REVIEW OF DRAFT OSPAR ICG-COBAM ADVICE MANUAL ON BIODIVERSITY

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Introduction

The Marine Strategy Framework Directive (MSFD; 2008/56/EC) calls upon EU Member States (MS) to develop criteria and methodological standards to allow consistency in approach in evaluating the extent to which Good Environmental Status (GES) is being achieved. MS are required to provide indicators of GES to the European Commission by July 2012, using the guidance provided in the Commission Decision document (2010/477/EU). A number of reports have been published relating to the descriptors of GES, including eight reports facilitated by the JRC and ICES and two (Contaminants in fish and other seafood and Marine litter) facilitated by DG SANCO and IFREMER respectively. OSPAR is coordinating the MSFD implementation process for the OSPAR Maritime Area and established an Intersessional Correspondence Group on Coordination of Biodiversity Assessment and Monitoring (ICG-COBAM). This group organised an expert workshop 23–24 November 2010 in Utrecht, Netherlands (BDC 11/4/2-E) to consider the definition of GES for the biodiversity descriptors, and to recommend appropriate indicators, targets and assessment tools. A product of this workshop is an Advice Manual aimed at national experts and policy makers who will be directly involved in this work at MS and Regional Sea levels.

Of the 11 Descriptors of GES, the Advice Manual deals with 4:

D1. Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

D2. Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.

D4. All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

D6. Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.

OSPAR has requested ICES to peer review a draft Advice Manual made available in April 2011. The objective of this peer review is to provide expert comments for consideration in revisions to the Advice Manual prior to publication.

The complete terms of reference for the request from OSPAR is found in Annex A. This document records the reviews of 5 independent scientists whose work was overseen by one of them. This does not constitute ICES advice but rather the consensus view of those independent scientists.

General Comments on the Advice Manual

The Manual is an important step toward advice on the assessment and monitoring of marine biodiversity and OSPAR should be congratulated for taking the lead on this difficult subject. However, the review group found that this draft is too general to provide sufficient guidance for the development of actions. The Manual provides introductive approaches but doesn't follow up with details and clarifying examples. With some further work it could be much more informative and clear. There are few if any incorrect or indefensible statements within the manual. Rather, it simply stops short of what is needed for useful advice. For example, Section 7, Approaches to setting targets for pressures, is all true. However, it does not provide advice on how to determine important pressures for individual species, how to set targets for those pressures, or how to achieve those targets once they have been set. The suggestion to map distribution and intensity of pressures is useful guidance but not typical of this document.

The Advice Manual clearly is based on the report of the workshop, but in translating the workshop recommendations into an Advice Manual, important points seem to have been lost. For example, paragraph 4 of the Fish and Cephalopods working group Appendix of the workshop report provides very important input from the group discussions for which we could find no reflection in the Advice Manual.

Overall, the discussion of potential methods for determination of baselines, targets, indicators, etc. seems adequate but insufficient for advice on biodiversity. There is a general need for advice about selection of the species for which proposed methods are to be applied. Are all species to be assessed or a subset? If a subset, how will the species be selected? If different methods are to be used for different species, how are those subsets of species to be selected? Will deterioration in the status of a single species trigger widespread corrective action? If not, what is the trigger?

Broad coordination of selections and methods is necessary for broadly distributed species. Although such coordination is mentioned several times, no advice is provided about how to achieve it. For example we envision a scenario where one Contracting Party (CP) chooses to assess population distribution, etc. for one suite of fish species and a neighbour-

ing CP chooses another suite of species and then being unable to put together anything meaningful. Further, if the monitoring methods are not harmonised it is not explained how to ensure that the GES assessment results would be comparable between CPs.

Lastly, the advice manual includes descriptors 1, 2, 4 and 6, however, the report does not really treat descriptor 4 on food webs. The understanding of this descriptor and the developed indicator for the Proportion of Large Fish has been proposed by the ICES/JRC TG 4 and has been developed over several years (see ICES, 2010, 2011)-WGECO reports 2010, 2011). The advice manual could be developed accordingly.

ToR 1: Are there other options for setting baselines and setting targets for GES?

i) Whether the methodologies outlined for setting baselines and setting targets for GES cover all options available to CPs (Chapters 3 and 4)

The report covers in general the potential ways to set baselines for GES, however, it would benefit from real examples on indicators that indicate difficulties as well as solutions, including references. One example of modelling to predict pristine conditions is the use of macroecological theory (Jennings and Blanchard, 2004). There are also a large number of experiences in setting the reference conditions under the Water Framework Directive (WFD) (2000/60/EC) that could be better explored here, or relevant examples could be chosen to help the MS in evaluating the tools for background/ reference conditions setting. For instance, concerning the setting of the historical/ past baseline (Method A), a further paleo-ecological method (combining experimental and modelling approach) for estimation of reference conditions that has been proposed to be applied in coastal water for the WFD purposes (e.g., Andersen *et al*., 2004; Clarke *et al.,* 2006) although it would be limited to coastal / estuarine pelagic waters only.

Under the base line setting Method A (iii) it is mentioned that ecosystem reconstruction modelling work is being developed "within academia, such as at British Columbia, Dalhousie and Chicago Universities", but not providing any reference where these approaches could be checked. Statistical and hind-casting methodologies can be also used for A (iii).

Three methodologies for setting targets are presented in Chapter 3.12. These cover the different approaches for target setting. There is no guidance on what criteria could be used to set the actual targets (particularly what are the principles on how the targets are set as absolute values or as deviation from baseline). However, such criteria would be dependent on the habitats/ species where those are applied, and more guidance is provided in Chapters 5 and 6. Also baseline setting and target setting are linked so that if the baseline setting C (current state) is used, Target setting method 1: Directional or trend-based targets, would be most feasible, showing only the direction of change.

(Chapter 4.1., p. 21–22, first paragr.): It would be useful to compare the assessment scales of habitats with the WFD type-approach that requires type-specific reference conditions for water body types, as all CP's have carried out characterization of their coastal waters based on the hydro-morphological features and criteria. This approach should enable comparison of similar water body types (including their habitats) within the CP as well as between the CPs that share similar water body types.

One of the key issues in identifying GES targets for different descriptors is how to define sustainable use, i.e., to what degree human activity causing perturbation(s) is acceptable. In Section 3 of the TG6 report (Rice *et al.,* 2010) this is discussed and the manual would benefit from taking this into account. In short, the TG6 concluded “Sustainability is achieved when the pressures associated with all those uses cumulatively do not hinder the ecosystem components to retain their natural diversity, productivity and dynamic ecological processes. Perturbations due to use must be small enough that recovery is rapid and secure if a use ceases.” The methodologies for identifying aspects of recoverability are well developed within fish population dynamics (precautionary levels for spawning stock biomass, fishing mortality etc). However, data to produce similar relationships are scarce for other components of the ecosystem such as benthic invertebrates, and for others, such as habitats, mechanisms for recoverability are less understood. The manual does not point out how to overcome this problem but see TG 6 discussion (3.1).

ToR 2: Are the proposed methods scientifically robust?

ii) Feedback on the relative value of these methods in terms of scientific robustness, practicality and transparency

All methods are valid but will depend on the indicator and quality of data that are used, again well chosen examples would be informative. The least appropriate method is method C, to use the current baseline, since this method introduces a significant risk that a baseline will be outside GES.

The review group cautioned advocating the use of population models to set baselines (e.g., “carrying capacity”) and feels that they should be approached carefully because of the assumptions required. Such methods may be useful for examining some questions about species for which most biological and other environmental interactions are well known. However, such species with relatively complete knowledge bases comprise a small percentage of the biodiversity in the ecosystem(s).

Specific Comments Related to Pelagic Habitats:

Base line setting: all methods would require operational definition of the pelagic habitat types which is not available currently.

Method A (un-impacted state/negligible impacts): All pelagic habitats are impacted to some extent, particularly with respect to the large species/ functional groups. This approach may thus not be feasible for pelagic habitats, although it would be most scientifically robust and transparent. As suggested above, paleo-ecological methods (in some coastal/ estuarine habitats) and modelling may be available to evaluate the historical un-impacted state with respect of eutrophication pressure (nutrient status as a proxy). However, in the case on dynamic food web models/ ecosystem models, the models are not yet adequate to address biodiversity issues. Also lack of data for validation of models would make the modelling approach unfeasible and very uncertain. However, expert judgement could be used, but this will have the problem of being very subjective.

Method B (past state): would be appropriate if sufficient long data series would be available. Therefore this method is probably not practical for many pelagic habitats. However, coastal and estuarine pelagic habitats may be an exception, as long term data series for those are available to many CPs.

Method C (current state): As stated in the guidance, this approach is problematic due to shifting a baseline.

ToR 3: Advantages and disadvantages of the proposed methods

iii) Experience in applying these methods in setting environmental targets – and their respective advantages/disadvantages

ICES has been involved in two larger projects related to the Common Fisheries Policy (CFP) and the Habitats Directive (HD) (92/43/EEC), i.e., the EMPAS (Pedersen *et al.,* 2008) and the FIMPAS projects. In both of these projects effects of fisheries have been evaluated in relation to conservation objectives under the HD, i.e., favourable conservation status. In practice, favourable conservation status has proved to be a challenge for scientists to interpret consistently and apply objectively (ICES, 2007a, 2007b; STECF, 2006). An important aspect of this problem is the setting of the baseline at the date of the inception of the HD (i.e., using Method C) since status, whether favourable or not according to the directive, needs to be evaluated from past and present perturbations as well as state of the indicators used. The consequence of this challenge to scientists in interpreting the conservation objectives is obviously the ability for delivering advice on management measures to achieve the objectives.

Experience with Pelagic Habitats

Target setting

Method 1: Directional or trend-based targets: if Method C is the only possible way of setting a baseline, this is the only feasible target setting methodology. However, this is the weakest target setting approach for operational policy implementation, and thus can only be used as supporting evidence that the direction of development is right with respect to the measures applied for protection of pelagic habitats.

Method 2: Target set as an absolute value: pelagic habitats are very fluctuating in space and time. It would probably be very difficult to set some absolute value for anything else than pressure targets (e.g., an example of a practical approach in setting of absolute values for pressure targets is the Baltic Sea Action Plan, where target values for land based nutrient loading have been set by modelling and using transparency as a proxy of ecosystem response on nutrient loading).

Method 3: Target set as a deviation from baseline: this could be feasible for some coastal and estuarine pelagic habitats, if Method A has been applied for baseline setting. A practical example is the ecological quality status assessment for WFD, where the target setting for chlorophyll *a* (as proxy for phytoplankton biomass) has been assessed as deviation from reference conditions. However, this applies only for eutrophication pressure and may not be feasible for other pressures impacting pelagic habitats (fishing, harmful substances).

Tor 4: Comments on the approach for the referenced Species and Habitats

iv) The applicability of the baseline setting and target setting methodologies to the species and habitats referred to in the Advice Manual (Chapters 6 and 7) (i.e. based on the conclusions of the Utrecht GES workshop)

Seabed Habitats

The advice on setting baseline for seabed habitats is technically sound (Section 5.1.2). The Advice Manual refers directly to the methods set forth in Section 3 in detail, including reiteration of and elaboration on their strengths and weaknesses in making recommendations. Listed methods are prioritized according to their merits in various situations.

The advice on setting targets for benthic habitats is less developed (Section 5.1.3). It is stated that "The way in which the targets are set for benthic habitats, in terms of the actual deviation from reference conditions, can be underpinned by science or set purely on the basis of policy aspirations." This appears contradictory to the definition of GES. According to the directive, targets shall relate to sustainable use (see discussion on understanding GES above in i) and that should

be underpinned by science preferably by empirical or experimental data, and/or expert judgment. However, the progress towards the identified targets is based on policy aspirations.

The Section ends with a recommendation that targets should be set as consistently and uniformly as possible across the NE Atlantic region. The review group suggests that this should be clarified better. Targets may well be different in different regions depending on the state of the ecosystem in relation to historical perturbations. In practice this means variable targets at least if the relationship with the baselines are evaluated in terms of deviations.

Water column habitats

This section is particularly vague and needs a lot more work. Although it is far too general to provide advice on assessment and monitoring of pelagic biodiversity (presumably zooplankton, phytoplankton, and microbes), it includes a few valuable recommendations about how to progress towards that goal. These include further defining pelagic habitats and determining what is good *vs* not-good. It is important to note that historically emphasized biomass measures, like chlorophyll *a* or zooplankton displacement volume, and productivity measures, such as carbon fixation, are NOT indicators of biodiversity.

With regard to the scarce information for the pelagic habitat we cannot find it justified to state that Method B would be preferred in relation to Methods A and C. The text seems to have focussed mainly on the lower end of the food web which is the most dynamic and difficult component to monitor in the pelagic ecosystem. Little attention seems to have been paid to higher trophic levels such as fish and seabirds that are part of the pelagic ecosystem or benefit from lower trophic levels. This section should be developed further and would benefit from being integrated with the results from the ICES/JRC TG 4 report on food webs.

Marine mammals- general

Top predators may, through top-down effects, have important consequences for other species in the ecosystem, e.g., recoverability for depleted fish stocks (Bundy, 2001). These ecological interactions are poorly understood. However, these research needs should be emphasized since targets for marine mammals may influence the possibilities to reach targets for depleted fish stocks.

Marine mammals- Cetaceans

It is more difficult to map this section onto the Terms of Reference. Other than a caveat about "Seals only", it is not clear what methods would be applied to what species. If all methods are to be applied to all species, then Table 6.1 seems a reasonable starting point for cetaceans. However, details about how to assess population size, demography, and distribution are lacking.

Marine mammals- Seals

Many seals forage across vast marine areas and breed in well-known locations often on isolated beaches. This latter characteristic makes them relatively easy to monitor. Section 6.2 focuses on two OSPAR EcoQOs related to seals: monitoring estimated population sizes for harbour seals and determining the relative breeding success (recorded as pup production) for grey seals at selected breeding sites. Another related indicator is the number of breeding cows (e.g., Southern Elephant Seals at Macquarie Island http://www.environment.gov.au/soe/2006/publications/drs/indicator/472/index.html).

ICES has previously provided an evaluation of the status of grey seals, harbour seals and harbour porpoise in relation to the Ecological Quality Objectives being applied by OSPAR in the North Sea (OSPAR, Ostend 25 – 29 June 2007, Annex 24):

a. Harbour seal population size: Taking into account natural population dynamics and trends, there should be no decline in harbour seal population size (as measured by numbers hauled out) of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of eleven sub-units of the North Sea. These sub-units are: Shetland; Orkney; North and East Scotland; South-East Scotland; the Greater Wash/Scroby Sands; the Netherlands Delta area; the Wadden Sea; Heligoland; Limfjord; the Kattegat, the Skagerrak and the Oslofjord; the west coast of Norway south of 62°N.

b. Grey seal pup production: Taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years), and in breeding sites, within any of nine sub-units of the North Sea. These sub-units are: Orkney; Fast Castle/Isle of May; the Farne Islands; Donna Nook; the French North Sea and Channel coasts; the Netherlands coast; the Schleswig-Holstein Wadden Sea; Heligoland; Kjørholmane (Rogaland).

This advice is much more specific and useful than anything in the draft Advice Manual. It was noted that the workshop participants viewed the 10% decline in grey seals to be simply a threshold which would trigger further research and dismissed it as unsuitable as a GES target. However, this seems too draconian, especially as the Advice Manual is not internally consistent in this regard (e.g., see Section 6.4 Population size). The ICES WGMME has pointed out that for

long-lived marine mammals such as seals (and also cetaceans), the time series may not reflect more than one or two generations. Grey seals for example have a life expectancy of about 35 years which would mean that the 10% decline could be within natural mortality bounds. Hence overly interpreting trends from such data is not recommended. However a 10% decline would be in the range of natural mortality and so deviance from that could relate to anthropogenic factors. *If combined with condition indices this target might be much more meaningful.* A New Zealand Department of Conservation programme has been monitoring three fur seal rookeries on the West Coast of the South Island since 1990. Parameters that have been monitored are: pup success and weight gains, and age at first breeding.

The reviewers felt that pressure indicators should also be used to monitor this ecosystem component. The number of marine mammals caught by species, by fisheries, by area by year is one such pressure indicator (Froude, 1998).

Reptiles

This is a difficult situation because of the lack of marine reptiles (turtles) nesting in the North Sea vicinity. It is quite clear from the OBIS SWOT program that this is true. Also lacking are any estuarine reptiles (e.g., *Malaclemys terrapin* of North America) that interact with marine systems. The Advice Manual claims that "… it is probably unrealistic to attempt to collect abundance data that could be used to provide indicators of population distribution/size or condition under Descriptors 1 and 4." It also indicates that the kind of carrying capacity models used for marine mammals would be extremely hard to construct due to the lack of data. The seeming uncertainty ("…probably unrealistic…") is not helpful in a manual such as this. It sounds as the authors are unsure about whether such data really does exist. Parenthetically, marine turtle data in the northeastern U.S., where they are also uncommon, come from a combination of commercial fisheries bycatch records and data from marine mammal surveys.

As a consequence of the lack of data one suggestion is to use an alternative method to achieving GES: setting a pressure-target to reduce or eliminate the impact of predominant pressures, for example, from fisheries by-catch. On the presupposition that there really is a lack of data, of which we are not convinced, a recommendation is being made to employ a method not really specified in Section 3 and for which little detail is offered. What the authors suggests may indeed be the best advice; as written the argument is not compelling and needs to be re-written with a better sense of how rare data actually are and a better vision of how the alternative analysis might be done.

Birds

As for other ecosystem components, Section 6.4 does not provide guidance on the selection of species (see General Comments above). The functional group approach under investigation by OSPAR appears promising; however, there can be widely divergent population dynamics within functional groups and so this approach is not recommended for species. New Zealand identified two sea bird indicators (Estimated population size for selected species of seabirds and Relative breeding success for selected species of seabirds in selected breeding sites) but recommended that they not be developed further: "It is recommended that these indicators not be developed further. This is because individual seabird populations behave differently and so it is not possible to define a suite of representative species." (NZ Ministry for the Environment, 1998, An Analysis of Potential Indicators for Marine Biodiversity). However, grouping of species according to ecological guilds may be useful indicators of change in particular aspects of the marine environment (Parsons *et al.*, 2008), and so be useful indicators of habitat change, particularly if all members of a particular guild respond in a similar direction.

The reviewers felt that population condition may be a more direct indicator of ecosystem health especially if linked to a change in population numbers. Such sublethal responses can be used to track ecosystem health, as well as the health of bird populations. Mallory *et al.* (2010) advocate this approach which may lead to the use of baseline physiological and chemical target levels for seabirds, against which we can detect future changes in aquatic ecosystems.

Fish and Cephalopods

The statements in this section are very vague. This group should be divided into pelagic and demersal components because of their very different interactions with the benthic and pelagic habitats considered elsewhere. This category could be expanded to include all Nekton, which would include shrimps and other large non-air-breathing swimmers.

This section is written as a brief outline rather than a text, and it does not address the subject on a descriptor-by-descriptor basis, as do other chapters, and lacks detail and explanation of choices. It also lacks any mention of issues of scale. The table, which is organized according to descriptors, contains a lot of blanks and question marks and not much explanation. Fish and cephalopod species are among those for which the most data on population and ecological parameters is known, yet the authors seem to give them short shrift. The scope and depth of the science in this section is inadequate. More depth is needed in addition to reorganization of the section. Why are some methods preferred in some cases and others in other cases? Why are there question marks in the tables? Why is the issue of pressure indicators being side-stepped altogether? This section requires a thorough re-writing in order to provide a credible advice document.

Another issue is the limited nature of this section. Why are invertebrates other than cephalopods not included here or in a separate section? At least decapod crustacean and bivalve species ought to be included somewhere because of their

ecological and commercial importance. Further, the group is divided into "well sampled" and "not often sampled (because of low abundance or unsuitability of sampling methods)". What about species that are not often sampled because they are not of commercial interest (i.e., they are collected by fishing/sampling methods but ignored because they are not target species)? Target setting states that for well-sampled species all methods are possible. Will different methods be used for different species? Will these vary by country?

With respect to Fish and Cephalopods it is unlikely that all species will be assessed with identical methods. Therefore species will have to be agreed upon by the various member nations in order for there to be consistency in application. As mentioned above, there is no guidance on how this will be accomplished to maximize comparability.

ToR 5: Are issues of scale addressed?

v) Whether the Advice Manual adequately addresses issues of scale in the context of target setting for species and habitats, in case of a need of further development on this aspect, please indicate an appropriate solutions to take this work forwards

The issue of scales is discussed in Chapter 4 on a general level, however, the advice manual could be developed more with regard to the problems of scales. The issue of scale is best understood with practical examples. Such concrete examples or case descriptions, addressing assessment scales needed for various types of habitats or species (if mobile or sessile, and depending on their distribution range) would be needed to take this forward.

The TG6 report concludes that pressures operate at different but always patchy scales and that monitoring of the seafloor as well is patchy. This is challenging for assessing the environmental status of that descriptor in particular. TG6 propose a way to address this challenge by using a spatial risk analysis (see Chapter 3.2 in Rice et al., 2010).

ToR 6: Comments on the target setting approach for pressures

vi) Whether the target setting approach outlined for pressures is clear, transparent and scientifically robust. In case of a need of further development on this aspect, please indicate an appropriate solutions to take this work forwards.

This issue is discussed in Chapter 7 only on a very general level. This would also benefit by the presentation of a few concrete examples focusing on the most common pressures such as eutrophication, fisheries, construction of installations such as wind energy parks in marine areas, etc. Many pressures, including harvesting, degradations of spawning habitats, etc. are well-known for many of fish species in particular. There is a wealth of literature on pressure indicators from which to draw on.

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Annex A. Terms of Reference for the ICES COBAM Review Group

The purpose of this ICG-COBAM Advice Manual is to provide practical advice to OSPAR Contracting Parties on the methodologies to be applied for determining good environmental status and the setting of environmental targets for Marine Strategy Framework Directive descriptors on biodiversity. The current version is a first draft that will undergo further editing to improve the presentation of the advice and to shorten the main text by moving supporting information to Annexes.

ICES is therefore invited to primarily focus on the contents of the document. OSPAR is now seeking advice from ICES on:

i) Whether the methodologies outlined for setting baselines and setting targets for GES cover all options available to CPs (Chapters 3 and 4)
ii) Feedback on the relative value of these methods in terms of scientific robustness, practicality and transparency
iii) Experience in applying these methods in setting environmental targets – and their respective advantages/disadvantages
iv) The applicability of the baseline setting and target setting methodologies to the species and habitats referred to in the Advice Manual (Chapters 6 and 7) (i.e. based on the conclusions of the Utrecht GES workshop)
v) Whether the Advice Manual adequately addresses issues of scale in the context of target setting for species and habitats, in case of a need of further development on this aspect, please indicate an appropriate solutions to take this work forwards;
vi) Whether the target setting approach outlined for pressures is clear, transparent and scientifically robust. In case of a need of further development on this aspect, please indicate an appropriate solutions to take this work forwards.