. The freshwater flow regime corresponds totally or nearly totally to undisturbed conditions.

Morphological conditions. Depth variations, substrate conditions, and both the structure and condition of the intertidal zones correspond totally or nearly totally to undisturbed conditions.

## 5.13 Transitional Type 2

### General Description

Type 2 transitional waters are partly mixed or stratified, with a tendency for salinity to be mesohaline or polyhaline. They are strongly mesotidal. They are sheltered, intertidal or shallow subtidal estuaries that have a predominantly sand and mud substratum.

### Occurrence

Ecoregion 1 (North Sea), ecoregion 4 (Atlantic) e.g. Tees, Dart

## Reference Conditions

### Phytoplankton

#### Partly mixed/stratified reduced salinity water column (A7.4, A7.6)

TWs prone to higher levels of production compared with CWs, though light availability, salinity and hydrological effects may naturally temper this. Patterns of seasonal growth and succession are similar to coastal dynamics but demonstrate greater variability, in peak duration and composition.

Nuisance/toxic species are at persistently low levels compared with local background levels. Peaks in chlorophyll-a, used as a proxy for phytoplankton bloom biomass, are infrequent and inter-bloom periods are low compared with background levels.

## Macroalgae

### Littoral rock, sub-littoral rock and other hard sediment (A1.3, A3.3)

There is a graded distribution from mouth to head whereby species richness declines upstream due to naturally selective attenuation firstly of red and then of brown algae. The outer (or lower) zones consist of a reduced version of coastal shore flora and zonation, with general furoid domination and species richness generally in the range of 10 – 50 species depending on position along the transitional water gradient. The inner (or upper) zones are dominated by mat forming green algae, *Vaucheria* and cyanobacteria, displaying local variations with around 10 species and the extent of furoid penetration is likely to be dependent on the salinity regime. The sublittoral flora is naturally very reduced or absent. There should also be an absence of excessive opportunistic algal growth or the presence of macroalgal blooms.

### Littoral and sub-littoral sediment (A2, A4)

No normal flora or zonation pattern (except where odd hard substrate outcrops are present). Opportunistic green, brown or red algae may occur on soft surfaces but there will be a general absence of opportunistic macroalgal blooms with total cover not exceeding 10%.

## Marine Angiosperms

### Seagrass beds on littoral and sublittoral sediments (A2.7, A4.5)

Clean, fine sedimentary littoral or sublittoral substrata, sheltered or extremely sheltered from strong tides and currents, variable salinity can support beds of seagrass. Littoral sediments support beds of *Zostera noltii* and/or *Zostera angustifolia* and sublittoral sediments support beds of *Ruppia* spp (extremely sheltered, weak tidal streams brackish muddy sand or mud). In existent seagrass beds mean density of healthy shoots is high. There may be a naturally high percentage cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected < 15%. Stable seagrass bed area with no loss or loss of area attributable to natural environmental events. There may be temporal variation in the abundance of seagrass in intertidal areas as seagrass will die back during cold winters.

### Saltmarsh

#### EUNIS Classification: A2 (A2.6)

Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. Where they occur they would be expected to cover at least 75% of suitable habitat and not show significant decline in aerial extent over a 5 year rolling mean.

## Benthic Macroinvertebrates

A mosaic of habitats occur within transitional waters, influenced by tidal streams, sediment deposition and salinity ranges, and a wide variety of benthic invertebrate communities exist; within this mosaic typical habitats include:

### Variable salinity sublittoral sediments (A4.32, A4.43, A4.24)

Shallow sublittoral muds, extending from the extreme lower shore to about 15m depth in estuarine conditions. Such habitats typically support communities of oligochaetes and polychaetes such as *Aphelochaeta*. At the higher salinity end of

mesohaline conditions, communities comprised of bivalves such as *Abra*, *Corbula* and *Nucula* and the polychaete *Nephtys* are possible.

#### **Shallow sublittoral mixed sediments (A4.43, A4.431, A4.432, A4.433)**

Variable salinity, mixed sediments, often with surface shells or stones enable the development of epifaunal communities, such as solitary ascidians, or molluscs such as *Mytilus edulis*, as well as infaunal communities such as the polychaete *Polydora*, and bivalve *Mya truncata*.

#### **Variable salinity mud and fine sand communities (A4.32, A2.23)**

Intertidal and shallow subtidal mesohaline/polyhaline mud communities which extend from the extreme lower shore may support communities comprised of bivalves such as *Macoma*, *Mya*, *Cerastoderma* and polychaete *Arenicola*, of these genera deposit feeders would dominate mud sediments, the suspension feeders favouring sandier conditions.

### **Fish**

**EUNIS CLASSIFICATION** – A1, A2, A3, A4, A7.

Currently there is some data available to the fish team to take this classification further. Fish species will utilise a range of habitat types dependent upon state of tide, season and life stage. A full literature search is required in order to associate habitat type with fish species.

Salinity regime and stratification of transitional water suggests that the functional guilds are comprised mainly of marine species. There is a shift within these guilds from meso-haline to poly-haline habitats. Numbers of freshwater species tend to be low and concentrated towards the transitional water/river interface. Sites tend to be dominated by an influx of marine juveniles in winter e.g. *Gadus morhua*, *Sprattus sprattus*, *Clupea harengus* & *Merlangius merlangus* and marine adventitious during summer e.g. *Liza ramada*, *Chelon labrosus*, & *Dicentrarchus labrax*. Diadromous species such as *Salmo salar* & *Salmo trutta* are also common.

### **Physico-Chemical Characteristics**

#### **Nutrients**

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

#### **Dissolved Oxygen**

Dissolved oxygen levels exceed 7mg/l 95% of the time in freshwater conditions (salinity 0). Dissolved oxygen in more saline waters will exceed the appropriate equivalent concentration, as calculated using the UNESCO equation for solubility of oxygen in salt water.

#### **Temperature**

Mean temperature is typically between 5 and 16°C with a maximum range of 0.8 – 21°C, dependent on latitude. Temperature should rarely exceed 21.5°C.

#### **Transparency**

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

**Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime corresponds totally or nearly totally to undisturbed conditions.

Morphological conditions. Depth variations, substrate conditions, and both the structure and condition of the intertidal zones correspond totally or nearly totally to undisturbed conditions.

**5.14 Transitional Type 3****General Description**

Type 3 transitional waters are fully mixed, predominantly polyhaline and are macrotidal. They are sheltered, with a sand or mud substratum and tend to have have extensive intertidal areas.

**Occurrence**

Ecoregion 1 (North Sea), ecoregion 4 (Atlantic) e.g. Dee, Severn, Thames

**Reference Conditions****Phytoplankton****Fully mixed, reduced salinity water column (A7.2, A7.5)**

TWs prone to higher levels of production compared with CWs, though light availability, salinity and hydrological effects may naturally temper this. Patterns of seasonal growth and succession are similar to coastal dynamics but demonstrate greater variability, in peak duration and composition. Nuisance/toxic species are at persistently low levels compared with local background levels. Peaks in chlorophyll-a, used as a proxy for phytoplankton bloom biomass, are infrequent and inter-bloom periods are low compared with background levels.

**Macroalgae****Littoral rock, sub-littoral rock and other hard sediment (A1.3, A3.3)**

There is a graded distribution from mouth to head whereby species richness declines upstream due to naturally selective attenuation firstly of red and then of brown algae. The outer (or lower) zones consist of a reduced version of coastal shore flora and zonation, with general fucoid domination and species richness generally in the range of 10 – 50 species depending on position along the transitional water gradient. The inner (or upper) zones are dominated by mat forming green algae, *Vaucheria* and cyanobacteria, displaying local variations with around 10 species and the extent of fucoid penetration is likely to be dependent on the salinity regime. The sublittoral flora is naturally very reduced or absent. There should also be an absence of excessive opportunistic algal growth or the presence of macroalgal blooms.

**Littoral and sub-littoral sediment (A2, A4)**

No normal flora or zonation pattern (except where odd hard substrate outcrops are present). Opportunistic green, brown or red algae may occur on soft surfaces but there will be a general absence of opportunistic macroalgal blooms with total cover not exceeding 10%.



## Marine Angiosperms

### Seagrass beds on littoral and sublittoral sediments (A2.7, A4.5)

Clean, fine sedimentary littoral or sublittoral substrata, sheltered or extremely sheltered from strong tides and currents, variable salinity can support beds of seagrass. Littoral sediments support beds of *Zostera noltii* and/or *Zostera angustifolia* and sublittoral sediments support beds of *Ruppia* spp (extremely sheltered, weak tidal streams brackish muddy sand or mud).

In existent seagrass beds mean density of healthy shoots is high. There may be a naturally high percentage cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected < 15%. Stable seagrass bed area with no loss or loss of area attributable to natural environmental events. There may be temporal variation in the abundance of seagrass in intertidal areas as seagrass will die back during cold winters.

### Saltmarsh

#### EUNIS Classification: A2 (A2.6)

Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. Where they occur they would be expected to cover at least 75% of suitable habitat and not show significant decline in aerial extent over a 5 year rolling mean.

## Benthic Macroinvertebrates

A mosaic of habitats occur within transitional waters, influenced by tidal streams, sediment deposition and salinity ranges, and a wide variety of benthic invertebrate communities exist; within this mosaic typical habitats include:

### Variable salinity mud and fine sand communities (A4.32, A2.23)

Intertidal and shallow subtidal mesohaline/polyhaline mud communities which extend from the extreme lower shore may support communities comprised of bivalves such as *Macoma*, *Mya*, *Cerastoderma* and the polychaete *Arenicola*, of these genera deposit feeders would dominate mud sediments, the suspension feeders favouring sandier conditions.

### Muddy sand shores (A2.25)

The drier sediment of the upper shore is characterised by the amphipods *Bathyporeia* and *Corophium* with a limited abundance of polychaetes and bivalves. Sediment of the mid and lower shore remains saturated throughout the tidal cycle and supports a lower abundance of amphipods but a wide range of polychaetes commonly occur, including *Nephtys hombergii*, *Scoloplos armiger* and *Pygospio elegans*. The bivalves *Cerastoderma edule* and *Macoma balthica* may also be common.

### Littoral muds (A2.3)

Littoral muds, which typically form extensive mudflats in variable salinity environments, are habitats characterised by abundant polychaetes, such as *Hediste*, *Eteone* and *Pygospio*. Oligochaetes such as *Tubificoides*, the clam *Macoma*, the spire shell *Hydrobia ulvae* and the furrow shell *Scrobicularia plana* can also be present. The biological community becomes increasingly impoverished in reduced salinity conditions.

**Fish****EUNIS CLASSIFICATION – A1, A2, A3, A4, A7.**

Currently there is some data available to the fish team to take this classification further. Fish species will utilise a range of habitat types dependent upon state of tide, season and life stage. A full literature search is required in order to associate habitat type with fish species.

Dominated by flatfish e.g. *Platichthys flesus*, *Pleuronectes platessa*, *Limanda limanda* & *Solea solea*. Tends to be a larger functional component of freshwater species, e.g. *Leuciscus leuciscus* & *Osmerus eperlanus* and estuarine resident species such as *Agonus cataphractus*, *Ammodytes tobianus*, *Pomatoschistus microps*, *Pomatoschistus minutus* & *Platichthys flesus*. Marine juveniles are common in winter e.g. *Gadus morhua*, *Sprattus sprattus*, *Clupea harengus* & *Merlangius merlangus* with marine adventitious species becoming more prevalent in summer e.g. *Liza ramada*, *Chelon labrosus*, & *Dicentrarchus labrax*.

**Physico-Chemical Characteristics****Nutrients**

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

**Dissolved Oxygen**

Dissolved oxygen levels exceed 7mg/l 95% of the time in freshwater conditions (salinity 0). Dissolved oxygen in more saline waters will exceed the appropriate equivalent concentration, as calculated using the UNESCO equation for solubility of oxygen in salt water.

**Temperature**

Mean temperature is typically between 5 and 16°C with a maximum range of 0.8 – 21°C, dependent on latitude. Temperature should rarely exceed 21.5°C.

**Transparency**

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

**Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime corresponds totally or nearly totally to undisturbed conditions.

Morphological conditions. Depth variations, substrate conditions, and both the structure and condition of the intertidal zones correspond totally or early totally to undisturbed conditions.

**5.15 Transitional Type 4****General Description**

Type 4 transitional waters are fully mixed or stratified, with a tendency for salinity to be predominantly polyhaline. They are mesotidal, sheltered, intertidal or shallow subtidal estuaries that have a predominantly sand and mud substratum.



**Occurrence**

Ecoregion 1 (North Sea), ecoregion 4 (Atlantic) e.g. Solway Firth, Plymouth Sound, Orwell & Stour

**Reference Conditions****Phytoplankton****Partly mixed/stratified reduced salinity water column (A7.4, A7.6)**

TWs prone to higher levels of production compared with CWs, though light availability, salinity and hydrological effects may naturally temper this. Patterns of seasonal growth and succession are similar to coastal dynamics but demonstrate greater variability, in peak duration and composition.

Nuisance/toxic species are at persistently low levels compared with local background levels. Peaks in chlorophyll-a, used as a proxy for phytoplankton bloom biomass, are infrequent and inter-bloom periods are low compared with background levels.

**Macroalgae****Littoral rock, sub-littoral rock and other hard sediment (A1.3, A3.3)**

There is a graded distribution from mouth to head whereby species richness declines upstream due to naturally selective attenuation firstly of red and then of brown algae. The outer (or lower) zones consist of a reduced version of coastal shore flora and zonation, with general furoid domination and species richness generally in the range of 10 – 50 species depending on position along the transitional water gradient. The inner (or upper) zones are dominated by mat forming green algae, *Vaucheria* and cyanobacteria, displaying local variations with around 10 species and the extent of furoid penetration is likely to be dependent on the salinity regime. The sublittoral flora is naturally very reduced or absent. There should also be an absence of excessive opportunistic algal growth or the presence of macroalgal blooms.

**Littoral and sub-littoral sediment (A2, A4)**

No normal flora or zonation pattern (except where odd hard substrate outcrops are present). Opportunistic green, brown or red algae may occur on soft surfaces but there will be a general absence of opportunistic macroalgal blooms with total cover not exceeding 10%.

**Marine Angiosperms****Seagrass beds on littoral and sublittoral sediments (A2.7, A4.5)**

Clean, fine sedimentary littoral or sublittoral substrata, sheltered or extremely sheltered from strong tides and currents, variable salinity can support beds of seagrass. Littoral sediments support beds of *Zostera noltii* and/or *Zostera angustifolia* and sublittoral sediments support beds of *Ruppia* spp (extremely sheltered, weak tidal streams brackish muddy sand or mud).

In existent seagrass beds mean density of healthy shoots is high. There may be a naturally high percentage cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected < 15%. Stable seagrass bed area with no loss or loss of area attributable to natural environmental events. There may be temporal variation in the abundance of seagrass in intertidal areas as seagrass will die back during cold winters.

**Saltmarsh****EUNIS Classification: A2 (A2.6)**

Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. Where they occur they would be expected to cover at least 75% of suitable habitat and not show significant decline in aerial extent over a 5 year rolling mean.

**Benthic Macroinvertebrates**

A mosaic of habitats occur within transitional waters, influenced by tidal streams, sediment deposition and salinity ranges, and a wide variety of benthic invertebrate communities exist; within this mosaic typical habitats include:

**Variable salinity mud and fine sand communities (A4.32, A2.23)**

Intertidal and shallow subtidal mesohaline/polyhaline mud communities which extend from the extreme lower shore may support communities comprised of bivalves such as *Macoma*, *Mya*, *Cerastoderma* and the polychaete *Arenicola*, of these genera deposit feeders would dominate mud sediments, the suspension feeders favouring sandier conditions.

**Muddy sand shores (A2.25)**

The drier sediment of the upper shore is characterised by the amphipods *Bathyporeia* and *Corophium* with a limited abundance of polychaetes and bivalves. Sediment of the mid and lower shore remains saturated throughout the tidal cycle and supports a lower abundance of amphipods but a wide range of polychaetes commonly occur, including *Nephtys hombergii*, *Scoloplos armiger* and *Pygospio elegans*. The bivalves *Cerastoderma edule* and *Macoma balthica* may also be common.

**Littoral muds (A2.3)**

Littoral muds, which typically form extensive mudflats in variable salinity environments, are habitats characterised by abundant polychaetes, such as *Hediste*, *Eteone* and *Pygospio*. Oligochaetes such as *Tubificoides*, the clam *Macoma*, the spire shell *Hydrobia ulvae* and the furrow shell *Scrobicularia plana* can also be present. The biological community becomes increasingly impoverished in reduced salinity conditions.

**Fish****EUNIS CLASSIFICATION – A1, A2, A3, A4, A7.**

Currently there is some data available to the fish team to take this classification further. Fish species will utilise a range of habitat types dependent upon state of tide, season and life stage. A full literature search is required in order to associate habitat type with fish species.

*Fish faunal assemblage tends to be dominated by estuarine resident species such as Agonus cataphractus, Ammodytes tobianus, Pomatoschistus microps, Pomatoschistus minutus & Platichthys flesus. A greater flatfish component is also present in relation to TW1 eg. Platichthys flesus, Pleuronectes platessa, Limanda limanda & Solea solea. Salinity is a major factor in restricting the distribution of marine species and is dependent upon season.*

Within Eco-region 4, TW2's the diadromous functional component e.g. *Salmo salar* & *Salmo trutta* is not present.

### Physico-Chemical Characteristics

#### Nutrients

Nutrient concentrations follow usual seasonal fluctuations, peaking at the end of winter and declining through the growing season. The winter concentration of nitrates and phosphates correspond totally or nearly totally to regional undisturbed conditions.

#### Dissolved Oxygen

Dissolved oxygen levels exceed 7mg/l 95% of the time in freshwater conditions (salinity 0). Dissolved oxygen in more saline waters will exceed the appropriate equivalent concentration, as calculated using the UNESCO equation for solubility of oxygen in salt water.

#### Temperature

Mean temperature is typically between 5 and 16°C with a maximum range of 0.8 – 21°C, dependent on latitude. Temperature should rarely exceed 21.5°C.

#### Transparency

Transparency does not show signs of anthropogenic disturbance and remains within the range normally associated with undisturbed conditions.

### Hydromorphological Characteristics

Tidal regime. The freshwater flow regime corresponds totally or nearly totally to undisturbed conditions.

Morphological conditions. Depth variations, substrate conditions, and both the structure and condition of the intertidal zones correspond totally or nearly totally to undisturbed conditions.

## 5.16 Transitional Type 5

### General Description

Type 5 waters are transitional sea lochs. These are sheltered bodies of water, which are mesotidal and predominantly polyhaline. They may be stratified.

### Occurrence

Ecoregion 1 (North Sea), ecoregion 4 (Atlantic) e.g. Loch Eil, Loch Linnhe, Loch Etive

### Reference Conditions

#### Phytoplankton

#### EUNIS Classification: A7 (A7.2, A7.5)

TWs prone to higher levels of production compared with CWs, though light availability, salinity and hydrological effects may naturally temper this. Patterns of seasonal growth and succession are similar to coastal dynamics but demonstrate greater variability, in peak duration and composition.

Nuisance/toxic species are at persistently low levels compared with local background levels. Peaks in chlorophyll-a, used as a proxy for phytoplankton bloom biomass, are infrequent and inter-bloom periods are low compared with background levels.

**Macroalgae****EUNIS Classification: A2, A4**Littoral and sub-littoral sediment

No normal flora or zonation pattern (except where odd hard substrate outcrops are present). Opportunistic green, brown or red algae may occur on soft surfaces but there will be a general absence of opportunistic macroalgal blooms with total cover not exceeding 10%.

**Marine Angiosperms****EUNIS Classification: A2 (A2.7) A4 (A4.5)**

On clean, fine sedimentary substrata, of variable salinity, sheltered or extremely sheltered from strong tides and currents, 1 or more species of seagrass may be found.

Littoral sediments: *Zostera noltii* and/or *Zostera angustifolia*

Sublittoral sediments: *Zostera marina* and/or, very rarely *Ruppia* spp (extremely sheltered, weak tidal streams brackish muddy sand or mud). In existent seagrass beds high mean density of healthy shoots. May be naturally high % cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected < 15%. Stable seagrass bed area with no loss or loss of area attributable to natural environmental events.

**Saltmarsh****EUNIS Classification: A2 (A2.6)**

Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. Where they occur they would be expected to cover at least 75% of suitable habitat and not show significant decline in aerial extent over a 5 year rolling mean.

**Benthic Macroinvertebrates****Variable salinity coarse sediment shores (A2.12)**

The littoral habitats of the upper reaches of sea lochs are typically comprised of coarse sediment (shingle, gravels and coarse sand). The habitats are subject to variable and reduced salinity conditions, and are typically species-poor and characterised by oligochaete worms.

Tide-swept circalittoral cobbles and pebbles (A1.33)

Lower shore of tide-swept areas, a mixed substratum (mainly cobbles and pebbles on muddy sediments) with dense aggregations of the mussel, *Mytilus edulis* may be found. In high densities the mussels bind the substratum and provide a habitat for many species more commonly found on rocky shores; the mussels are usually encrusted with barnacles and whelks and small crabs are common amongst the mussels. Areas of sediment may contain polychaetes such as the genus *Arenicola* and *Lanice*, the bivalve *Cerastoderma* and other infaunal species.

**Variable salinity subtidal mud communities (A4.321, A4.322, A4.323)**

Variable salinity cohesive muddy sediment can be dominated by the polychaete *Aphelocheata marioni* and the oligochaetes *Tubificoides*. The polychaetes *Polydora*, *Cossura longocirrata* and *Melinna palmata* may also occur in high numbers. The cirratulid polychaete *Caulleriella zetlandica* may be present.

**Fish**

Currently there is some data available to the fish team to take this classification further. Fish species will utilise a range of habitat types dependent upon state of tide, season and life stage. A full literature search is required in order to associate habitat type with fish species.

The fish task team does not have any datasets from this type but would suggest that the descriptors are similar to TW1:-

Salinity regime and stratification of transitional water suggests that the functional guilds are comprised mainly of marine species. There is a shift within these guilds from meso-haline to poly-haline habitats. Numbers of freshwater species tend to be low and concentrated towards the transitional water/river interface. Sites tend to be dominated by an influx of marine juveniles in winter e.g. *Gadus morhua*, *Sprattus sprattus*, *Clupea harengus* & *Merlangius merlangus* and marine adventitious during summer e.g. *Liza ramada*, *Chelon labrosus*, & *Dicentrarchus labrax*. Diadromous species such as *Salmo salar* & *Salmo trutta* are also common.

**Physico-Chemical Characteristics****Nutrients**

Nutrient concentrations will be elevated above Atlantic Shelf Concentrations by a factor dependent on local geological, hydrological and natural input regimes and characterised by a conservative dilution regime.

**Dissolved Oxygen**

Dissolved O<sub>2</sub> annual range is 80 – 100%.

**Temperature**

Maximum temperature range 0.8 – 21°C, typically between 5 and 15°C (mean 10°C) depending on latitude and type-specifics.

**Transparency**

Light availability is likely to be naturally lower for TWs than for CWs. It is a natural function of physical processes, estuary size, phytoplankton blooms and other organic and inorganic components.

*Interactions between nutrients, light and salinity are such that the overall resultant processes do not have a negative effect on the biological elements, e.g. no shading by excessive macroalgae/macrophyte growth caused by increased nutrient inputs in a non-turbid environment. Interactions between turbidity and phytoplankton growth in turbid TW are complex and can be driven by other physical processes e.g. phytoplankton re-suspension through tidal cycles.*

**Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime corresponds totally or nearly totally to undisturbed conditions.

Morphological conditions. Depth variations, substrate conditions, and both the structure and condition of the intertidal zones correspond totally or nearly totally to undisturbed conditions.

### 5.17 Transitional Type 6

#### General Description

Type 6 waters are transitional lagoons. These are sheltered bodies of water, which are oligohaline to polyhaline. They may be partly mixed or stratified.

#### Occurrence

Ecoregion 1 (North Sea), ecoregion 4 (Atlantic). Widespread around UK coasts.

| Reference Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Phytoplankton</b></p> <p><b>EUNIS Classification: A7 (A7.4, A7.6)</b></p> <p>TWs prone to higher levels of production compared with CWs, though light availability, salinity and hydrological effects may naturally temper this. Patterns of seasonal growth and succession are similar to coastal dynamics but demonstrate greater variability, in peak duration and composition. Nuisance/toxic species are at persistently low levels compared with local background levels. Peaks in chlorophyll-a, used as a proxy for phytoplankton bloom biomass, are infrequent and inter-bloom periods are low compared with background levels.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <p><b>Macroalgae</b></p> <p><b>EUNIS Classification: A2, A4</b></p> <p><u>Littoral and sub-littoral sediment</u></p> <p>No normal flora or zonation pattern (except where odd hard substrate outcrops are present). Opportunistic green, brown or red algae may occur on soft surfaces but there will be a general absence of opportunistic macroalgal blooms with total cover not exceeding 20%.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p><b>Marine Angiosperms</b></p> <p><b>EUNIS Classification: A2 (A2.7) A4 (A4.5)</b></p> <p>On clean, fine sedimentary substrata, of variable salinity, sheltered or extremely sheltered from strong tides and currents, 1 or more species of seagrass may be found.</p> <p>Littoral sediments: <i>Zostera noltii</i> and/or <i>Zostera angustifolia</i>.</p> <p>Sublittoral sediments: <i>Zostera marina</i> and/or, very rarely <i>Ruppia</i> spp (extremely sheltered, weak tidal streams brackish muddy sand or mud). In existent seagrass beds high mean density of healthy shoots. May be naturally high % cover of epiphytic macroalgae, without compromising health of seagrass species. Sub-littoral species may exhibit no or low levels of Wasting Disease (leaf infection); mean leaf area affected &lt; 15%.</p> <p><b>Saltmarsh</b></p> <p><b>EUNIS Classification: A2 (A2.6)</b></p> <p>Salt marshes form on the upper parts of intertidal mud flats on sheltered coastlines where fine sediment is deposited. Salt marshes are typically found on sheltered coasts such as estuaries, inlets and behind barriers such as islands and shingle spits. Where they occur they would be expected to cover at least 75% of suitable habitat and not show significant decline in aerial extent over a 5 year rolling mean.</p> |



**Benthic Macroinvertebrates**

Examples of the specialised habitats found in lagoons are represented in EUNIS types (e.g. A4.412, A4.14, A2.2531):

Transitional lagoons are typified by their ephemeral nature and very variable salinity. Characterising species are therefore difficult to catalogue. As a general guide, a lagoon with a salinity range of 6-10 will be dominated by chironomid (midge) larvae and *Sigara* (water boatmen, Corixid bugs). A lagoon with a range of 18-24 will be dominated by the amphipod *Corophium volutator*, the polychaete *Hediste diversicolor* and mysid shrimp *Neomysis integer* (Bamber *et al.*, 2001).

**Fish**

Currently there is some data available to the fish team to take this classification further. Fish species will utilise a range of habitat types dependent upon state of tide, season and life stage. A full literature search is required in order to associate habitat type with fish species.

The fish task team does not have any datasets from this type but would suggest that estuarine residents and/or marine juveniles would dominate these lagoons. There would also be the occasional presence of marine adventitious species. Composition and abundance would be highly seasonal and essentially these water bodies would be utilised as nursery grounds. There would be an absence of the diadromous species and as such no 'diadromous functional guild'.

**Physico-Chemical Characteristics****Nutrients**

Nutrient concentrations will be elevated above Atlantic Shelf Concentrations by a factor dependent on local geological, hydrological and natural input regimes and characterised by a conservative dilution regime.

**Dissolved Oxygen**

Dissolved O<sub>2</sub> annual range is 80 – 100%. Light availability is likely to be naturally lower for TWs than for CWs.

**Temperature**

Maximum temperature range 0.8 – 21°C, typically between 5 and 15°C (mean 10°C) depending on latitude and type-specifics.

**Transparency**

It is a natural function of physical processes, estuary size, phytoplankton blooms and other organic and inorganic components.

*Interactions between nutrients, light and salinity are such that the overall resultant processes do not have a negative effect on the biological elements, e.g. no shading by excessive macroalgae/macrophyte growth caused by increased nutrient inputs in a non-turbid environment. Interactions between turbidity and phytoplankton growth in turbid TW are complex and can be driven by other physical processes e.g. phytoplankton re-suspension through tidal cycles.*

**Hydromorphological Characteristics**

Tidal regime. The freshwater flow regime corresponds totally or nearly totally to undisturbed conditions.

Morphological conditions. Depth variations, substrate conditions, and both the structure and condition of the intertidal zones correspond totally or nearly totally to undisturbed conditions.