UKTAG – Biological Status Methods Coastal and Transitional Waters – Opportunistic macroalgae

What do we use as an Indicator?
Opportunistic macroalgae (mainly green seaweeds)

Why do we use opportunistic macroalgae?
Opportunistic macroalgae are able to utilise excess nitrogen in the environment and outcompete other seaweed species. They can produce blooms, forming mats on the mud surface. Dense algal mats can have harmful effects on underlying mudflat sediments and fauna, other algae, seagrass, and saltmarsh.

Sampling
Sampling is usually carried out during summer when blooms are at their peak, and between mean high water and mean low water of spring tides. The overall size of algal mats is estimated either from aerial imagery or by walking around the algal patches with a GPS. We use randomly placed quadrats to assess the density of mats (% cover within the quadrats), and also biomass ($g.m^{-2}$). Weed growing within the sediment is also noted (entrainment). The more weed there is, the more likely it is to affect organisms in the sediment and birds trying to feed on them. We assess the entire intertidal area of a waterbody, but only where algae have the potential to grow; this is called the available intertidal habitat (AIH).

Quadrat

The main species likely to form blooms in the UK are the green algae: *Enteromorpha, Ulva* and *Chaetomorpha,* though some red or brown algae may also form blooms.

What do we measure?
After calculating the AIH, we measure 5 things:

% Cover of Available Intertidal Habitat (AIH)
This is the percentage cover estimated from the quadrats measured over all of the macroalgal patches of the AIH.

Total extent of algal bloom (Affected Area-AA)*
This is a measure of the total area affected by the algal bloom and is measured in hectares.

AA/AIH (%)*
We also calculate the affected area as a percentage of the AIH, but only use the worse of these two (asterisked) measures. This helps to adjust the impact to the size of the waterbody.

Biomass of the Affected Area (AA)
Opportunistic macroalgae are cut and peeled from the surface of each quadrat, washed and weighed wet.

Biomass over the Available Intertidal Habitat (AIH)
This is the estimate of the average biomass of algae over the whole of the available intertidal habitat.

Proportion of entrained algae
This is an estimate of the percentage of quadrats where algae grow down into the underlying sediment.

The effects of weed cover are greatest on sites which are consistently covered by deep blooms; sites affected only intermittently have greater opportunity to recover, with flushing of the sediment by seawater. In pristine waters few or no macroalgal blooms would be expected, and the cover of the indicator species would be less than 5% of the AIH. As nutrient pressure increases there would be significant cover of macroalgae and an increase in biomass; algal entrainment may occur in > 1% of quadrats. At this level there is likely to be some impact on the sediment and animals in the mud below algal mats.

How do we decide the Ecological Quality Status?
For the above 5 measures figures were determined to represent undisturbed waters (reference conditions). The observed results are then compared with these figures to calculate the Ecological Quality Ratio (EQR). EQR values close to one indicate macroalgae communities are close to their natural state; those near zero indicate a high level of pollution or disturbance. To decide the Ecological Status the five measures are combined and the range from one to zero divided into the five bands required by the Water Framework Directive (see the table below):

Biological Status Boundary Values

Status	EQR Values
High	0.80
Good	0.60
Moderate	0.40
Poor	0.20
Bad	0

For more details see the UKTAG Opportunistic Macroalgal Blooming Tool Method Statement