Cefas comments on *Proposed recommendations on biological standards* for WFD by UKTAG

Introduction

Ecosystem management needs to balance between conservation or restoration of natural ecosystem states on one hand and sustainable use of the ecosystem on the other hand. Depending on the aims of management, these two aspects will be weighted differently. In the proposed recommendations on biological standards for the WFD by the UK, the status of water bodies is assessed in comparison with undisturbed states, indicating that, at least in the UK's interpretation of the WFD, high emphasis is put on conservation and restoration of natural states. Compared to this, the MSFD appears to put stronger emphasis on sustainable use, most notably by invoking exploitation of commercially important fish populations at or below MSY as one of the criteria for Good Environmental Status. Thus, there may be differences in the aims of the two directives, at least from the perspective of their implementation. It should therefore not surprise if criteria and indicators used to assess the ecological status of water bodies under the two directives differ.

In the following, we provide specific comments on Annexes 14-19, and 21 of the *Proposed recommendations on biological standards*.

Annex 14 Coastal waters Phytoplankton, Phytoplankton

We have several minor comments:

Page 4: It could be problematic to use the term functional groups for this work because groups are here understood only on the basis of taxonomy. Conventionally, the term refers to, e.g., size or ecosystem role.

We found it difficult to understand the calculation of the Z-score and how it is compared to among different waters bodies. I suppose that L4 (Plymouth) was used as the reference for the mean of P (Pages 7 and 19). If it is so (no explanation was given in this document), it is unclear whether this time series could be used as a reference for eutrophication work, despite this being the longest and the most documented. Some information or reference should be given in the document explaining the origin of Table 8.

Page 7: I know that it is difficult to handle the bloom of Phaeocystis because of the high number of cells. However, there can be blooms of Phaeocystis in UK waters (though apparently not in France or Belgium). We recorded a bloom of Phaeocystis in the Wash (Norfolk) in 2011. Counts of more than 10^6 cells l-1 of Phaeocyctis are regularly observed at our SmartBuoy mooring 'West Gabbard'. The real question is whether 'blooms' of Phaeocystis have changed in frequency of occurrence due to a human induced pressure such as nutrient input.

Page 7: We recommend to state explicitly that the reduced taxonomy list (RTL) will consistently be used as it is now, rather than being incrementally updated as technology improves.

Pages 8-17: Chlorophyll: The document uses the terms Chlorophyll a or Chlorophyll, apparently interchangeably. There is a difference between both. Chlorophyll a can be measured using HPLC and spectrophotometry. Chlorophyll is measured using fluorimetry. These methods do not give the same values. For clarity it should be specified which technique is used (HPLC for Chlorophyll a will be the best and is already used in other countries like the Netherlands and Belgium).

Hereafter we cite two passages from the Annex in italic and provide comments thereafter.

> *Phytoplankton biomass as indicated by the concentration of chlorophyll a;*
> *(b) elevated cell counts of algal species; and*
> *(c) the seasonal succession of groups of species with different ecosystem functions (diatoms, dinoflagellates).*

Dinoflagellates are not important in UK waters, ranking fifth compared to other functional groups. Better to use 'small flagellates' as a functional group which is very abundant, and trophically distinct from diatoms.

> *The observed (measured) values for each of the above indicators are compared to those expected under near undisturbed (reference) conditions. The reference conditions were derived using historical records, expert judgement and data from sites at high and low risk of eutrophication.*
>
> *Our recommended improvements to the method include:*
> *(a) modifying the elevated cell count indicator by removing consideration of blooms of Phaeocystis. Such blooms have only rarely been observed in the UK.*
> *(b) changes in thresholds for some of the indicators to better reflect geographical differences in phytoplankton communities; and*
> *(c) updating and better focusing of the taxa list used in assessing elevated cell counts.*
> *and the absence of seagrasses from an area may be natural.*

The last point needs to put into historical context (shifting baselines). Seagrasses were very abundant 100 years ago, and are now scarce everywhere.

Annex 15 Transitional and coastal waters Macroalgae, Opportunistic macroalgal blooming tool

There are several long sentences, that are difficult to follow. I would suggest a general proof reading to cut these sentences where possible. For example,

"The majority of algal mats encountered in UK locations are composed principally of *Ulva*, although other green species of algae such as *Cladophora* and *Chaetomorpha* have been reported, along with the brown algae *Ectocarpus* and *Pilayella* and the red algae *Porphyra* which may also reach nuisance proportions" (p5).

"Entrainment was felt to be an early warning sign of potential eutrophication problems so a tight High /Good standard of 1% was selected (this allows for the odd change quadrat or error to be

made), consequently the Good / Moderate boundary was set at 5% where (assuming sufficient quadrats were taken) it would be clear that entrainment and potential over wintering had started" (p7).

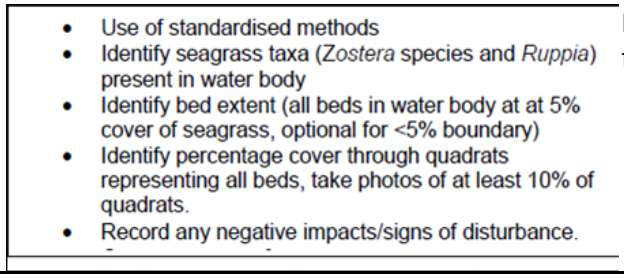
Additional comments follow in tabular form:

p5: As the need to normalise definitions of eutrophication, and monitoring schemes, to produce a robust assessment satisfying all relevant criteria is recognised, attention has been paid to align methods between directives.	Rewrite this sentence e.g. "To produce a robust assessment, satisfying all relevant criteria, the methods for the directives and OSPAR were aligned. The definitions of eutrophication and the monitoring schemes were standardised."
p7: …potential start eutrophication	… potential start **of** eutrophication
p7: this allows for the odd change quadrat or error to be made	… chang**ed** quadrat …

Annex 16 Transitional and coastal waters Angiosperms, Intertidal Seagrass

We provide comments in tabular form.

p3: **When:** Sampling should be completed from June through to September	This suggests surveying should be continuous during this period. In fact one survey *during* the period is required, ideally at the same time each year when there is peak growth.
p3: **Response to pressure** … increased nutrient concentrations (eutrophication),	Increased nutrient concentrations do not equal eutrophication. Either delete eutrophication or state, 'which may lead to eutrophication'.
Table 1: **Good** No loss of seagrass species	This is not consistent with Tables 3 and Fig. 4 where up to ¼ or 1/3 of species can be lost at Good status (depending on initial number of species present).
Table 1: **Moderate** Loss of 1 *seagrass* species, but 1 species still remaining in the water body	Why italics? Was the intention for 'species' to be italicised? This statement doesn't make sense if there are 3 or more species present, nor does it correspond with the Taxonomic composition column in Table 3. I suggest stating something like, 'In multi-species seagrass beds; loss of 1 species, with all others remaining. In mono-specific beds; no loss'.
p7: Therefore the final metric is based around the number of species present, as detailed from historical records, remaining consistent.	Better to say, 'Therefore … remaining **constant'**, not consistent.



- Use of standardised methods
- Identify seagrass taxa (*Zostera* species and *Ruppia*) present in water body
- Identify bed extent (all beds in water body at at 5% cover of seagrass, optional for <5% boundary)
- Identify percentage cover through quadrats representing all beds, take photos of at least 10% of quadrats.
- Record any negative impacts/signs of disturbance.

It looks like there may be some text missing from the bottom of this box (Fig. 2)

Annex 17 Transitional and coastal waters Angiosperms, Saltmarsh Index

Angiopserms – saltmarsh vegetation (p.10, 11) should be listed as sensitive to nutrient enrichment as well as disturbance (see Deegan et al. 2012).

Annex 18 Transitional and coastal waters Invertebrates, IQI

A very useful document that summarises the development and use of the Infaunal Quality Index to assess the ecological health of the biological quality element, "benthic invertebrate fauna.
Key points are made in relation to the development of the technique and inter-calibration process used. Important notes on when the index can be used confidently are given in conjunction with reference to the importance of the calculation and interpretation of the Confidence of Class (CoC) and Risk of Misclassification (RoM).

Please find some more detailed comments and questions below

Applicability

- In a recent trial with offshore data the limit of 1000 species was found restrictive. This was just using data from one region in one year within the North Sea. To enable the IQI to be used on wider spatial and temporal scales these limitations would have to be reduced.
- The normative descriptions are well defined. This is something which would be beneficial to the MSFD process.
- Is consideration given to natural disturbance in terms of setting reference conditions?
- Can the IQI be further developed based on developing sensitivity studies i.e. the effects of other pressures or cumulative pressures on benthic communities?
- An in-depth and useful overview is given and how the IQI was formulated however this overview may benefit from the inclusion of a definitive list of which habitat types the IQI can be used in and some more clarification given on how the reference conditions were set for species within the current species list would be useful. Additional information could include, were communities assessed across different geographic regions, from different depths and varying natural disturbance regimes? (I am anticipating that much of this information is included in the referenced literature). I feel it would still be useful to include a short summary on how this was carried out.

Process

- Is there an alternative if the IQI is not deemed suitable? If reference conditions are not optimum for the IQI is there an alternative approach agreed.
- More details on the data truncation procedures embedded within the tool may be useful to the potential user
- At what point (if any) is it deemed that the IQI is not the correct tool to use. E.g. what is the cut off for the reference conditions (coarseness and salinity) and the number of species 'not in list'?
- A definition of appropriate fauna is needed.
- Can additional faunal attributes be added into the tool?

Annex 19 Transitional waters Phytoplankton, Phytoplankton

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We recommend to state explicitly that the reduced taxonomy list (RTL) will consistently be used as it is now, rather than being incrementally updated as technology improves.

The table on Page 5: The term "slight changes" unclear: there is no indication as to when there is a slight change and when not.

Annex 21 Transitional waters Fish, TFCI

The Annex builds heavily on the work by Coates et al. (2007) in both, the construction of the indicator and its scientific justification. We therefore find it important to point out that there appears to be a crucial difference in definition and usage of the TFCI by Coates et al. (2007) and Annex 21.

While Coates et al. (2007) evaluate the TFCI for each individual sample taken, and then average these values over a larger area, the procedures described in Annex 21 first pools data from many samples (the detailed protocol for pooling data remains unspecified), and then computes the TFCI for the pooled data. Furthermore, Coates et al. (2007) standardized their samples "by removing all but the 20% most frequent species" (where it remains unspecified if 20% refers to a proportion of species richness, biomass, or number), while this data processing step appears to be absent in Annex 21. In both cases, the deviation from Coates et al. (2007) makes the protocol of Annex 21 more sensitive to variations in sampling effort and protocol. In fact, Annex 21 recommends increasing sampling effort with the size of the water body. It is well known that indices based on species richness are highly sensitive to sampling effort. Exhaustive sampling of all species in a community or habitat can require large efforts, yet the protocol of Annex 21 can yield assessments unbiased by variations in sampling effort only when reading it as requiring exhaustive sampling.

The sensitivity of the TFCI to the status of ecological communities may not be as high as suggested by its verbal interpretation on page 1 of the Annex. While in the study by Coates et al. (2007) large variations across samples were observed, the difference in mean values obtained for the upper Thames and lower Thames seems to be small (about 0.1 on a scale from 0 to 1, unfortunately, Coates et al. (2007) do not address the question of sensitivity quantitatively). Observed variations in the index computed using the method of Annex 21 might be largely statistical variations, which cautions against using it for ecosystem assessment.

Metric 1 and even more so Metric 3 appear to imply the supposition of a fixed natural species composition for any given habitat. This implication contrasts with the known phenomenon of species turnover reported widely in the ecological literature. Besides, a reason why communities with high species richness are preferable over those with low richness is that richer communities can more easily adapt to changing environmental conditions. Metric 3 would interpret any such adaptation as a decline in ecological status.

For the computation of the TFCI, abundances are measured by number. Because there are many more small fish than large fish, within both populations and communities, such statistics tend to be strongly weighted towards smaller individuals. Houle et al. (2012) demonstrate that measuring population sizes by biomass generally gives statistically more robust indicators.

The index evaluated for Metric 1 is not the Bray-Curtis similarity but the Sørensen–Dice coefficient.[1]

It is not clear why the scores for Metrics 1 and 3 are assigned using the same boundaries. Data by Coates et al. (2007) show that Metric 3 attains systematically lower values than metric 1.

Refrences:

Coates, S.A., Waugh, A, Anwar, A, & Robson, M. (2007) Efficacy of a multi-metric fish index as an analysis tool for the transitional fish component of the Water Framework Directive. Marine Pollution Bulletin 55: 225–240.

Deegan, L. A., Johnson, D. S., Warren, R. S., Peterson, B. J., Fleeger, J. W., Fagherazzi, S., & Wollheim, W. M. (2012). Coastal eutrophication as a driver of salt marsh loss. Nature, 490(7420), 388-392.

Houle, E., K. D. Farnsworth, A. G. Rossberg, and D. G. Reid (2012), Assessing the sensitivity and specificity of fish community indicators to management action, Canadian Journal of Fisheries and Aquatic Sciences, 69(6), 1065—1079.

[1] http://en.wikipedia.org/wiki/S%C3%B8rensen_similarity_index