FINAL REPORT for APN PROJECT

Project Reference Number: CBA2011-08NSY-Baker

Towards engagement in the United Nations Regular Process for global assessment of the marine environment: strengthening capacity of developing countries in the Seas of East Asia

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Scientific Capacity Building & Enhancement for Sustainable Development in Developing Countries

Project Leader:
Dr Elaine BAKER, UNEP GRID-Arendal /The University of Sydney, AUSTRALIA;
Email: elaine.baker@sydney.edu.au

Collaborators:
Dr. Wouter Rommens
UNEP/GRID Arendal, NORWAY, grid@grida.no
Jean-Nicolas Poussart, UNEP/GRID Arendal, NORWAY, jean-nicolas.poussart@grida.no

Ellik Adler, UNEP, COBSEA Secretariat, THAILAND, ellik.adler@unep.org

Peter Harris, WEOG member Group of Experts for the Regular Process for Global Reporting And Assessment of the State of the Marine Environment, AUSTRALIA. peter.harris@ga.gov.au

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OVERVIEW OF PROJECT WORK AND OUTCOMES

Non-technical summary

In 2002, States agreed to establish a regular process under the United Nations for global reporting and assessment of the marine environment, including socio-economic aspects – now referred to as the World ocean Assessment. At the 65th session of the UN General Assembly it was confirmed by the Ad hoc Working Group of the Whole, that capacity building is an integral part of the Regular Process and essential during all stages of its implementation.

A workshop was held to build capacity in carrying out integrated marine assessments. The workshop utilized a methodology for a rapid regional ocean assessment and applied it to the South China Sea (SCS). The workshop included an evaluation of the assessment methodology and its potential effectiveness in producing a credible assessment, for the region and also for national jurisdictions. The participants used the methodology to produce an indicative assessment of biodiversity and ecosystem health in the SCS.

The workshop methodology was based on an expert elicitation process – a process that synthesises the subjective judgment of experts across a broad base of evidence. Expert elicitation is essentially a scientific consensus methodology. In this case, the process consisted of three phases: 1) a pre-workshop review to select the assessment parameters, such as habitats, species and processes; 2) the choice of a reference point or benchmark (the year 1900) against which the assessment of current conditions would be compared; and 3) the development of a scoring system and guiding rules to be used throughout the assessment including definitions for the assigned condition and the definition of time frames, so that trends in the assessment of condition could be included (current was de- fined as the period 2007-2012 and future, 2012-2017).

Objectives

The main objectives of the project were:

1. Provide capacity building to conduct a rapid marine assessment, encouraging review, questioning and real-time revision of the assessment process in order to develop a common understanding among participants of the most effective forms of rapid assessment for the region - including knowledge about how to scale the pilot assessment down to national jurisdictions.

2. Conduct a pilot assessment, which demonstrates how to conduct a rapid assessment of the condition of biodiversity across a region as large and complex as the SCS, and produces an assessment that supports the development of efficient and effective policy and programmes to enhance bio- diversity in the region.

Amount received and number years supported

The Grant awarded to this project was:
US$ $ 40,00 for Year 1:

Activity undertaken

At the workshop, participants were guided to provide their expert judgment on indicators of condition and trends in biodiversity and ecosystem health and in the importance of the main threats and pressures affecting the marine ecosystems. During the workshop, the grading process involved a mix of plenary discussion and discussion in small sub-groups, so that experts could discuss and agree on the scores assigned to each indicator. Estimates of uncertainty were also ascribed by the experts to condition grades, and this was used to provide a measure of confidence in the grading outcomes for each condition assigned to an environmental component.

Results

A preliminary analysis of the workshop scores has been undertaken. The median score for all of the 69 biodiversity parameters assessed across the SCS indicated that the experts considered that in the Best 10% of places the biodiversity of the region is in Good condition, and approaching the Very Good grade. However, for Most places, representing a notional 80% of the biodiversity of the region, the condition was graded as Poor; and in the Worst 10% of places the condition was graded as Very Poor. The experts assigned these scores with an average confidence level of 1.7, which equates to a level between High and Medium confidence.

The median score for the 27 ecosystem health parameters (indicators such as presence of pests, disease etc) in the Best 10% of places/occurrences/populations in the region was considered to be Very Good, Good in Most places, and Poor in the Worst 10% of places. The experts assigned these scores with an average confidence level of 1.6, which equates to a level be- tween High and Medium confidence.

The combined impacts of the eight pressures scored in this exercise were assessed as resulting in Poor condition in Most places — the notional 80% of the area of the biodiversity and ecosystems of the SCS that were considered.

In general, it was found that the workshop method- ology could be used to build a formal (i.e. well-developed, structured, systematic, transparent, traceable and documented) expert elicitation procedure that can be used on both a regional and national scale to produce a rapid integrated marine assessment. Participants agreed with the need to find a good spread of experts with relevant knowledge and experience in order to make good integrated judgments, and as part of the process to provide and document key sup- porting evidence for the judgments.

Relevance to the APN Goals, Science Agenda and to Policy Processes

The activity was relevant across the APN science agenda, particularly in the area of assisting countries in understanding change in the marine environment in order to manage resource utilisation. This activity contributed to: - Science policy interfacing; Awareness raising; and Disseminating scientific data and information.

Self evaluation

The workshop process was extremely successful in demonstrating the use of a methodology for producing integrated marine assessments. However, even thought the participants were given a complete explanation of the level of expertise required for the workshop to be produce a credible assessment, some of the participants only understood the process when it was explained at the workshop. Because of this lack of prior understanding some areas of expertise were under represented ie states had not sent the right “expert”. A follow-up workshop would attract a more complete set of experts. The programme was very ambitious and in the end we did not have time to include all the parameters required for the total integrated assessment, however the participants now have a thorough understanding of the principles and could undertake the full assessment.

Potential for further work

States have requested followup workshops to undertake national assessments. Plans are underway for this. The Group of Experts from the World Ocean Assessments would like to see the process replicated in other regions. A grant application is being prepared to do this in the Pacific.

Publications (please write the complete citation)

Ward, Trevor J., 2012. Workshop Report: Regional Scientific and Technical Capacity Building Workshop on the World Ocean Assessment (Regular Process), Bangkok, Thailand. 17– 19 September 2012. UNEP/COBSEA, Bangkok October 2012.

References

Acknowledgments

UNEP Regional Seas, UNEP/GRID Arendal and Geoscience Australia

TECHNICAL REPORT

Preface

World Ocean Assessment (Regular Process) – Regional Workshop
The World Ocean Assessment (WOA) is the new name of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socio-economic Aspects. The World Ocean Assessment has its home in the United Nation's Division for Ocean Affairs and the Law of the Sea. In support of the WOA, GRID-Arendal and its partners conducted a technical capacity building workshop in Bangkok on 17-19 September 2012. This workshop was focused on building capacity for an integrated assessment of the South China Sea region.

Scientific experts from eleven countries carried out a trial assessment on the South China Sea using an expert elicitation technique that is commonly used in business and economics, but is relatively new in environmental assessment. The exercise aimed to demonstrate how the methodology could be used to produce an assessment of the condition of biodiversity across a region as large and complex as the South China Sea and to encourage review, questioning and real-time revision of the assessment process. Participants were guided to provide their expert judgement on indicators of condition and trends in biodiversity and ecosystem health and to identify the main threats and pressures affecting the marine ecosystems. GRID-Arendal and partners hope to work with interested states to develop the methodology to carry out assessments at a national level.

The workshop was conducted in close cooperation with members of the Global Group of Experts of the WOA, and organized with the cooperation and support of UNEP through the Coordinating Body on the Seas of East Asia (COBSEA) and the NorthWest Pacific Action Plan (NOWPAP), the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO/IOC), and with funding support from the **Asia-Pacific Network for Global Change Research (APN)**.

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1.0 Introduction

Following the recommendations made at the work- shop for Eastern and South-Eastern Asian Seas convened from 21 to 23 February 2012 in Sanya, China, held under the auspices of the United Nations, in support of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socio-economic Aspects (now referred to as the World Ocean Assessment, WOA) (Annex 15 of the final report), a technical capacity- building workshop ("the Workshop") was conduct- ed in Bangkok on 17-19 September 2012. This work- shop was focused on building capacity to prepare integrated assessments, using the South China Sea (SCS) region as an example.

The Workshop was organized by GRID-Arendal (GA), the United Nations Environment Programme (UNEP COBSEA and NOWPAP), UNESCO/IOC Sub-Commission for the Western Pacific (IOC/WESTPAC) with funding support from the Asia-Pacific Network for Global Change (APN), IOC/WESTPAC and UNEP.

The objective for the WOA is articulated in UNGA Resolution 57/141, (2005) "to improve understanding of the oceans and to develop a global mechanism for delivering science-based information to decision makers and public".

The overall objective, endorsed by the UN General Assembly in UNGA Resolution 64/71 (2009), paragraph 177, is that:

- "The regular process under the United Nations would be recognized as the global mechanism for reviewing the state of the marine environment, including socioeconomic aspects, on a continual and systematic basis by providing regular assessments at the global and supraregional levels and an integrated view of environmental, economic and social aspects.
- Such assessments would support informed decision-making and thus contribute to managing in a sustainable manner human activities that affect the oceans and seas, in accordance with international law, including the United Nations Convention on the Law of the Sea and other applicable international instruments and initiatives.
- The regular process would facilitate the identification of trends and enable appropriate responses by States and competent regional and international organizations.
- The regular process would promote and facilitate the full participation of developing countries in all of its activities. Ecosystem approaches would be recognized as a useful framework for conducting fully integrated assessments."

The objectives of the workshop were twofold:

Provide capacity building to conduct a rapid marine assessment, encouraging review, questioning and real-time revision of the assessment process in order to develop a common understanding among participants of the most effective forms of rapid assessment for the region - including knowledge about how to scale the pilot assessment down to national jurisdictions.

Conduct a pilot assessment, which demonstrates how to conduct a rapid assessment of the condition of biodiversity across a region as large and complex as the SCS, and produces an assessment that supports the development of efficient and effective policy and programmes to enhance bio- diversity in the region.

These two objectives, taken together, are expected to build the capacity of regional and national organizations and authorities to conduct similar assessments in a manner that is coherent across the region and consistent with the spirit of the WOA.

2.0 Methodology

The pilot rapid assessment process for the SCS, tested by the experts at this workshop, used systematic and consistent methodology that minimises the risk of bias and enables the capture and reporting of information that is relevant to the region and likely to be useful for the WOA. The approach used here has been adapted from a number of earlier procedures used for similar purposes,, including, projects of the International Waters Program of GEF, including the GIWA Regional Assessment 54 for the South China Sea [http://www. unep.org/dewa/giwa/publications/r54.asp].

The assessment consisted of three phases: 1) a pre- workshop review of the decision structure, parameters and assumptions/constraints; 2) the attendance at the workshop by invited experts to evaluate the components of the pilot assessment methodology, and secure their consensus on grades, scores and confidence; and 3) a short post-workshop period for refinements and updates before issuing a final summary report on the workshop and its outcomes.

Phase 1 – Pre-Workshop Phase

Prior to the workshop, the participating experts received (by e-mail) a summary of the assessment methodology so that the dynamics and the process of

the workshop could be well understood before they arrived in Bangkok.

Participants also received six draft (electronic) work- sheets that they were requested to use to provide their initial input and commentary. The working tem- plates for their consideration/confirmation included the following elements:

1. The list of specific parameters of the region to be considered at the workshop (such as the region's major habitat types as well as the important at- tributes of those habitats to be incorporated into the assessment, including any areas of special environmental significance);

2. Any unique reference points for condition (e.g. the condition of habitats in the early 1900s) against which current status assessments will be made;

3. Grading statements to be used to provide system- wide guidance about setting levels of performance (such as what is meant by 'Very Good'); and

4. The timeframes considered to be appropriate for this assessment (such as 'current' is the period 2007–2012).

The participants were asked to return completed worksheets by email within two weeks. Responses were compiled by the workshop organisers into a single draft set, for final review at the beginning of the workshop. To make the workshop process efficient, the participants received a copy of the compiled draft worksheets prior to their arrival in Bangkok.

Phase 2 – The Workshop

At the workshop, participants were guided to provide their expert judgment on indicators of condition and trends in biodiversity and ecosystem health and in the importance of the main threats and pressures affect- ing the marine ecosystems. During the workshop, the grading process involved a mix of plenary discussion and discussion in small sub-groups, so that experts could dis- cuss and agree on the scores assigned to each indicator. Estimates of uncertainty were also ascribed by the experts to condition grades, and this was used to provide a measure of confidence in the grading outcomes for each condition assigned to an environmental component.

Condition: the condition of each assessed parameter used one of four performance grades (Very Poor, Poor, Good or Very Good) assigned to each of three spatially-based indicators (Best10%, Most, Worst10%; see

below). Each of the grades was divided into a subset of numeric scores (Figure 1). The numeric data pro- vided the basis for compilation of region-wide summaries, and to gauge uncertainty in the estimates of condition. The numeric scoring also enabled the experts to provide marginal refinements within each of the 4 classes (e.g. assigning a score to the top – or bot- tom – of a grade, where enough detailed information was available). The scores also enabled a numerically based aggregation of condition estimates and the confidence assessments. Although there is a numeric basis for estimating each parameter and indicator, assessment accuracy finer than one grade is not inferred, and results for the overall regional assessment of condition are only interpreted and presented in the con- text of the four performance grades.

Uncertainty surrounding condition was estimated by the experts in three grades of confidence: High, Medium or Low. These grades were guided by the following rules: High confidence in a condition estimate infers that the condition score is highly unlikely to fall outside one grade, or an equivalent distance; Medium confidence infers that the condition estimate is highly unlikely to fall outside two grades; and Low confidence infers that the condition estimate is highly unlikely to fall outside three grades. In the numeric aggregation of confidence these grades were assigned as confidence levels of 1.2, 2.4 and 3.5 performance units respectively (approximating an estimate of the 95% Confidence Limits).

Indicators: the three indicators for which scores/grades were assigned by the experts were Best10%, Most, and Worst10%. The scores for each of these indicators were determined by reference to the notional (or actual data where they exist) frequency distribution of a spatial set of condition scores related to the parameter being assessed. The exact meaning of this is slightly different across the set of parameters, but is always interpreted as a spatial construct of the condition elements being assessed. For habitats, for example, the indicators refer to the spatial distribution of the condition (which may be estimated as, for example, a combination of structural and functional intactness) across the region, where the habitat either does occur, has or occurred or could occur. Equivalent constructs apply to species, ecological processes, and the other components mentioned above. The methodology provided specific guidance to the experts on how to consistently interpret and apply this scoring system.

Trends in Condition: estimation of trends in each parameter was accomplished also using three grades: Improving, Stable or Declining, referring to the cur- rent (2007-2012) condition status. Confidence in the assignment of a trend was also assessed using the High, Medium or Low categories as for condition. However, since the trends did not involve a numeric assessment basis, the confidence estimates were summarised simply as the relative proportion of the class to the total number of confidence estimates made across each dataset of trends.

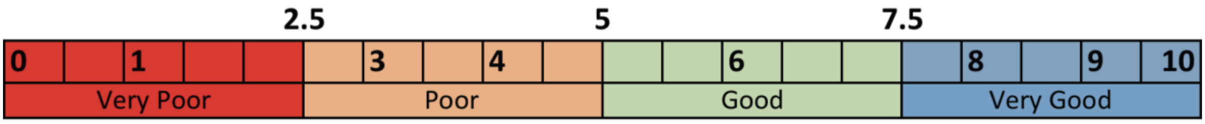
Accuracy of the Outcomes: where experts in a sub- group or in plenary were unable to assign a grade be- cause of a lack of adequate knowledge, either because an appropriate expert was not available to attend the workshop or there was an acknowledged major knowledge gap, then condition/confidence estimates were not assigned. These situations were treated throughout the workshop as missing data, and they have no influence on the region-wide outcomes of the expert assessment of condition or trends. Distinguishing between these two situations (no relevant expert at the workshop; not enough data/knowledge or ad- equate resolution to make a judgment) is important for assessment of data gaps, but was not the focus of this workshop. While such lack of information does limit the resolving power (accuracy) of the outcomes from this workshop, it does not degrade the quality of the outcomes that have been achieved, since this same bias is evident in all forms of assessment.

Here, these gaps are made explicit, and the resolving power is limited to the defined assessment construct of the decision methodology and the four coarse performance grades. This level of resolution has been chosen to best match the capabilities of a rapid assessment pro- cess, and the likely capacity of experts from regions of the size and complexity of the South China Sea (SCS) to be able to attend and contribute their knowledge.

A more detailed summary of the approach and methodology used to guide the workshop can be found in Annex 3..

Phase 3 – Post-Workshop

The summary outcomes of the workshop were circulated back to participants for a short period to allow for any necessary checking and updating. This report provides a platform for further focus and improvement of the assessment process.



3.0 Results & Discussion

The workshop considered the following components of biodiversity, ecosystem health and pressures, and assigned grades to their condition and trends in the South China Sea region.

Biodiversity

Habitat Quality (24 parameters) Species and Groups of Species (32 parameters) Ecological Processes (13 parameters) Ecosystem Health Physical and Chemical Processes (18 parameters) Pests, Invasive Species, Diseases and Algal Blooms (9 parameters) Pressures (8 parameters) Climate Change and Variability River Discharges Coastal Urban Development Coastal Wetland Development Land Reclamation Fishing Aquaculture (on-shore ponds and sea-cages) Eutrophication from Coastal Sources Extreme Climate Events* Island Development for Tourism* Port Facilities* Oil and Gas Exploration and Production* Power Generation* Foreshore Protection with Hard Substrates* Mining and Associated Infrastructure*

*These seven pressures were considered by the experts, but were unable to be scored in a manner consistent with the scoring and grading of the work- shop methodology, or, only very limited data and in- formation were available from the experts in attendance. Hence these pressures have not been included in the scoring or graphical summary of pressures.

The scoring matrices (in summary form) as completed by the experts at the workshop are attached at Annex 5.

Summary of Scoring Outcomes

To summarise the outcomes of the condition assessments, the data provided by the experts at the workshop have been aggregated into three groups: biodiversity (comprising the 69 scored parameters in habitat quality; species and species groups; and ecological processes), ecosystem health (comprising he 27 scored parameters in physical and chemical processes; pests, invasive species, diseases and algal blooms), and the eight scored pressure parameters.

a) Condition of Biodiversity

The median score of all the scored biodiversity parameters across the SCS in Best10%, Most and Worst10% (of places/occurrences/populations) is shown in Figure 2. The confidence bar indicates the dataset average level of confidence (high, medium or low) applied by the experts to their individual estimates of the condition for each parameter.

The experts considered that the Best10% of the biodiversity of the region is in Good condition, and approaching the Very Good grade. However, for the Most category, representing a notional 80% of the biodiversity of the region, the condition was graded as Poor. The uncertainty bar (derived across all the biodiversity parameters) represents a level of confidence of 1.7 of a scoring unit, indicating that the experts considered that using this rapid assessment process, the status of biodiversity was, on average, assigned with a level of confidence between High and Medium.

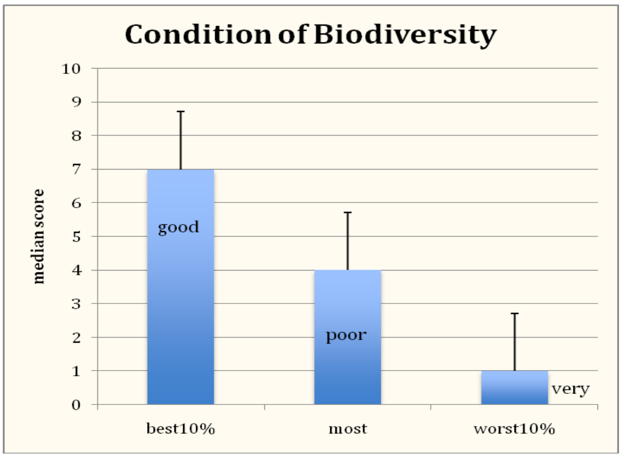


Figure 2: Median score for the condition of all biodiversity parameters (habitats, species and species groups, ecological processes) in the Best10%, Most, and Worst10% places/occurrence in the South China Sea region. The uncertainty bar (derived across all the biodiversity parameters) represents an average level of confidence of 1.7 of a scoring unit.

b) Current Trends in Biodiversity Condition

The judgment of the experts is that Most biodiversity, the notional 80% of biodiversity across the SCS, is currently in decline (36 of the 56 parameters assessed in the Most category are in decline), with only a small proportion (4 of the 56 parameters) improving in condition. Across all 3 of the data categories (condition scores of Best10%, Most and Worst10% places/occurrence) 45% of the parameter estimates indicated a decline. Overall, the judgment of the experts at this workshop was that biodiversity of the region is either stable or in decline, with very few parameters showing improving trends (Figure 3).

The trends in condition for the majority of parameters (56%) were assigned with High confidence, and overall, the trends for 92% of the parameters were assigned with either High or Medium confidence (Figure 4).

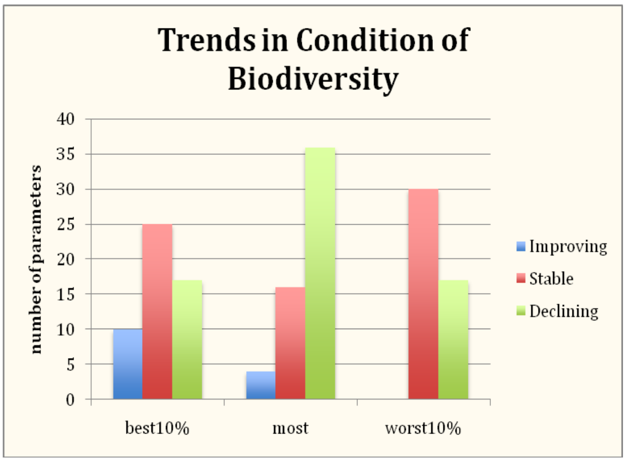


Figure 3: The estimated current (2007-2012) trend in biodiversity parameters across the SCS region, in each of the best10%, most and worst10% places/occurrence.

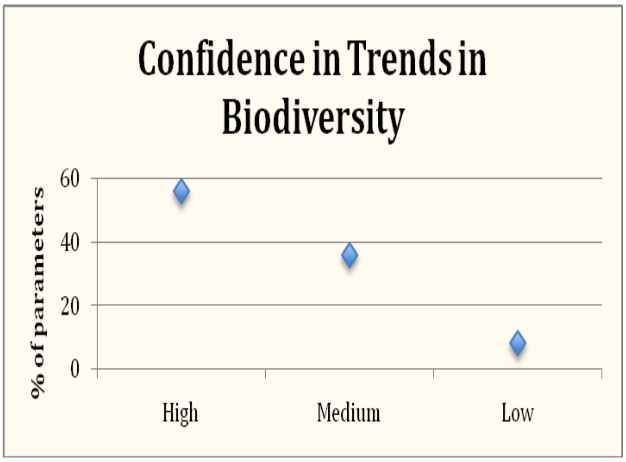


Figure 4: Confidence (High, Medium or Low) assigned by the experts to their assessments of trends in the condition of biodiversity shown in Figure 3.

c) Condition of Ecosystem Health

The median score across the SCS of all the scored ecosystem health parameters in Best10%, Most and Worst10% (of places/occurrences/populations) is shown in Figure 5. The confidence bar indicates the dataset average level of confidence (high, medium or low) applied by the experts to their individual estimates of the condition for each parameter.

The experts considered that the ecosystem health parameters in the Best10% of the region are in Very Good condition. However, for the Most category, representing a notional 80% of the ecosystem health parameters of the region, the condition was graded as Good. The uncertainty bar (derived across all the ecosystem health parameters) represents a level of confidence of 1.6 of a scoring unit, indicating that the experts considered that using this rapid assessment process, the status of the ecosystem health parameters were assigned with confidence that fell between High and Medium.

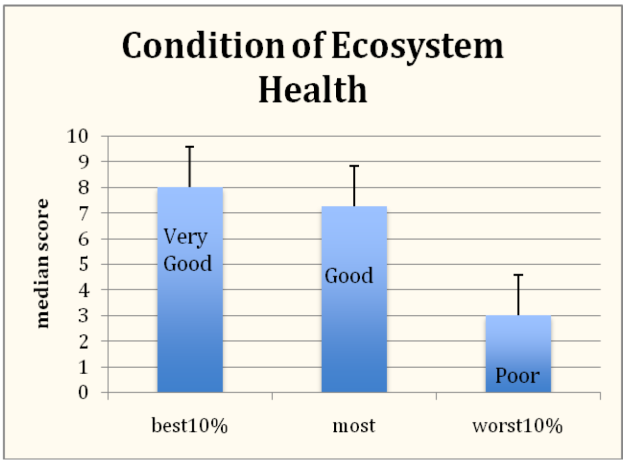


Figure 5: Median score for the condition of all ecosystem health parameters (physical and chemical processes; pests, invasives, diseases and algal blooms) in the Best10%, Most, and Worst10% places/occurrence in the South China Sea region. The uncertainty bar (derived across all the biodiversity parameters) represents an average level of confidence of 1.6 of a scoring unit.

d) Current Trends in Ecosystem Health

The judgment of the experts is that almost all of ecosystem health parameters across the region are either stable or currently in decline (Figure 6).

The trends in condition for the majority of parameters (72%) were assigned with High confidence, and overall, the trends for all of the parameters were assigned with either High or Medium confidence (Figure 7).

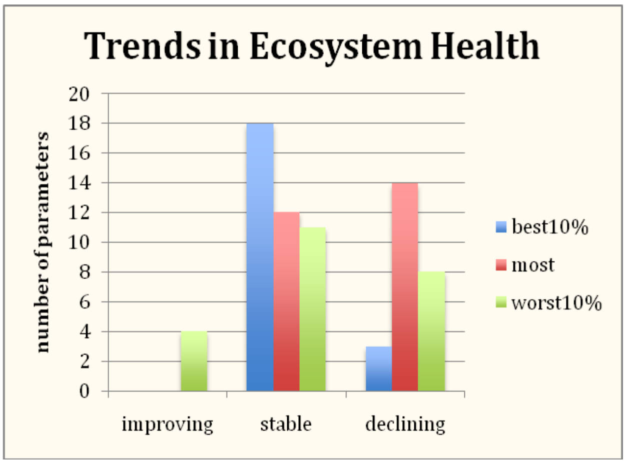


Figure 6: The estimated current (2007-2012) trend in ecosystem health parameters across the SCS region, in each of the best10%, most and worst10% places/occurrence.

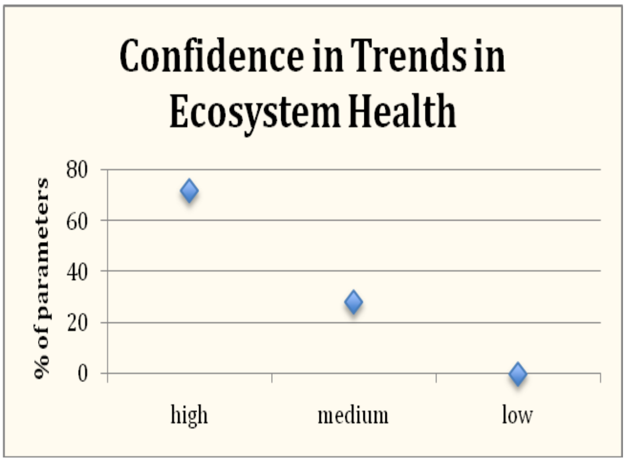


Figure 7: Confidence (High, Medium or Low) assigned by the experts to their assessments of trends in the condition of ecosystem health parameters shown in Figure 6.

e) Pressures

The combined impacts of the 8 pressures scored in this exercise were assessed as resulting in Poor condition in the notional 80% of the area of the biodiversity and ecosystems of the SCS (Figure 8). Where the pressures have the least impact (the Best10% of places), the impact is considered by the experts as consistent with this grading statement "few or negligible current impacts from this factor, and future impacts on the environmental values of the region are likely to be negligible" (this is the guidance provided in the Grading Statement for Very Good). Conversely, where the pressures scored here have the greatest impacts (Very Poor, in the Worst10%), the effects are considered by the experts as consistent with the grading statement "The current and predicted environmental impacts of this factor are widespread, irreversibly affecting the values of the region, and widespread and there is serious environment degradation, or this is likely across the region within 10 years".

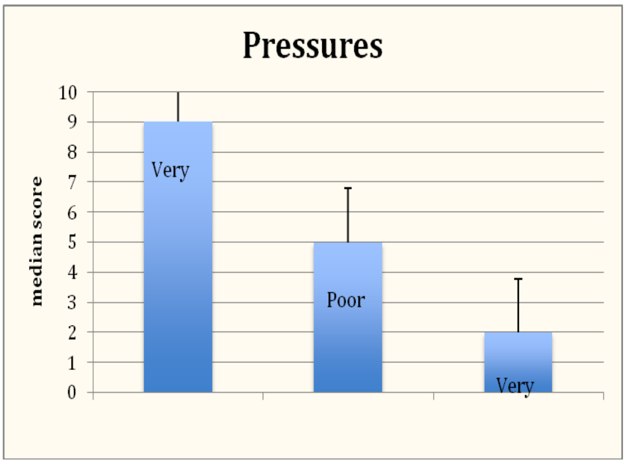


Figure 8: The impacts of human-induced pressures on the biodiversity and ecosystems of the SCS, scored as the condition in the biophysical environment as a result of the current and likely future effects of the pressures. The uncertainty bar (derived across all the scored pressure parameters) represents an average level of confidence of 1.8 of a scoring unit.

f) Trends in Pressures

The experts considered that the impacts from the pressures were either increasing or stable in all parameters in all 3 categories across the region. There were no pressures considered to be reducing to the extent that would result in an improvement in environmental conditions (Figure 9).

The trends in pressures were assigned with either High or Medium confidence (Figure 10).

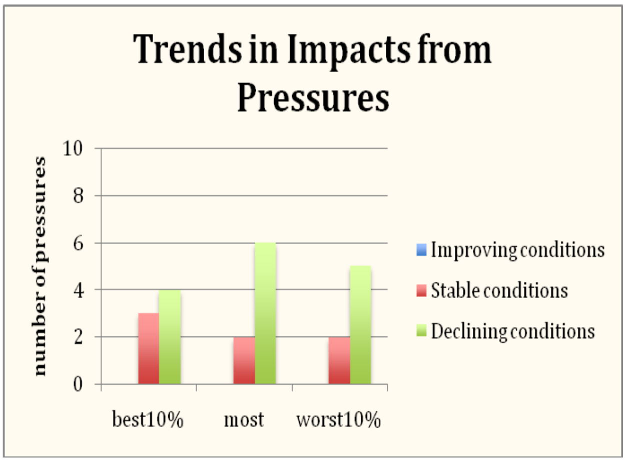


Figure 9: The estimated current (2007-2012) trend in impacts from pressure parameters across the SCS region, in each of the best10%, most and worst10% places/occurrence.

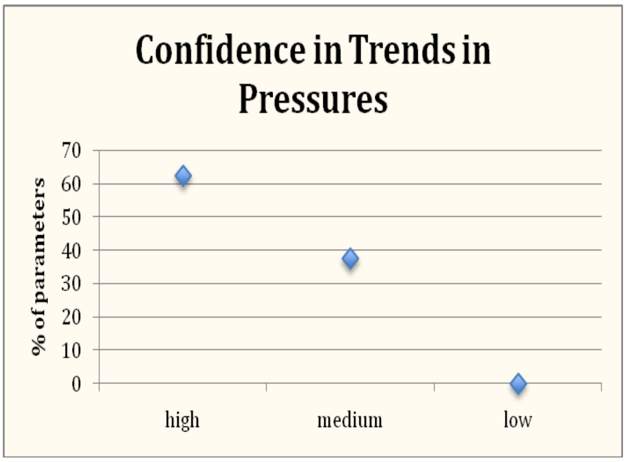


Figure 10: Confidence (High, Medium or Low) assigned by the experts to their assessments of trends in the condition of pressure parameters shown in Figure 9.

4.0 Conclusions

Data contributed by experts through this methodology, such as that summarised above, may be used at the regional scale for a number of purposes. For the purpose of a regional overview of the marine environment, the data from the workshop is used to explore patterns in the condition of the biodiversity, the pressures that impact it, and the quality of the available data/information. Further examples of possible uses of the data are outlined in Annex 4, including for more specific prioritisation purposes.

This integrated overview of the environment of the SCS uses all the expert-derived data on biodiversity and ecosystem conditions, the pressures impacting on those conditions, the trends in changes currently observable in the region, and the quality of the available information base. The integration of these differing types of information within a single analytical framework provides a mechanism for assessing patterns amongst these various information types across the whole region, and enables a broad overview of the issues to be quickly established. Such an overview may be of value for policy-makers to identify parameters (and ultimately the places) where various forms of intervention may need to be delivered, and may assist agencies and governments in the setting of region-wide marine environment investment priorities.

The parameters scored at this workshop provide cover four key areas that can provide an overview of the marine environment of the SCS:

1. Identity of the important biodiversity and ecosystem components of the SCS, and the pressures acting on those components;
2. Current condition of these components and pressures relative to a reference point that represents conditions at a time of higher system quality and resilience;
3. Current (5-yr) trajectories of change of these components;
4. An estimate of the confidence assigned by experts attending the workshop to the information base used in this workshop (this combines three aspects of knowledge limitations: suitable scale/focus of knowledge about a parameter doesn't exist; an appropriate information base does exist but has not been synthesised or made available to the workshop; and, the limitations in the personal knowledge of the experts attending the workshop).

These four types of information enable an integrated set of outputs that can identify, at a system-wide level, a range of types of environmental issues. For example, it may identify the high value ecosystems and species that are also under high levels of pressure, and are rapidly changing, but have low information quality; or any combination of these matters. The combination of these 4 types of issues may also relate to important cultural, social, or economic consequences that are not revealed in more usual assessments based on, say, just an analysis of pressures or condition alone.

The integrated analysis demonstrated here uses an un-weighted multivariate analysis of pattern in the data that was provided by the experts at the workshop. This data has a number of limitations — most likely additional experts would be required for a fully comprehensive coverage of all the important environmental components of the SCS region, but even so, for many important aspects of the region, the experts had high confidence in their scoring/grading. A realistic integrated analysis might choose to sieve the information by using only high and medium confidence data, since workshops like the one conducted here always will have issues with the extent of availability of experts. However, leaving out parameters that are assessed with low confidence introduces a further bias to the outcome—

assignment of low confidence at the workshop does not mean that the scores/grades are not accurate, and removal of these parameters from the analysis skews the outcomes towards parameters for which there is full knowledge, much of which will have been obtained because it relates to a well known issue. Here, the full data set has been retained for the purposes of this example. A more realistic full assessment would test the sensitivity of the outcomes to the inclusion of low and medium confidence data.

The multivariate analysis uses the information content of the data, but makes no assumptions about underlying statistical distributions, and uses only a simple set of well-tested non-parametric statistical tools, available free (or at low cost) in the public domain. The approach used here is cluster analysis, which classifies the parameters into coherent groups of parameters with similar information content across all 8 of the indicators scored/graded for each parameter.

The information pattern for the data provided by the experts for the 104 parameters that were scored at the workshop is shown in the classification dendrogram (Figure 11). The 8 groups of parameters shown in the dendrogram each have unique patterns in condition, trends, confidence and information base, and some examples are discussed below.

The important point about the cluster analysis is that the differences being displayed are the summarised differences relative to the differences between all the other parameters. This helps to avoid what might be a small relative difference for a small number of parameters being prioritised as important, when there are other parameters that may be also as (or more) important but not recognised as such because they are measured or reported using different indicators or in a different way.

To guide assessment, the cluster analysis is further summarised in a 'heat map' diagram. This graphic (Figure 12) depicts the extent to which the groups in the cluster dendrogram are different from each other. The higher differences identify greater relative divergence in the patterns of information, and indicate which groups may be worthy of more detailed discussion or investigation. The highest differences in the heat map are linked to Groups 6, 7 and 8 of the cluster.

Classification Groups 6, 7 and 8 consist of 22 parameters: 14 species groups, 5 physical or chemical processes, and one each of habitat; pests, diseases; and pressure parameters (Table 1). These parameters have high average levels of condition (Figure 13), and most of the parameters in Most and Best10% places are either stable or increasing (Figure 15), assigned with medium to high confidence (Figures 14, 16).

In Groups 1 to 3, the average score for all parameters in the Worst10% areas of the region is Very Poor, and a substantial proportion of these parameters continue to decline across the region.

In Group 6, 15 of the 16 parameters are distinguished in the cluster analysis because they were not assigned scores/grades for either condition or trends in Best10% or Worst10% of places. A large proportion of these parameters were species groups of fish where there was general knowledge of their overall conditions and trends, but no specific knowledge finer than region scale. The lack of region-wide spatial knowledge about these populations might be an important outcome from this workshop, and provide guidance for prioritising further information programmes in the region.

The parameters in Group 7 have a substantial range between the best and worst places, assigned with a medium to high confidence, and all the parameters in this group show continuing decline across most of the region (Table 2). Other members of Groups 6, 7 and 8 also demonstrate continuing regional decline, such as dugongs, which were assessed as in Very Poor condition and continuing to decline across the region.

Further examples of possible questions that can be asked of the workshop data and accompanying frameworks for integrated analysis are shown in Annex 4.

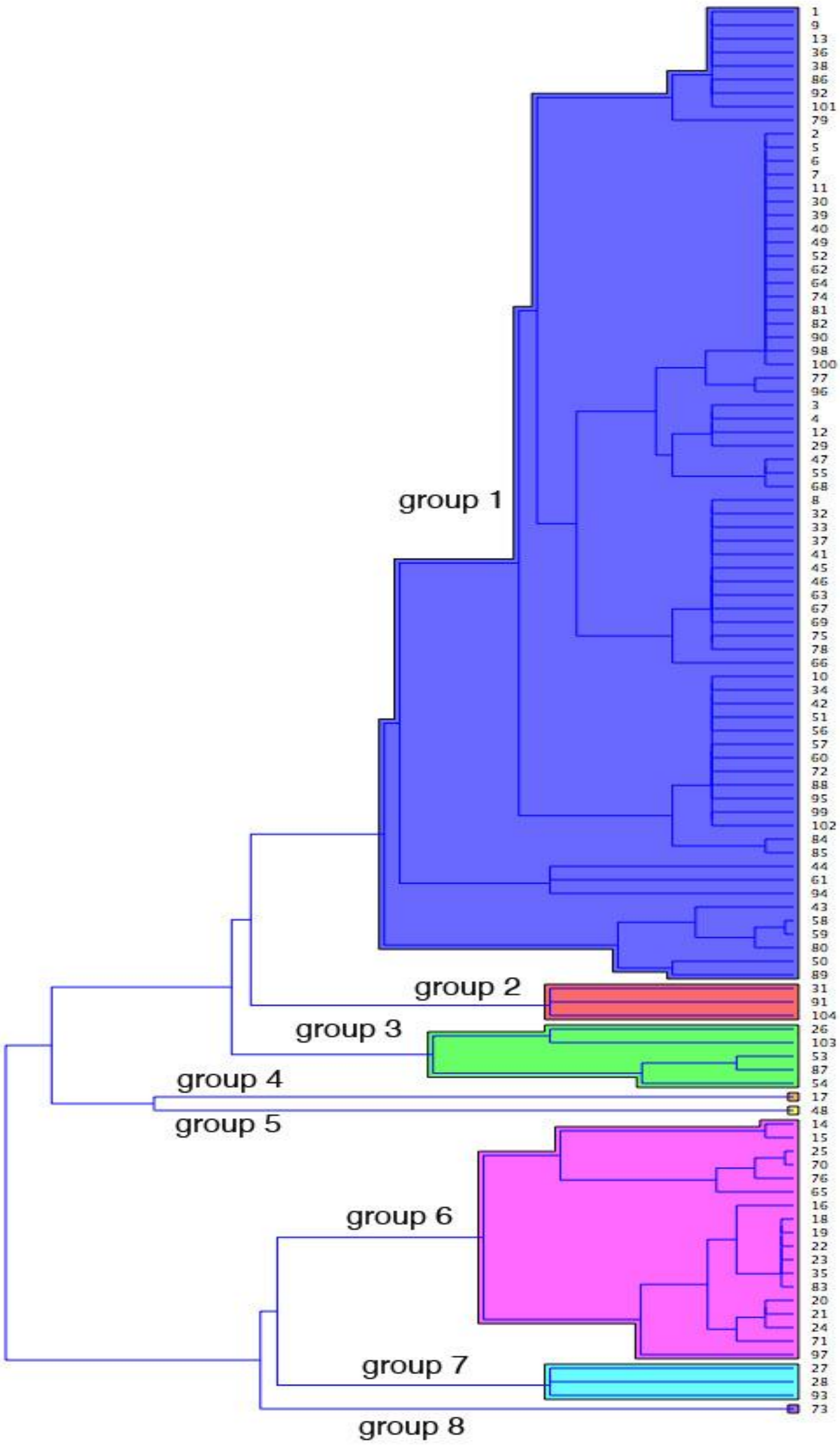


Figure 11: Classification (average linkage) of scores assigned at the workshop, resolving the 104 parameters into 8 groups of parameters that share similar characteristics as defined by the scores/grades.

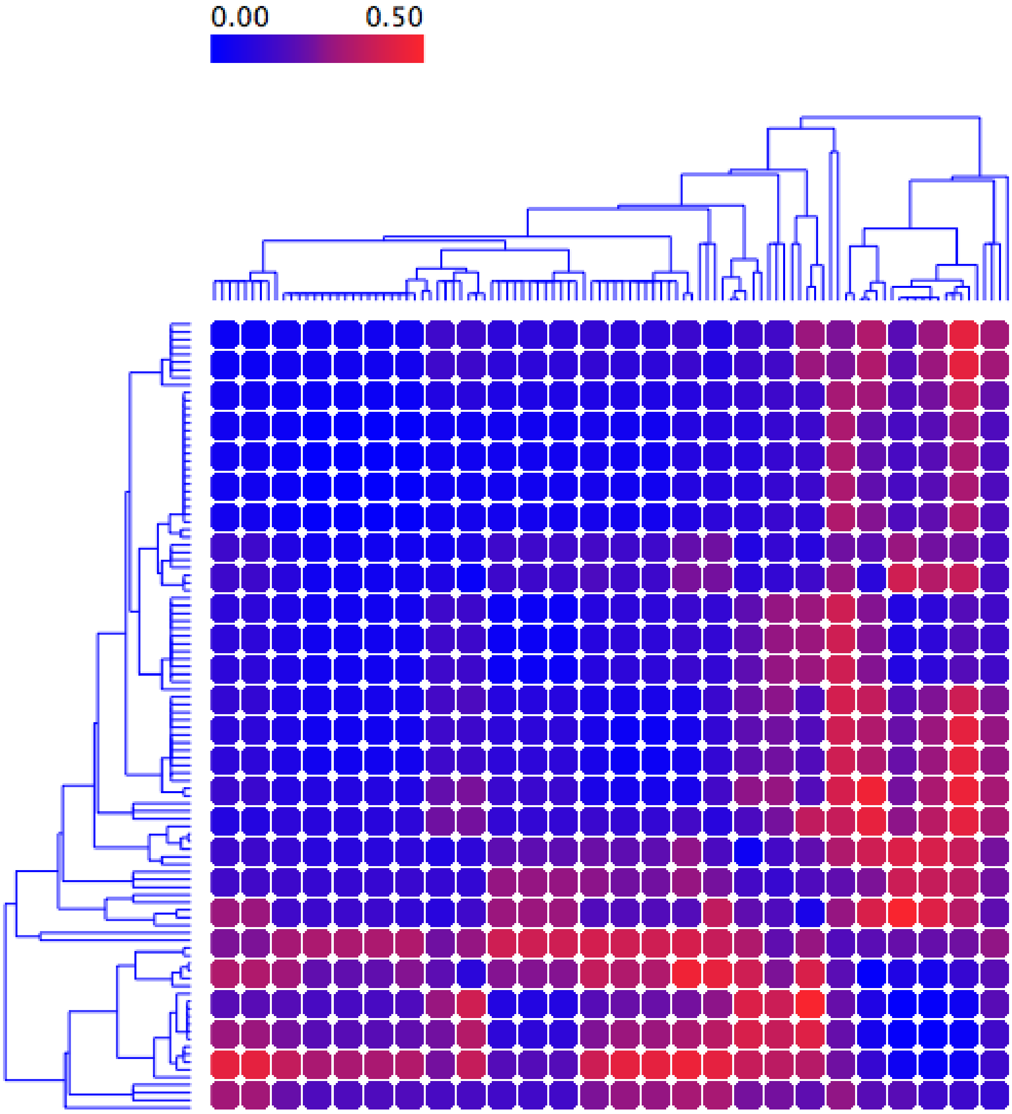


Figure 12: Heat map symmetrical matrix of groups from the classification (Figure 11); the dark blue cells represent lowest difference in information content, red cells represent the highest level of difference in information content. The greatest differences are demonstrated by groups 6, 7 and 8.

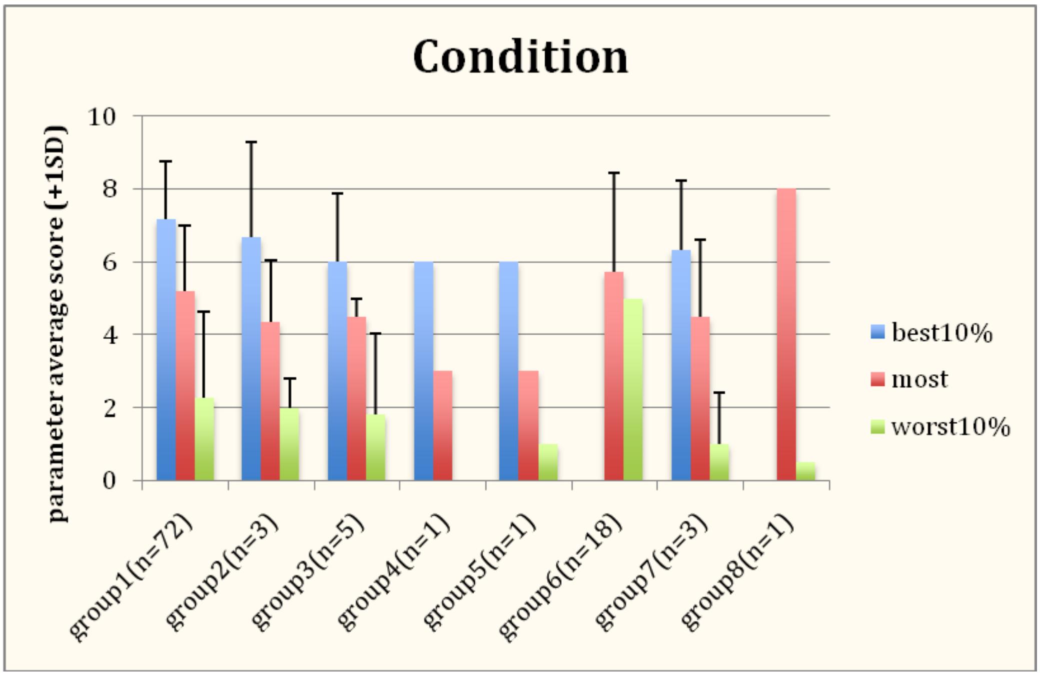


Figure 13: Average condition scores for the region for each of the 8 groups from the classification shown in Figure 11, with 1 standard deviation bar, for the best10%, most and worst10% areas. (n = the number of parameters included in a group).

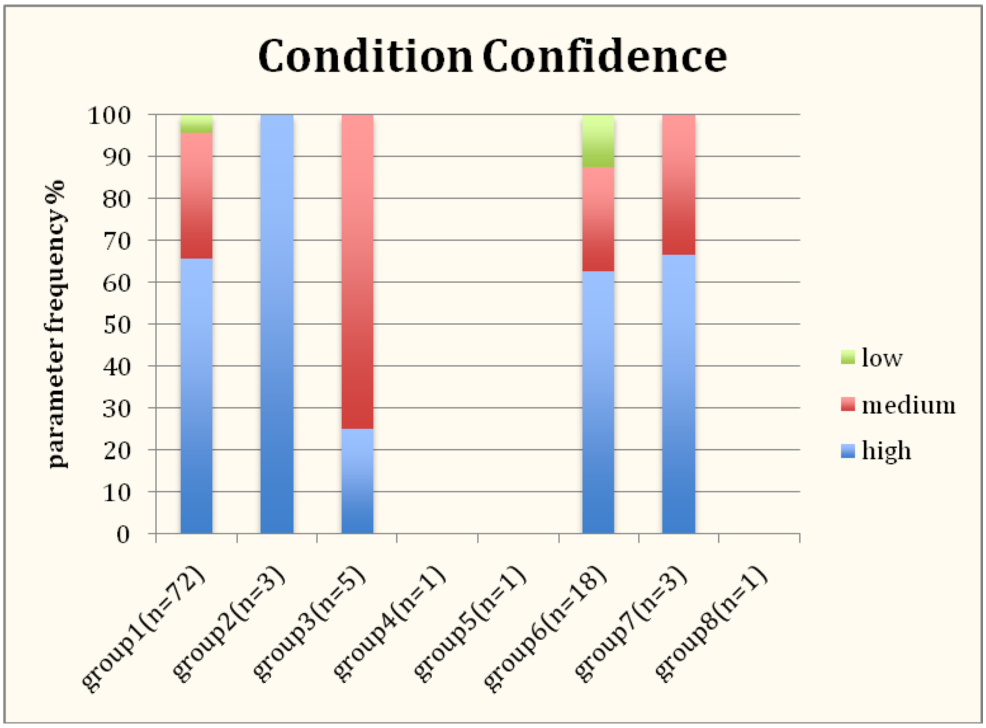


Figure 14: Summary of the confidence levels assigned by the experts to each group of parameters identified by the classification: frequency of parameters (%) assigned high, medium or low confidence for each classification group. (n = the number of parameters included in a group; confidence is not shown where there is only one parameter in a group).

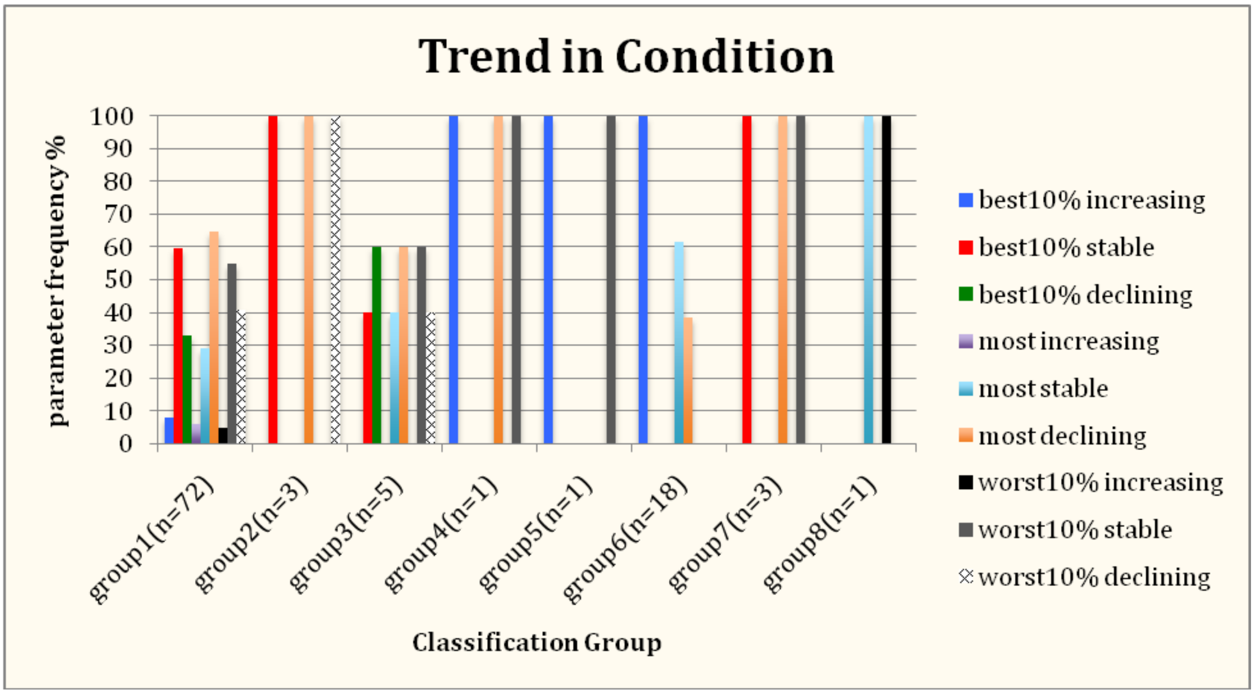


Figure 15: Summary of the trends assigned by the experts to condition parameters within each of the classification groups: frequency % of parameters increasing, stable or decreasing in condition, within each of the best10%, most and worst10% areas of the region.

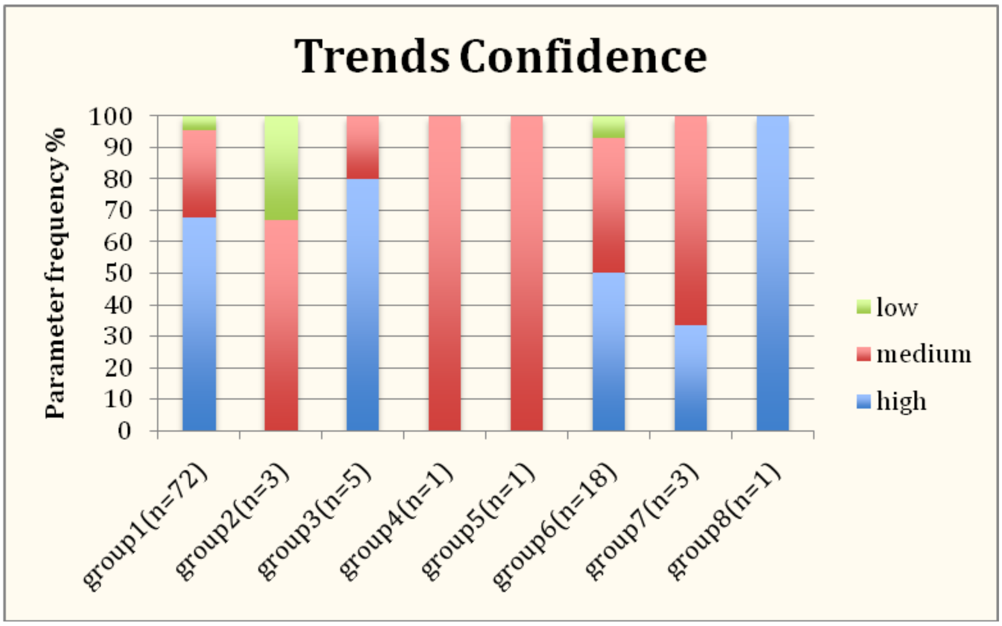


Figure 16: Confidence levels assigned by the experts to the trends in the condition of parameters, summarised by classification groups: frequency % of parameters assigned with high, medium or low confidence.

#	Parameter	Biodiversity Component	Condition score (Most)	Confidence
14	Whales - baleen	Species groups	8	Medium
15	Whales - toothed	Species groups	8	Medium
16	dolphins, porpoises	Species groups	6	Medium
18	dugongs	Species groups	1	High
19	sharks and rays	Species groups	2	High
20	Whale shark	Species groups	4.5	Low
21	tuna and tuna-like fish	Species groups	3	High
22	Inner shelf (0-50m) demersal large fish assemblages	Species groups	2	High
23	Inner shelf (0-50m) demersal small fish assemblages	Species groups	3.5	High
24	outer shelf (50-200m) demersal & benthopelagic fish assemblages	Species groups	3	Medium
25	meso-pelagic fish assemblages	Species groups	6	Low
27	Inner-shelf reef fish assemblages (0-50m)	Species groups	3	High
28	grazers/herbivorous fish assemblages of coral reefs	Species groups	3	High
35	seabirds - resident	Species groups	8	High
65	Ha Long Bay WH	Habitats	7	-
70	Ocean currents, structure and dynamics	Physical, chemical processes	9.9	High
71	Storms, cyclones, wind patterns	Physical, chemical processes	9	-

73	Sediment transportation	Physical, chemical processes	8	Medium
76	Sea temperature, including SST	Physical, chemical processes	8	Low
83	Ocean salinity	Physical, chemical processes	9	High
93	Frequency, abundance distribution of algal blooms	Pests, diseases, etc	7.5	Medium
97	Climate change and variability	Pressure	5	-

Table 1: Parameter membership of classification Groups 6, 7 and 8. Average condition (Most) = Good (score 5.7).

		Condition				Trend			
#	Parameter	Best 10%	Most	Worst 10%	Conf	Best 10%	Most	Worst1 0%	Conf
27	Inner-shelf reef fish assemblages (0-50m)	5	3	0	H	S	D	S	M
28	grazers/herbivorous fish assemblages of coral reefs	5	3	0	H	S	D	S	M
93	Frequency, abundance distribution of algal blooms	9	7.3	3	M	S	D	S	H

Table 2: Parameter membership of classification Group 7, showing raw data captured at the workshop.

Spatial Resolution: This workshop did not involve spatial resolution below the level of region (the SCS was addressed as a single unit), other than any inherent spatial resolution inferred by the parameter itself (eg seagrass beds are restricted to shallow waters, and cannot occur in waters deeper than 50m in this region, so any assessment of relative condition is based on the distribution of the area of shallow waters across the region). This also means that, before any actual commitment of resources or action informed by the outputs of this or similar workshops are actioned, both the accuracy of the experts judgment and the spatial distribution of the parameters being addressed would need to be further resolved and verified. In further workshops, particularly those at the national level, finer-scale spatial resolution of the input data would yield a higher level of output spatial resolution, and for some parameters this could reduce the need for extensive further verification to underpin policy development.

Economic, Social and Cultural aspects: This workshop did not specifically address the economic, social or cultural aspects of the region in relation to the environmental issues. The primary reason for this was that a different set of experts would be required in order to make judgements about the magnitude and importance of the consequences of the environmental issues. Nonetheless, if such experts were available to contribute relevant data and information, the methodology would have been capable of resolving the issues and grouping environmental drivers and economic etc consequences together at the region-wide scale, in a manner similar to that discussed above for the environmental features of the region.

The methodology and approach trialed at this workshop, while broad in scale and strategic in content, provides for a semi-objective mechanism for integrated assessment. At best, it may be able to deliver prioritised sets of environmental factors that relate well to economic, social and cultural issues and the consequences of ocean degradation. At worst, it may be used as a strategic mechanism to focus attention on a small subset of issues for more detailed later evaluation, including better spatial resolution, leading eventually to corrective action. Irrespective, the process of bringing together experts to address the issues within a common currency framework of expert judgment increases the likelihood of establishing a common understanding across jurisdictions, across disciplines and across the science-policy divide that plagues integrated management of the worlds oceans.

VI Adopted Amendments to the Methodology

Throughout the workshop, a number of suggestions were made by experts about improving the focus and effectiveness of the overall methodology, and sharpening the approach to be more functional in the specific regional context of the South China Sea. Changes adopted included:

Condition: The workshop did not have any available time to consider both LME - SCS and the Gulf of Thailand - as was originally proposed. The scoring and grading system was therefore constrained specifically to the boundaries of the SCS LME. The matrices and summary outcomes reported here only refer to the defined area of the SCS LME.

Pressures: it was agreed that the social and economic implications of the pressures on the environmental and biodiversity values of the SCS would not be scored, because of a lack of appropriate expertise available at the workshop, and difficulty in understanding the application of three spatially-based indicators (Best10%, Most, Worst10%) to these pressures. Instead, a short list of selected examples of the likely social and economic impacts created by the effects of the pressures on the ecosystems and biodiversity was recorded into the scoring matrix, in association with the relevant pressure.

VII Suggested Amendments to the Methodology

Several other changes were suggested for adoption, although they could not be applied because there was either a lack of agreement amongst the experts, or they could not be applied in mid-workshop because of the significant investment in the existing methodology activity up to that point. Each of the suggestions not adopted were carefully considered by the workshop organisers, and while some of the variations could have value at the national level of assessment, they were ultimately not considered to be likely to improve the assessment outcome of either this workshop or a full regional integrated assessment approach.

VIII Participants Feedback

At the end of the workshop, participants were offered the opportunity to provide commentary and feedback on any aspect of the workshop. The comments from individual participants were captured in real-time visible to the participants, and are summarised below, with, where appropriate, comments in reply by the Moderator.

1. Comments on the overall value of this workshop to South China Sea region

- Most of the participants are now familiar with method
- Participants improved the methodology in some important aspects
- It is difficult to come up with assessment on this scale – there is a disconnect with local level. Better data, images, maps, ports distribution etc would have been a big help, so there is a need for additional resource material to be available prior to the workshop.

  Moderator: participants were advised to bring with them any data and information that might be relevant to the issues; now that participants understand the scale and detail of information for this type of assessment, then this request may be clearer for future workshops of this type.

- The large area of the SCS was difficult to cover. These 3 days represent an initial step in assessment of SCS. There are many issues that need to be considered. After 3 days there is only a weak scientific basis. After group discussion some criteria are considered to be weak, although this can be changed based on individual views. There is still confusion. The assessment wasn't correct for inclusion in the WOC. Information from countries is needed for initial information for each working group to consider. Need a lot of consultation amongst countries after this meeting to determine if this methodology can be used.

  Moderator: participants were guided through the rapid assessment methodology – while it is their scientific opinion that was being sought, no assessment of this scale could achieve the level of scientific robustness that was requested by some participants. The methodology is a process to rapidly harvest opinion, not investigate the detail of the science, and is a match to the type and detail of information generally required by decision- makers within a typical national or regional policy setting framework.

- It is hard work to come up with an intergraded assessment even at the regional level. An assessment at the global level will be even harder!
- It is recommended that before such a workshop the participants should do their homework. Get familiar with the area before the workshop, and get early access to data.
- Methodology – too many parameters- perhaps select some indicators for this region.

  Moderator: selecting indicators for which there is data is fatal to expert elicitation procedures – if this suggestion were to be followed, then there is no need for this form of workshop or methodology. Participants were invited to comment on the full set of parameters and indicators prior to the workshop, but few chose to engage in that opportunity.

- Methodology is interesting approach. Perhaps could be conducted at a smaller scale in the countries first; this could be better and then combine to make a regional assessment. Parameters – some are not applicable, so a revision is needed.
- Key species driving ecosystem change different in SCS than in Australia. Participants need basic data before the workshop, and the secretariat needs to list important databases for this analysis. Needs to be chemical, biological etc. NOWPAP area 4 countries – could use this methodology in that area where data is scarce.

Moderator: the methodology is based on key attributes of marine ecosystems worldwide, not just in SCS or Australia. They do not all occur in SCS, so these would not have been scored, but the ones that do occur were to be scored. Additional features of the SCS that are unique are freely added to the generic parameters, at participants suggestion.

- Assessment results for the SCS are positive. However, this is an informal assessment - just a trial. There are not enough experts here to cover all parameters. Some parameters have no data support. Not enough time for discussion, therefore decide that result is informal. Methodology needs to be more reliable – better to have more defined definition for parameters. For example, what is a coral reef in each part of the assessment, so need definition. Structure is fine – ecosystem first, then examination of pressure which is good, but need to refine to optimize the structure and avoid duplication. This would make it simpler.
- Expert system is very useful. Concern when talking about conditions and trends, this works, but threats and pressures perhaps does not depend on size. Threats and pressures should be included in relation to MPAs. Score should be recorded in different subgroups for statistical comparison, or score rules should be harmonized. But expert system useful and big future for complicated areas to give a very fast assessment.

  Moderator: the scoring procedures are firmly established, but perhaps they needed better explanation at the beginning of the workshop, in more extensively worked examples.

- More rigour needed in the data, need some real data, especially if we are going to identify worst places. This would provide confidence.
- Structure of indicators needs to be more linked to the outline of the WOC. To use for WOC needs to be closer linked. To invite scientists must be done on personal capacity not on behalf of countries – otherwise this will bias the result. Regional scientists that know the region provide better input to process. Good preparation on the disciplines, need to have a list of skills so we know we have coverage of all the issues. Pre-workshop discussions useful but cost involved. Need to remove Australian language and make sure terms are put into international language. Agree that on one side need access to better data, or ability to get data during the workshop (but scientists always say they need more data) but this process is based on intuitive and expert opinion. Way the workshop is run and how opinion is elicited is important.

2. Group feedback on potential application of this workshop methodology to marine assessments in individual countries

- This is a Capacity Building workshop, so the assessment output not the main thing, but how much the participants learned from the process. This process not new because many participants involved in GIWA. This is useful in countries but need to spend more time on methodology before attending a workshop. A difference in approach to the methodology was evident in parts of scoring by one subgroup, so need to spend time agreeing on methodology and getting a common understanding. Some recommendations have been made, but not sure if they are correct.
- Useful. In terms of applying in country, perhaps better access to better range of experts. Might be best applied at a country level, as opposed to region where there are different issues and availability of expert opinion.
- Applicable at the national level. Good indication of state of the marine environment. Doubts

about application to regional level. WOC has been asked to use existing assessments, and several already exist in the region.
Moderator: the issue about using existing assessments is usually that they typically focus on different problems, use reporting systems that are largely incompatible with each other, and the integration of information becomes very subjective. The methodology used in this workshop makes the subjective decisions explicit, and at a low level in the decision hierarchy, assisting to overcome bias that may be hidden in the outcomes. The data and information from the existing assessments can easily be used as input to a regional assessment based on the methodology used in this workshop. This methodology can be considered as a key part of the integrating mechanisms for a wide variety of other types and levels of data and information.

- Useful, especially to compare to the coral triangle report. Need link between analytical situation and actionable opportunities – another workshop is needed. Might need to segmentise some of the scales – put into context both from and area and impact level. Perception vs overall impact on a regional scale.
  Moderator: this is also an issue about accuracy: whereas the perceptions can be assessed for precision, where a specific investment action is planned to be undertaken as a result of prioritisation from expert opinion, it is always necessary to validate the accuracy through either more detailed analysis of the underlying data and information, and possibly through targeted additional research.

- Methodology applicable to state. If experts agree well and know environment well. This can be considered to be a social science because based on judgment – but not scientific assessment because the initial data is not a scientific fact but the opinion of each expert. Suggestion for improvement – when the scores are given – we do not know the difference in levels of the scale, so too broad definition of the scale. No statistical analysis result – so result needs to be displayed based on statistics (even social science).
  Moderator: while this methodology is based on judgements, the data is the judgement of scientists with experience in the area. The question of what is a fact is complex; in environmental assessments the main issue usually revolves around the choice of questions being asked by the science, so that when science provides an answer that might be considered factual, is it an answer that can be actually used for well grounded region-scale policy making.

- Concerned how to explain this to an expert meeting back home, how to explain what we did. People will ask, some confusion in this workshop especially today, but need to be able to inform. No confidence to explain the methodology. Show results and parameters – experts may say how did you give these scores. We gave a score relying on experts to fill the scores. Maybe hard to get cooperation from experts, so need more detailed guidelines and explanation of parameters. More detailed information would improve process and perhaps proceed.

3. Discussion on potential application of this workshop methodology to the World Ocean Assessment

- Need to nominate experts to the pool of experts for the first WOC. See the DOALOS website for details.
- AOA – 2007-09, group of experts looked at assessments to find best practice. Results endorsed by the UN General Assembly. Any WOC – relevant, legitimate (involve proper experts and

good communication between all players; via website, meetings like this, more formal workshops such as Sanya) and credible (good evidence for what we say, this work here valuable for identifying material we need to look at). Less valuable – we need to have a clearer way to link judgment to the underlying evidence. We can use the judgment here, but need more formal way of linking the conclusions – signposts to credibility. The result here necessary but not sufficient to achieve credibility. This process most interesting in regards to the overall assessment – environment, society and economy. Need to bring together different elements and this process will provide an interesting way on how this can be done. Process has produced interesting ideas on how socioeconomic can be looked at but needs more focus to link these. This is the first time we have looked at socio economic. Whether appropriate for other regions needs discussion, but helpful in introduction to SCS.

Moderator: normally these workshops are run with specific datasets and information bases agreed/provided, across all relevant parameters. Where there is no such data, then the workshop judgement is no less relevant, since there will be no better judgements able to be made, assuming that the relevant experts are assembled for the workshop.

- When doing assessment assume that the result will need to be reinforced in management process, so need to be very objective, so needs to be based on quantitative data not qualitative data. Need to keep in mind IPCC 4th report push countries to reduce emissions this affects countries. WOC may act like that in the future so we need to be very cautious because can have influence.
- Data – all the countries should go away and come back with metadata base for their countries.
- SCS data poor situations, management needed in data poor situations also, so there is a need for data but we need to educate decision-makers to accept a score that is the best guess of a well informed group of scientists. The score is then also quantitative data. Needs to be linked to governance: international waters programmes learned that assessment and governance is separated but needs to be combined.
- UN GA advised governments to build on existing regional assessments.

  Moderator: this workshop has used the outputs of from a variety of existing assessments, and although more could have been used, the framework and methodology used here is consistent with the UN GA guidance.

5.0 Future Directions

The methodology has promise for conduct at a national level in various countries of the SCS region. In conducting this form of assessment at the national level, the process should follow the sequence of these 7 steps:

1. Identify/agree the boundaries of the region to be assessed, and any spatial subsets, subregions etc.
2. Develop an agreed list of parameters to be assessed by discussion with experts who will attend the Assessment Workshop, and agree on the guiding statements and rules governing the conduct of the workshop. These parameters should be comprehensive and represent important aspects of the region, and not be limited in the first instance to those with available data (this would otherwise create a major bias). This is an important step, and should be the focus of an Initialisation Workshop, where the relevant experts are exposed to the methodology (perhaps in a mini-version of the Bangkok workshop), and are thereby charged with the responsibility to subsequently provide a list of the fundamental components and parameters for the region under assessment.
3. Require experts to (remotely) fill in matrices with their scores for each parameter within their competence, with remote guidance by a moderator. Then collate scores, and provided back to workshop attendees prior to the Assessment Workshop.
4. Conduct the Assessment Workshop, using the same approach as the Bangkok Workshop, using the initial scores of the experts as the starting position for sub-group discussions/refinement.
5. Compile a final draft set of matrices and rapid statistical analysis for post-workshop circulation and verification.
6. Compile a second round set of matrices and scores, and circulate for final revision.
7. Conduct detailed statistical analysis and issue a draft report, and conduct an Outcomes Workshop, where the experts re-convene and consider the details of the assessment findings. This would give experts a final opportunity to consider outcomes, and to make a defense in front of their peers of any contested findings, should that be needed.

At several stages of these steps above, there will need to be collation and provision to experts of the established data and information, so that judgments are better supported, and explicitly linked to, an anchor information base. The conduct of such a national assessment should probably be expected to span about 18 months, giving adequate time for the number of iterative steps, including assembly of relevant reports and databases etc, some of which may need to be synthesised for the specific purpose of the assessment process (including such aspects as spatial modelling or aggregation).

Appendix 1 Agenda and participants

Agenda

Workshop Day 1 - Monday, 17 September 2012	
08:30 – 09:00	Registration
09:00 – 09:10	**Welcome Remarks** Dr. Ellik Adler, UNEP and COBSEA Dr. Somkiat Khokiattiwong, IOC/WESTPAC Dr. Elaine Baker, GRID Arendal and APN Dr. Alexander Tkalin, NOWPAP
09:10 – 10:30	**Introduction Presentations** Background presentation on the Regular Process – World Ocean Assessment – *Mr. Alan Simcock* Short summary of existing regional marine assessments – *Dr. Juying Wang* Introduction to workshop methodology – *Dr. Trevor Ward*
10:30 – 10:45	*Coffee Break and Group Photo*
10:45 – 12:30	Working session to review/confirm Biodiversity parameters, grading statements, benchmarks (3 sheets) *Plenary activity. Sub-groups will be formed if needed* *Dr. Trevor Ward*
12:30 – 13:30	*Lunch Break*
13:30 – 15:30	Review/confirm Ecosystem health parameters, grading statements, benchmarks (2 sheets) *Plenary activity. Sub-groups will be formed if needed* *Dr. Trevor Ward*
15:30 – 15:45	*Tea break*
15:45 – 18:00	Review/confirm Pressure parameters, grading statements, benchmarks (1 sheet) *Plenary activity. Sub-groups will be formed if needed*

	Dr. Trevor Ward
18:30 – 20:00	Reception
Workshop Day 2 – Tuesday, 18 September 2012	
08:30 – 10:30	Populate assessment sheet for habitats (Part 1) Plenary activity *Dr. Trevor Ward*
10:30 – 10:45	*Coffee Break*
10:45 – 12:30	Populate assessment sheet for species, ecosystem processes (Part 2 and 3) *4 sub-groups* *Dr. Trevor Ward, Dr. Peter Harris, Dr. Elaine Baker and Mr. Alan Simcock* *Sub-group Chairs*
12:30 – 13:30	*Lunch Break*
13:30 – 15:00	Populate assessment sheet for species, ecosystem processes (Part 2 and 3 (continued) *4 sub-groups* *Dr. Trevor Ward, Dr. Peter Harris, Dr. Elaine Baker and Mr. Alan Simcock* *Sub-group Chairs*
15:00 – 15:30	Part 2 and Part 3- report back to Plenary *Dr. Trevor Ward*
15:30 – 15:45	*Tea break*
15:45 – 18:00	Populate assessment sheet for pests, physical/chemical processes (Part 4 and 5) *4 sub-groups* *Dr. Trevor Ward, Dr. Peter Harris, Dr. Elaine Baker and Mr. Alan Simcock* *Sub-group Chairs*
Workshop Day 3 (Wednesday 19 September 2012)	

08:30 – 09:00	Part 4 and Part 5 - report back to Plenary *Dr. Trevor Ward and groups reporters*
09:00 – 10:30	Populate assessment sheet for pressures (Part 6) *4 sub-groups* *Dr. Trevor Ward, Dr. Peter Harris, Dr. Elaine Baker and Mr. Alan Simcock* *Sub-group Chairs*
10:30 – 10:45	*Coffee Break*
10:45 – 12:30	Populate assessment sheet for pressures (Part 6) *4 sub-groups* *Dr. Trevor Ward, Dr. Peter Harris, Dr. Elaine Baker and Mr. Alan Simcock* *Sub-group Chairs*
12:30 – 13:30	*Lunch Break*
13:30 – 15:30	Populate assessment sheet for pressures (Part 6) *4 sub-groups* *Dr. Trevor Ward, Dr. Peter Harris, Dr. Elaine Baker and Mr. Alan Simcock* *Sub-group Chairs*
15:30 – 15:45	*Tea break*
15:45 – 16:15	Part 6 - report back to Plenary *Dr. Trevor Ward and groups reporters*
16:15 – 17:00	Risks, Management Effectiveness - discussion of assessment procedures *Dr. Trevor Ward*
17:00 – 17:30	Workshop evaluation and feedback session Plenary work
17:30 – 18:00	Closing Remarks
18:30 – 20:00	Dinner

Participants

CAMBODIA Mr. Koch Savath Deputy Director General Ministry of Environment. #48 Samdech Preah Sihanouk,Chamkarmorn, Tonle Basak Phnom Penh, Cambodia	 Mr. Hak Mao Head of Climate Change Vulnerability Assessment and Adaptation Office Ministry of Environment #48, Samdech Preah Sihanouk Chamkarmorn, Tonle Basak, Phnom Penh, Cambodia
CHINA Mr. Guo Zhenren Head Marine Environmental Research Center South China Institute of Environmental Sciences, Ministry of Environmental Protection of the People's Republic of China 7 West Street, Yuancun 510655 Guangzhou, P R China	Mr. Yu Xijun Senior Engineer South China Institute of Environmental Sciences (SCIES) Ministry of Environmental Protection of the People's Republic of China 7th West Street, Yuancun Guangzhou, P.R. China
Dr. Hao Chen Room 235 Building 2 Chinses Research Academy of Environment Sicences #8 Anwan Dayangfang Chaoyang District, Beijing 100012, P.R.China	Mr. Jianbo Han Deputy Chief Marine Chemistry Division National Marine Environment Monitoring Centre State Oceanic Administration 42 Linghe Street, Dalian, P.R.China
Ms. Xinzhen Lin Chief, International Cooperation Office National Marine Environmental Monitoring Centre State Oceanic Administration 42 Linghe St., Dalian 116023, P.R.China	
INDONESIA Prof. Dr. Indra Jaya Staff, Departemen llmu dan Teknologi Kelautan (ITK) Fakultas Perikanan dan llmu Kelautan (FPIK), Gedung FPIK, Kampus IPB Darmaga, Bogor 16680, Indonesia.	
JAPAN Dr. Yasuwo Fukuyo Professor Division of Bio-Environmental Assessment Asian Natural Environmental Science Center University of Tokyo	Dr. Takeshi Kawano Program Director Ocean Climate Change Research Program Research Institute for Global Change Japan Agency for Marine-earth Science and Technology (JAMSTEC) 2-15, Natsushima Yokosuka 237-0061, Japan

Dr. Kentaro Ando Team Leader Indo-Pacific Ocean Climate Variations Research Scientist Research Institute for Gobal Change, Ocean Climate Change Research Programme Japan Agency for marine Earth Science and Technology (JAMSTEC)	
REPUBLIC OF KOREA Dr. Qtae Jo Aquaculture Scientist National Fisheries Research and Development Institute (NFRDI) Busan 619-705, Busan, Republic of Korea	Dr. Kyung Tae Jung Cheif Editor for Ocean and Polar Research Korea Ocean Research & Develop Institute Republic of Korea
Dr. Youn-Ho Lee Principal Research Scientist/Professor Marine Ecosystem Research Division Korea Institute of Ocean Science and Technology 787 Haean-ro, Sangnok-gu, Ansan-si, Gyeonggi-do 426-744, Republic of Korea	
MALAYSIA Prof. Dr. Aileen Tan Shaw Hwai School of Biological Sciences Universiti Sains Malaysia 11800 Penang, Malaysia	Ms. Ezahtul Syahreen Binti Ab Rahman Environmental Control Officer Marine Data Unit Marine and Water Division Department of Environment Putrajaya, Malaysia
Mohd Nizam Basiron Research Fellow Centre for the Straits of Malacca Maritime Institute of Malaysia B-06-08 Megan Avenue II 12, Jalan Yap Kwan Seng 50450 Kuala Lumpur, Malaysia.	
PHILIPPINES Dr. Gil Jacinto Professor Marine Science Institute University of the Philippines Diliman Quezon City, PHILIPPINES	Dr. Annadel Cabanban c/o Sulu-Celebes Seas Sustainable Fisheries Management Project Suite 1801, 18th Floor, OMM CITRA Building San Miguel Avenue, Pasig City Metro Manila, Philippines
Prof. Edgardo D. Gomez The Marine Science Institute University of the Philippines Diliman, Quezon City 1101 Philippines	Dr. Miguel D. Fortes Marine Science Institute CS University of the Philippines Diliman, Quezon City 1101 Philippines
Dr. Porfirio M. Alino	

The Marine Science Institute University of the Philippines Diliman, Quezon City 1101 Philippines	
RUSSIA Dr. Kachur Anatoly Nikolaevich Director NOWPAP POMRAC Deputy Director Pacific Geographical institute Far Eastern Branch of Russian Academy of Sciences Address: 7 Radio str. Vladivostok, 6900041, Russia	Dr. Vladimir Shulkin NOWPAP POMRAC Head, Laboratory of Geochemistry Pacific Geographical Institute Far Eastern Branch, Russian Academy of Sciences 7 Radio St. Vladivostok 690041 Russian Federation
SINGAPORE Prof. Chou Loke Ming Professor Faculty of Science Department of Biological Sciences, National University of Singapore (NUS) 14 Science Drive 4, Singapore 117543	Dr. Beverly Goh Natural Sciences & Science Education National Institute of Education Nanyang Technological University NIE7-03-88, 1 Nanyang Walk Singapore 637616
THAILAND Dr. Anuwat Nateewathana Marine Biodiversity Specialist Department of Marine and Coastal Resources Ministry of Natural Resources and Environment 5th Fl.,Building B, Cheangwattana Rd. Laksi, Bangkok 10210, Thailand	Dr. Suchana Chavanich Associate Professor Chulalongkorn University Reef Biology Research Group Department of Marine Science Faculty of Science Bangkok 10330, Thailand
Mr. Pirochana Saikiang Senior Expert on Marine Fisheries Department of Fisheries 6th Chulaphorn Building Kasetklang, Chatuchak, Bangkok 10900	Mrs. Pornsri Mingkwan Environmental Scientist Pollution Control Department 92 Soi Phaholyothin 7, Phaholyothin Road Samsean-Nai, Phayathai Bangkok 10400, Thailand
Captain Bongkoch Samosom Operational Officer Hydrographic Department Royal Thai Navy 222 Rim Tang Rod Fai Kao Road Bangna, Bangkok 10260, Thailand	Dr. Rudolf Hermes Chief Technical Advisor Bay of Bengal Large Marine Ecosystem Project (BOBLME) c/o Andaman Sea Fisheries Research & Development Center 77 Moo 7 Sakdidej Rd., Makham Bay Tambon Vichit, A. Muang Phuket 83000, Thailand
VIETNAM Mr. Le Dai Thang Head of Division Division of Management of Technical Infrastructure for Marine Survey and Control- Bureau of Marine Resources and Environment	Mr. Nguyen Tan Douc Researcher Research institute for the management of seas and islands (RIMSI), Vietnam Administration of Seas and Islands (VASI) No. 25 Trung Kinh, Trung Hoa town,

Survey and Control (VASI) Ministry of Natural Resources and Environment (MONRE), No 10, Ton That Thuyet Street Cau Giay District, Hanoi, SR. Vietnam	Cau Giay Dist. Hanoi, Vietnam
Dr. Dao Van Hien Bureau for Marine Resources and Environment Survey and Control Vietnam Administration of Seas and Islands (VASI) Level 17, 10 Ton That Thuyet, Cau Giay District, Hanoi, Vietnam.	Dr. Vo Si Tuan Associate Professor on Marine Biology Vice Director of Insitute of Oceanography 01 cau Da street, Nha Trang city, Vietnam
Assc. Prof. Dr. Nguyen Chu Hoi Department of Environmental Management Faculty of Environment 334 Nguyen Trai Road Thanh Xuan, Hanoi, Vietnam	
RESOURCES PERSON Dr. Trevor J. Ward Greenward Consulting – Marine Ecosystems and Biodiversity Perth, Western Australia Adjunct Professor, University of Technology Sydney, NSW, Australia trevor.ward@uts.edu.au	Dr Peter T Harris Senior Marine Science Advisor Geoscience Australia % UNEP/GRID Arendal Postboks 183, N-4802 Arendal, Norway
Mr. Alan Simcock Coordinator of Group of Experts Regular Process United Kingdom of Great Britain and Northern Ireland	Ms. Dr. Juying Wang Member of Group of Experts, Regular Process & Chairperson of WESTPAC Working Group on GRAME Chief, Marine Chemistry Division National Marine Environment Monitoring Centre, State Oceanic Administration 42 Linghe Street, Dalian, P.R. China
Dr. Chul Park Member of Group of Experts, Regular Process Department of Oceanography Chungnam National University Daejon 305-764, Republic of Korea	Dr. Elaine Baker University of Sydney Madsen FO9 The University of Sydney NSW 2006, Australia
UNEP Dr. Ellik Adler Co-ordinator United Nations Environment Programme United Nations Building, 2nd Floor, Block B Rajdamnern Avenue Bangkok 10200, Thailand	Mr. Jerker Tamelander Head, Coral Reef Unit United Nations Environment Programme Freshwater and Marine Ecosystem Branch, DEPI, United Nations Building, 2nd Floor, Block B, Rajdamnern Avenue Bangkok 10200, Thailand
Mr. Reynaldo Molina Consultant	Ms. Yoon Young Back

United Nations Environment Programme United Nations Building, 2nd Floor, Block B Rajdamnern Avenue Bangkok 10200, Thailand	Consultant United Nations Environment Programme United Nations Building, 2nd Floor, Block B Rajdamnern Avenue Bangkok 10200, Thailand
Dr. Hugh Kirkman Consultant 5a Garden Grove, Seaholme, Vic 3018, Australia	Ms. Krittika Kleesuwan Secretary United Nations Environment Programme United Nations Building, 2nd Floor, Block B Rajdamnern Avenue, Bangkok 10200, Thailand
Dr. Alexander Tkalin Coordinator Northwest Pacific Action Plan (NOWPAP) of UNEP NOWPAP RCU, 152 Haean-ru, Gijiang-up, Busan 619-705 Republic of Korea	Mr. Tobias Fast Intern, Coral Reef Unit United Nations Environment Programme Freshwater and Marine Ecosystem Branch, DEPI, United Nations Building, 2nd Floor, Block B, Rajdamnern Avenue, Bangkok 10200, Thailand
UNESCO-IOC/WESTPAC Mr. Wenxi Zhu Head of IOC Regional Office for the Western Pacific (WESTPAC) Intergovernmental Oceanographic Commission of UNESCO c/o Department of Marine and Coastal Resources, 9th Fl. Governmental Complex B 120 Chaengwattana, Bangkok 10210, Thailand	Dr. Somkiat Khokiattiwong Chairperson of IOC Sub-Commission for the Western Pacific (WESTPAC) Head of Oceanography and Marine Environment, Phuket Marine Biological Center, Department of Marine and Coastal Resources, 51 Sakdhidej Rd. Muang District, Phuket 83000, Thailand
Ms. Nachapa Saransuth Administrative and Programme Assistant IOC Regional Office for the Western Pacific (WESTPAC) Intergovernmental Oceanographic Commission of UNESCO c/o Department of Marine and Coastal Resources, 9th Fl. Governmental Complex B 120 Chaengwattana, Bangkok 10210, Thailand	Ms. Thapupsorn Hnoonin Administrative Assistance IOC Regional Office for the Western Pacific (WESTPAC) Intergovernmental Oceanographic Commission of UNESCO c/o Department of Marine and Coastal Resources, 9th Fl. Governmental Complex B 120 Chaengwattana, Bangkok 10210, Thailand

Appendix 2 Introductory letter

UNITED

NATIONS

Regular Process/WP.3

30.August 2012

Original: ENGLISH

Regional Scientific and Technical Capacity Building Workshop

on the World Ocean Assessment (Regular Process)

Bangkok, Thailand

17–19 September 2012

Regional Scientific and Technical Capacity Building Workshop on the World Ocean Assessment (the U.N Regular Process); South China Sea and the Gulf of Thailand; Bangkok, 17–19 September 2012

Summary of the Approach, Methodology and Process of the Workshop

The Bangkok workshop is a capacity-building workshop designed as a pilot for a rapid regional ocean assessment. The assessment process is expected to build the capacity of regional and national organizations and authorities to conduct similar assessments in a manner that is coherent across the region and consistent with the spirit of the World Ocean Assessment (Regular Process).

The assessment process, including the workshop, uses an elicitation of expert judgement. This is set within a systematic and consistent methodology that minimises the risk of bias and enables capture and reporting of information, both relevant to the region and likely to be useful for the World Ocean Assessment.

The process consists of three phases: first, a pre-workshop agreement on the decision structure, parameters and assumptions/constraints; second, attendance at the workshop by the invited experts to provide their judgement and secure their consensus; and third, a short post-workshop period for any refinements and updating to be finalised before issuance of a final summary report.

Phase 1 – pre workshop phase

Prior to the workshop, the participating experts will receive by e-mail a summary of the assessment methodology so that the dynamics and the process of the workshop are well understood.

They will also receive 6 draft worksheets and they will be requested to provide their input into those worksheets by suggesting/confirming the following elements:

1. The list of specific parameters that will be the judgement basis (such as the list of major habitat types of the region and the attributes of those habitats that are important to include in the assessment, including any areas of special environmental significance);

2. Benchmarks against which judgements will be made (the reference condition for comparison against the current condition, such as the condition of habitats in the early 1900s);
3. Grading statements that are used to provide system-wide guidance about setting levels of performance (such as what is meant by 'Very Good'); and
4. The timeframes considered to be appropriate for this decision problem (such as 'current' is the period 2007-2012).

The participants will be asked to return the completed sheets by email within two weeks. All responses will then be compiled by the workshop organisers into a single draft set, which will be reviewed at the beginning of the workshop. To make this review process efficient, the participants will receive a copy of the draft set in due time prior to the workshop.

Phase 2 – at the workshop

At the workshop, participants will be guided to provide their expert judgement on indicators of condition of the biodiversity and ecosystem health and on the importance of the main threats and pressures affecting the marine ecosystems and their social and economic values. If time permits, the workshop will also consider an assessment of risks and the effectiveness of management measures.

Phase 3 – post workshop

The outcomes of the workshop will be summarised and circulated back to participants for a short period to allow for any necessary corrections and updating.

The summary of the workshop and its main outputs and conclusions will be circulated also to the Group of Experts of the World Ocean Assessment and to other relevant partners and organizations.

Appendix 3 Methodology and matrices Round 2 package

UNITED

NATIONS

Regular Process/WP.4

31.August 2012

Original: ENGLISH

Regional Scientific and Technical Capacity Building Workshop

on the World Ocean Assessment (Regular Process)

Bangkok, Thailand

17–19 September 2012

Regional Scientific and Technical Capacity Building Workshop on the World Ocean Assessment (Regular Process) Bangkok, Thailand 17–19 September 2012

Round 2 Package for Participants: issued on 31 August 2012

(Prepared by Trevor Ward: Workshop Moderator/Facilitator)

Bangkok Workshop Preparatory Tasks

1. Review the workshop methodology; Consider the updated Parameters list as shown in the scoring matrices below. The Benchmarks and Grading Statements are unchanged from Round 1.

2. Assemble any regional information, published or unpublished reports and syntheses, local site-specific information, historic reports and any other background knowledge and information that may be helpful for populating the assessment matrices at the workshop. Bring original documents, e-copies, or url-addresses with you to the workshop for reference.

3. Choice of benchmark: There has been some debate, but the current proposal is that the benchmark for your judgement will be the conditions that prevailed in about 1900. While conditions in the period 1900 to 1950 may be less certain, extrapolation and use of surrogates may assist in forming a decision about grading of present-day conditions into one of the four proposed grades relative to the conditions that prevailed in 1900. Adopting a 1900 benchmark will permit information from a broad range of biodiversity parameters to be included in the assessment, and does not degrade the utility of higher quality information for those few parameters where there are good region-wide data available from recent times.

4. Spatial Resolution: The current proposal is that the two LMEs (South China Sea and Gulf of Thailand) will be scored separately, with separate sets of matrices, and possibly with separate sets of local Parameters. In preparing your information base to bring to the workshop, please be aware that the two regions will be scored separately for appropriate parameters.

Short Description of Assessment Methodology and Workshop

Background

This assessment will consult experts to assemble information and review data, and to gauge expert opinion about the condition of the ocean's marine ecosystems across a broad range of values of the South China Sea and Gulf of Thailand. The assessment is a rapid assessment of expert opinion, and while this limits the resolution that can be applied to any single ocean value, the assessment as a whole draws from a wide base of parameters, minimising the risks of decision model failure in this context of regional ocean assessment. This approach explicitly trades-off a high-resolution assessment based on a few, well-known parameters against a lower-resolution assessment based on a broader base of less well-known parameters. This results in a lower resolution set of outcomes but is less biased in its approach to assessing condition. When outcomes are assembled across spatial units (such as regions), this framework provides for a more powerful and less biased answer to the question of biodiversity condition at regional scales than the use of a small number of parameters with high levels of data/knowledge.

The Bangkok workshop draws from the collective experience and knowledge of local and regional experts, and allows their judgements to be set within a specified decision model that can be systematically adapted to apply to ocean systems at a range of scales for the purposes of regional (and potentially global) assessment. The consultation and workshop process described here has been adapted from the broad approach and decision model established for the recent assessment and reporting of Australia's national marine environment (Australia State of the Environment 2011; www.environment.gov.au/soe).

Decision Model

The Bangkok workshop will focus on biodiversity, ecosystem health and pressures on the LMEs of South China Sea and Gulf of Thailand. The decision model consists of a hierarchical arrangement of the Assets/Values, Assessment Components, Parameters, and Indicators (see Figure 1 below for some examples of this hierarchy). The expert judgements made about these aspects are aggregated in an explicit manner within the structure of the decision-making framework to provide the raw information for reporting on the region. The expert data/knowledge elicited at the workshop is used in this structure through a set of coarse-grade scoring and aggregation procedures, including any weightings that might be either explicitly required by the experts or inferred through the structural architecture of the model, to reach a final set of judgements about each of the Assets/Values. The assessment requires scores/grades (where possible) to be assigned to both Indicators of condition and trend for each Parameter, and an estimate of confidence in both condition and trend.

Scoring and Grading

At the workshop, scores will be assigned (by the expert participants) to each Indicator on a scale from 0 to 10, where 0 is consistent with the weakest level of performance or achievement of the grading criterion (see below for the grading criteria), and 10 is the strongest or highest level of achievement.

The Grades are coarse levels of condition performance/achievement used for reporting purposes at the Indicator level: Very Poor, Poor, Good, and Very Good. These should be used in navigating towards an agreed score, and are subsequently reconstructed (post-workshop) from the expert-assigned scores, using linear thresholds of 2.5, 5, and 7.5.

Grading Criteria Statements

The Grading Statements (shown below) have been uniquely derived for each set of assessment Parameters. Grading Statements provide criterion-style guidance to inform the experts about the thresholds they should use in determining first a grade and then a score that is consistent with their knowledge of the data and information, and best represents their judgement at the Indicator level of the Decision Model.

Benchmarks

The score/grade assigned to an Indicator is formed by the experts based on relativity to a benchmark. The benchmark is established as a point of reference for the decision framework. For the biophysical indicators, the benchmark should be set generically as the condition that would have existed prior to the commencement of the major changes in type and intensity of use and exploitation of the region, and can be considered to best represent a relatively natural set of conditions perhaps only slightly impacted by human activities. This will usually require a surrogate to be adopted, or for some aspects, a set of modelled hind-cast estimates may be appropriate and available. In some cases, benchmarks will need to be developed to represent highly desirable conditions that are known to have existed previously, such as provision of services or recovery of biomass or habitat distributions.

For the purposes of the Bangkok workshop, the benchmarks for biodiversity, ecosystem health and environmental, social and economic pressures are set to represent the conditions prevailing in about 1900. While it is clear that the conditions at that time are not 'pristine' or unaffected by human civilisation, this is a time before the extensive use of mechanised power for maritime purposes, including fishing, and can reasonably be expected to represent a time when there was only a limited set of human-derived impacts in the region. While it is clear that the best data to inform analysis of conditions is likely to be available from more recent times, at least for some parameters, the choice of an early time is critical if natural and undisturbed conditions are to be used as the reference framework for the assessment and if the widest possible diversity of parameters is to be included in the assessment. Conversely, constraining the assessment to conditions that are data-rich and recent imposes a false sense of power in the assessment and its outcomes, principally because data availability is often confounded with environmental degradation/impacts, and it may limit parameter choice, and these both apply a systematic bias that is very difficult to uncouple from the assessment process.

The form of benchmark for the social and economic indicators will be framed on the type and extent of pressure that is being applied to social and economic assets/values through the causal chain of alterations in the environmental assets/values.

The use of a benchmark here should not be confused with the setting of a target or an objective for current management systems to achieve. Benchmarks as established in this Decision Model are used for 'anchoring' the scoring and grading system to a common point of reference across regions, and to encourage consistent scoring within and across regions that will contribute to a more balanced aggregated form of regional assessment. Benchmarks used here do not infer that such conditions should, or even could, be used to establish the targets for local-scale restoration efforts or national/regional management. This assessment will provide a regional overview of the relative condition of the parameters, and provide coarse-scale input to regional priorities to address biodiversity issues. Within this broad context, national and local-scale initiatives may then be developed outside the context of the WOA, to specifically address fine scale issues that may be contributing to the regional-scale patterns.

Parameters

The Parameters elements of the Assets/Values are divided into two groups: generic aspects that will apply to many other ocean regions, and region-species groups that will contain mainly Assets/Values that are unique to the region under consideration. All Parameters are assessed based on the score/grade assigned to an Indicator for each Parameter (such as 'most places'), and ultimately aggregated, graded and reported at the regional levels. Where possible, the Parameters should be defined at a level of aggregation that is applicable globally to regions of similar types, so that the regional assessment may be consistent and coherent with assessments in other regions. The Parameters have been assigned in natural groups, comprising a number of related members, as a Parameter. In species groups, for example, an Indicator to be assessed might be 'sharks', perhaps with separate species-specific components for high profile species such as 'Great Whites', 'Whale Sharks', etc., or groups of small and non-targeted species. It may also be appropriate to identify other groupings, such as 'targeted sharks' by size, by family or by some other natural grouping. While there is no upper limit on the number of Parameters that could be assessed, the practicalities of the Bangkok workshop (such as the timeframe, resources available, the scale of the report, etc) indicate that a maximum number of between 20 and 40 Parameters for each set of Assets/Values will bring an acceptable level of resolution to the regional assessment problem.

In reviewing the list of parameters, experts should pay particular attention to the question of parameter weightings within the decision structure. For example, resolving fish into component species for individual parameter assessment at the workshop will heavily increase the weighting of fish species in the final outcome, and this might not properly reflect the importance of fish in answering the WOA question of overall biodiversity condition in the region.

Scoring Indicators

The Indicators comprise these reporting quantities (or metrics): 'Most places', 'Worst 10% places' and 'Best 10% places' for *Condition*, and Increasing, Decreasing or Stable for *Trend* (relative to changes that have occurred over the last 5 years). Expert judgement should be applied at the scale of the whole region, and not be overly influenced by small areas of very good or very bad condition, or small areas where changes are very great—treat the scoring process as attempting to assign a median estimate within the established scoring categories.

Sampled estimates of the condition quality of any individual Parameter will be distributed across a range of values. Commonly, this knowledge/data will be related to the spatial distribution of the Parameter, but not always. Some forms of data/knowledge for some Parameters may not be spatially arranged, such as estimates of the size of the population of a well-researched species. However, the Indicators should be interpreted to apply to the distributional range of values, expressed in terms of spatial distribution if possible. If a spatial structure cannot be inferred, these Indicators can be simply interpreted (on a Parameter basis) as reflecting the statistical distribution of condition values. The intention of this form of Indicator structure is to reflect not only the mode (or more crudely a median or 'average') score for a Parameter, but to also assign an estimate of the condition at the ends of the distribution of condition values. The Indicator '10%' has been chosen to try to ensure that scoring is not confined to reporting the absolute worst (or best) known individual example of a Parameter, but reasonably reflects the condition in a group of examples of the Parameter at the extremes of the distribution of values. This information set (most, best, worst) is an important component of ecosystem-based policy and management. It can be used as a powerful mechanism for reporting/tracking the effectiveness of management initiatives, and is a useful tool for aggregation into regional-scale and (potentially) global-scale reporting systems.

The rationale for scores assigned at the workshop will be noted in summary form (text dot points) in the matrix, assigned to each score so that the main factor(s) influencing your scores are documented. For example, although there may be no direct information about the condition of a habitat or species group, you may feel that this component of the environment is in 'good' condition because there are few obvious environmental pressures that have influenced its condition. Alternatively, you may feel that the factors that degrade some aspect of biodiversity condition today have operated previously, and so cause-effect relationships known from recent studies can be used to make estimates of earlier conditions using surrogate environmental factors.

Information Quality

This process is a form of rapid assessment, and draws upon the best data and expert knowledge within the resources available to complete the assessment. It is clear that resources are not available for a full technical synthesis and analysis of all information/data for the purposes of the assessment, and it is recognised that the resolution available for each Parameter is coarse (typically restricted to the level of the four performance grades). However, for the purposes of the World Ocean Assessment, this level of resolution (both the accuracy and precision) across large numbers of individual parameters provides a modestly robust and low-bias decision structure for regional assessment purposes, and can be efficiently compiled within regions to provide a rapid assessment of their marine environments with a known resolution and level of certainty.

For estimates of condition, trend, and importance of factors affecting the environment, the participants should assign estimates of the level of confidence in the information base they used to make their judgments. Uncertainty and reliability contributing to confidence in the knowledge should cover all aspects of the information base, including such matters as technical quality/robustness, spatial and taxonomic coverage, process uncertainty, all forms of model uncertainty, and access to appropriate levels of detail.

The grading statements for the estimates of Confidence are:

High: Adequate high quality evidence and high level of consensus

Moderate: Limited or low quality evidence or limited consensus

Low: Evidence and consensus too low to make an assessment

Elicitation Bias

The assessment process designed and being trialled in the Bangkok workshop is subject to a number of potential sources of bias. These include such matters as a limited representation of the extant knowledge base at the workshop (including insufficient experts in attendance), and the bias always inherent in a Delphi-style rapid assessment process. The most important aspect of this matter is recognising the type and extent of bias that may apply, and where any aspect may be important (recognising the coarse resolution of the overall process), the existence of such bias will be documented in the workshop outcome. Participants at the workshop will be guided to recognise each of the main forms of elicitation bias that apply to assessment processes such as is applied in the workshop.

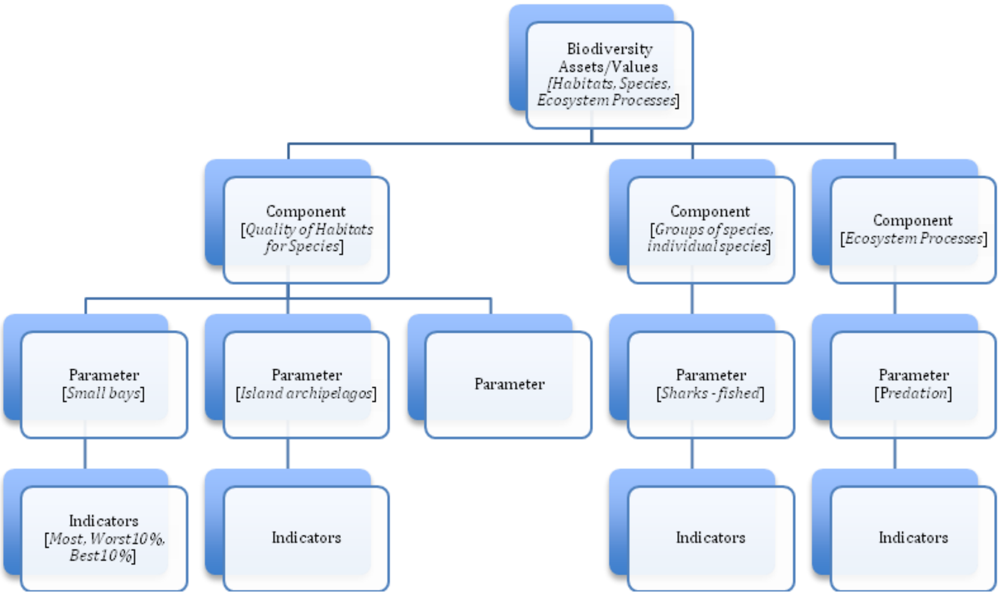


Figure 1: The form of the Decision Structure for condition assessment, with some specific examples.

Condition Assessments

Guidance for Scoring at the Workshop

For each Parameter in the condition matrices, assign a score that represents your overall estimate of condition, ranging between 0 (worst) to 10 (best) for current (2007-2012) condition, guided by the Grading Statements (as below). Your score is required for three Indicators/metrics for each Parameter: 'most', the 'best 10%' and the 'worst 10%', representing the notional frequency distribution of scores across the spatial grouping or distribution of values of the indicator being assessed. Also, assign an estimate of High, Medium or Low that represents the level of confidence that you consider surrounds your estimate of the condition (types of uncertainty contributing to confidence are discussed further below). Benchmark your judgement against natural conditions and trends, an earlier time in development of the region considered to be a condition of high quality, or such other generic but specified benchmark as may be agreed at the workshop (proposed to be conditions applying in about 1900). Please keep in mind these two important aspects: (a) the spatial scope of the region being assessed, which encompasses the area from highest tidal influence at the shoreline of the islands and continental coastline out to the edge of the EEZ, and including any river deltas and bays etc. that are influenced by tidal conditions, and any high seas; and (b) benchmark your estimate of condition against the condition established as the benchmark, or any reasonable surrogate for that benchmark.

For Trends, assign one of the three categories of current trend over the past 5 years (2007-2012) in the condition of the Parameter, assigned relevant to the grading statements: I=improved; D=deteriorating; S=stable. Note that Stable is intended to include the natural dynamics of the component, and does not infer a lack of natural variability (such as the natural dynamics in space or time).

For Trend, also provide an estimate of your confidence in the assignment, using High, Medium, or Low.

Grading Statements

This set of statements provides guidance and a basis for scoring and grading of Indicators established to assess and report on the Parameters.

Marine Biodiversity *(this deals with the structural and functional aspects of biodiversity)*	
P1: Quality of Habitat for Species	*applies to habitat components and what is best understood about their status and trends expressed in terms of habitat quality for species*
Very Good (>7.5-10)	All major habitats are essentially structurally and functionally intact and able to support all dependent species
Good (>5-7.5)	There is some habitat loss, degradation or alteration in some small areas, leading to minimal degradation but no persistent substantial effects on populations of dependent species
Poor (>2.5-5)	Habitat loss, degradation or alteration has occurred in a number of areas, leading to persistent substantial effects on populations of some dependent species
Very Poor (0-2.5)	There is widespread habitat loss, degradation or alteration, leading to persistent substantial effects on many populations of dependent species
P2: Populations of Species and Groups of Species	*applies to the major structural components and what is best understood about their status and trends expressed in terms of populations and groups of species (abundance, size/age structure, geographic distribution); this includes threatened species which may be assessed by species or as groups of species*
Very Good (>7.5-10)	Only a few, if any, species populations have declined as a result of human activities or declining environmental conditions
Good (>5-7.5)	Populations of a number of significant species but no species groups have declined significantly as a result of human activities or declining environmental conditions
Poor (>2.5-5)	Populations of many species or some species groups have declined significantly as a result of human activities or declining environmental conditions
Very Poor (0-2.5)	Populations of a large number of species or species groups have declined significantly as a result of human activities or declining

	environmental conditions
P3: Ecological Processes	*applies to what is best understood about the status and trends (abundance, distribution, rates) in the main ecological processes and effects of human activities*
Very Good (>7.5-10)	There are no significant changes in ecological processes as a result of human activities
Good (>5-7.5)	There are some significant changes in ecological processes as a result of human activities in some areas, but these are not to the extent that they are significantly affecting ecosystem functions
Poor (>2.5-5)	There are substantial changes in ecological processes as a result of human activities, and these are significantly affecting ecosystem functions in some areas
Very Poor (0-2.5)	There are substantial changes in ecological processes across a wide area of the region as a result of human activities, and ecosystem function is seriously affected in much of the region

Marine Ecosystem Health *(this deals with the processes affecting biodiversity)*	
P4: Physical and Chemical Processes	*applies to what is best understood about the status and trends in the main physical and chemical processes (abundance, distribution, rates) as a result of human activities. The grading scale is based on a gradient in impacts of change.*
Little change/impact (>7.5-10)	There are no significant impacts of changes in physical or chemical processes as a result of human activities
Some change/impact (>5-7.5)	There are some significant impacts of changes in physical or chemical processes as a result of human activities in some areas, but these are not to the extent that they are significantly affecting ecosystem functions
Major change/impact (>2.5-5)	There are substantial impacts of changes in physical or chemical processes as a result of human activities, and these are significantly affecting ecosystem functions in some areas
Extreme change/impact (0-2.5)	There are substantial impacts of changes in physical or chemical processes across a wide area of the region as a result of human activities, and ecosystem function is seriously affected in much of the region
P5: Outbreaks of Pests, Invasive Species, Diseases and Algal Blooms	*applies to what is best understood about the status and trends in the main outbreaks (frequency, distribution, densities). These matters are considered here as symptoms of ecosystem health.*
Very Good (>7.5-10)	The incidence and extent of diseases and algal blooms are at expected natural levels, and there are insignificant occurrences or outbreaks of pests, and the numbers and abundance of invasive species are minimal
Good (>5-7.5)	Diseases or algal blooms occur occasionally above expected occurrences or extent, and recovery is prompt with minimal affect on ecosystem functions; pests sometimes present and have been found at levels above natural occurrences but with limited ecosystem impacts; the occurrence, distribution and abundance of invasive species are limited and have minimal impact on ecosystem functions
Poor (>2.5-5)	Diseases or algal blooms occur regularly in some areas above

	natural levels of occurrence or extent; occurrences of pests require significant intervention or have significant effects on ecosystem function; occurrence, distribution and abundance of invasive species trigger management responses, or have resulted in significant impacts on ecosystem functions
Very Poor (0-2.5)	Disease or algal blooms occur regularly across the region at unnaturally high levels; occurrences of pests or invasive species are uncontrolled in some areas and are seriously affecting ecosystem functions

Factors Affecting the Environmental Values: Pressures/Threats *(this deals with high level pressure/threat factors that are, or are likely, affecting the biodiversity and environmental values of the bioregion)*	
P6: Impacts on Environmental Values	*applies to what is best understood about the status and trends in the main factors affecting the biophysical environment*
Very Good (>7.5-10)	There are few or negligible current impacts from this factor, and future impacts on the environmental values of the region are likely to be negligible.
Good (>5-7.5)	There are minor current impacts in some areas, and future impacts from this factor on the environmental values of the region are likely to be minor and localised
Poor (>2.5-5)	The environmental impacts of this factor are currently significantly affecting the values of the region, and serious environment degradation is likely to occur within 50 years.
Very Poor (0-2.5)	The current and predicted environmental impacts of this factor are widespread, irreversibly affecting the values of the region, and widespread and there is serious environment degradation, or this is likely across the region within 10 years.
Impacts on Social and Economic Values	*applies to what is best understood about the status and trends in the consequences/importance of main pressure/threat factors affecting the social and economic values*
Very Good (>7.5-10)	There are few or negligible environmental current impacts from this factor, and future consequent impacts on the social or economic values of the region are likely to be negligible.
Good (>5-7.5)	There are minor current environmental impacts in some areas, and future consequent impacts on the social or economic values of the region are likely to be minor and localised
Poor (>2.5-5)	The environmental impacts of this factor are currently significantly affecting the social or economic values of the region, and serious degradation is likely within 50 years.

Very Poor (0-2.5)	The current and predicted environmental impacts of this factor are widespread, irreversibly affecting the social or economic values of the region, and there is widespread and serious further degradation and impacts, or this is likely across the region within 10 years.

Proforma Workshop Decision Matrices (Round 2)

Part 1: Habitats - Quality for Species

Benchmark = conditions in 1900

Habitat Systems	**Parameter**	**Summary Rationale**	**Current Condition (*0 to 10 compared to benchmark*)**				**Current Trend (*Improving, Stable, Declining*)**			
			Best 10%	**Most places**	**Worst 10%**	**Confidence H, M, L**	**Best 10%**	**Most places**	**Worst 10%**	**Confidence H, M, L**
benthic	estuaries and deltas									
	small gulfs and bays									
	lagoons – open and barred									
	beaches									
	non-coral reefs fringing coasts and islands (intertidal and subtidal)									
	coral reefs fringing coasts and islands (intertidal and subtidal)									
	subtidal and intertidal coral and rocky reefs not									

	contiguous with shoreline										
	seabed inner shelf (0-50m)										
	seabed outer shelf (50-200m)										
	seabed shelf break and upper slope										
	slope (700-1500m)										
	seabed abyss (>1500m)										
water column	water column shoreline (0-20m)										
	water column inner shelf (20-50m)										
	water column outer shelf (50-200m)										
	water column offshore (>200m)										
biological	mangroves										
	seagrass beds										
	algal beds										
	coral reefs (<30m)										

	deepwater corals and sponges (>30m)									
	bryozoan reefs									
	mudflats									
structural	canyons and shelf-break									
	seamounts (>1000m rise from seafloor)									
	large gulfs, large bays									
	offshore banks, shoals, islands									
	major river deltas/wetlands									
	karst systems									
Special individual habitat features										
	Ha Long Bay WH									
	Bight of Bangkok									
	Mekong Delta									
	Coast of Hong Kong									
	Jakarta Bay									
	Sihanouvkville Bay									

	Lingayen Gulf									
	Tubbataha Reef WHS									
	Palawan Biosphere Reserve									
	Verde Island Passage									
	Batanes Islands									
	NIPAS MPA									
	Natuna Archipelago									
	Upper Gulf of Thailand									
	Lower Gulf of Thailand									

Part 2: Species Populations and Groups

Benchmark = conditions in 1900

Groups	Parameter	Summary Rationale	Current Condition (*0 to 10 compared to benchmark*)				Current Trend (*Improving, Stable, Declining*)			
			Best 10%	Most places	Worst 10%	Confidence H, M, L	Best 10%	Most places	Worst 10%	Confidence H, M, L
mammals	Whales - baleen									
	Whales - toothed									
	dolphins, porpoises									
	dugongs									
fish	sharks and rays - targeted and bycatch									
	sharks and rays - non exploited									
	Great white shark									
	Whale shark									
	tuna and billfish									

	Inner shelf (0-50m) demersal fish species										
	outer shelf (50-200m) demersal & benthopelagic fish species										
	slope - demersal fish species (>200m)										
	meso-pelagic fish species										
	small pelagics - inner shelf (0-50m)										
	small pelagics - outer shelf (50-200m)										
	Inner-shelf reef fish species (0-50m)										
	Inner-shelf demersal fish species (0-50m)										
	grazers/herbivores of coral reefs										
Invertebrate s	Inner shelf – squid etc										
	Inner shelf - crustaceans										
	Inner shelf – other										

	invertebrate spp.									
	outer shelf & inner slope invertebrate spp.									
	shoreline and intertidal soft sediment invertebrate spp.									
	shoreline and intertidal rocky shore invertebrate spp.									
	benthic filter feeders of soft and hard subtrata									
	hard coral species									
birds	seabirds - resident									
	migratory seabirds/waders									
reptiles	turtles									
	seasnakes									
	crocodiles									
plants	mangrove species									
	seagrass species									
	algae species									

	dune, saltmarsh, foreshore species									
Additional key species, specially protected or iconic species groups										
	Seahorses and pipefish									
	Holothurians									
	Triton gastropods (*Charonia spp*)									
	Giant clam (*Tridacna spp*)									
	Coelacanth									
	Groupers									
	Urchins *(Tripnuestes gratilla)*									
	Protected species of ornamental reef fish									
	Crown of Thorns starfish									
	Lobsters (spiny)									
	Butterfly fish									

Part 3: Ecological Processes

Benchmark = conditions in 1900

Type	Parameter	Summary Rationale	Current Condition (*0 to 10 compared to benchmark*)				Current Trend (*Improving, Stable, Declining*)			
			Best 10%	Most places	Worst 10%	Confidence H, M, L	Best 10%	Most places	Worst 10%	Confidence H, M, L
Connectivity	Spatial/physical disjunctions									
	Biological, migration, flyways									
	Recruitment, settlement									
	Genome structures, genetic adaptation									
	Nesting, roosting, spawning and nursery sites									
	Feeding grounds									
Productivity	Trophic structures and relationships									

	Water column, pelagic productivity									
	Benthic productivity-inshore									
	Benthic productivity-offshore									
	Reef building									
	Symbiosis: fish, corals, molluscs									
	Predation									
	Herbivory									
	Filter feeding									
	Microbial processes									
Additional key processes										
	Epiphytism									
	Succession									
	Turnover									
	Source-Sink relationships									

Part 4: Physical and Chemical Processes

Benchmark = conditions in 1900

Type	Parameter	Summary Rationale	Current Condition (*0 to 10 compared to benchmark*)				Current Trend (*Improving, Stable, Declining*)			
			Best 10%	Most places	Worst 10%	Confidence H, M, L	Best 10%	Most places	Worst 10%	Confidence H, M, L
Transport mechanisms	Ocean currents, structure and dynamics									
	Storms, cyclones, wind patterns									
Sediment regime	Sediment inputs									
	Sediment transportation									
	Coastal/shoreline erosion									
Light regime	Inshore water turbidity, transparency and colour									
Temperature regime	Sea temperature, including SST									
Sea level	Sea level change									
Nutrient	Nutrient supply and									

supply, cycling	cycling: land-based (land sourced nutrients supplied by river or stream)										
	Nutrient supply and cycling: ocean-based										
	Freshwater inflow, surface and groundwater runoff										
Components	Toxins, pesticides, herbicides										
	Dumped wastes										
	Radionuclides										
	Ocean acidity										
	Ocean salinity										
	Low oxygen-dead zones										
	Groundwater salinity										
	Coastal land salinity/acidity										
	Seaweed/seagrass wracks										
	Marine debris										

Physical Features	major currents									
	major upwellings									
	oceanic fronts									
Air–sea Interactions	air-sea nutrient fluxes, air-sea gas exchange									
	air-sea chemical, pollutant inputs									
	atmospheric forcing via rainfall, wind, air temperature									
	extreme climate events									

Part 5: Pests, Invasive Species, Diseases and Algal Blooms

Benchmark = conditions in 1900

Type	**Parameter**	**Summary Rationale**	**Current Condition** (*0 to 10 compared to benchmark*)				**Current Trend** (*Improving, Stable, Declining*)			
			Best 10%	**Most places**	**Worst 10%**	**Confidence H, M, L**	**Best 10%**	**Most places**	**Worst 10%**	**Confidence H, M, L**
Pests (declared)	Number and abundance of declared pest species									
Invasive Species	Abundance and distribution of introduced species									
	Frequency, abundance distribution of jellyfish blooms									
Diseases	Number and extent of outbreaks of viral, bacterial, and fungal diseases									
	Number and extent of outbreaks of parasitic									

	infestations									
	Number and extent of fish-kills									
Algal Blooms	Frequency, abundance distribution of algal blooms									
	Frequency, abundance distribution of *harmful* algal blooms									
Biofouling	Frequency, abundance distribution of biofouling									

Part 6. Factors Affecting Environmental Values -Threats/Pressures

This is an assessment of the broad-scale and high-level groups of threats that are detrimentally influencing the condition of the environment across the region. The score is an assessment of the broad significance of the threat to the identified assets/values across the region, based on the environmental, social and economic consequences of the threat. The scale of the threat (global, regional, local) primarily contributing to the score should be annotated.

Benchmark = conditions in 1900

Source	**Factors detrimentally affecting the current condition**	**Summary rationale**	**Importance of impacts** *(0-10, size, extent, importance of threats relative to the benchmark)*				**Current Condition trend** *(condition Improving, Declining, Stable)*			
			Best 10%	**Most places**	**Worst 10%**	**Confidence** *(high, med, low)*	**Best 10%**	**Most places**	**Worst 10%**	**Confidence** *(high, med, low)*
Climate change and variability	*Environmental impacts:* Sea level, wind fields, storms (frequency, intensity), storm surges, rainfall pattern, acidity, current strength, productivity, temperatures, coastal erosion/accretion	**(***identify the assets/values from P1-P5 that are affected***)**								
	Social & Economic	(*identify the social & economic assets/values*								

	Impacts	*affected*) (*could include eg coastal stability, land salinization, groundwater salinization, reduced wetland production, reduced subsistence fishing, river navigability, reduced coastal property protection,* *disruptions in normal activities (e.g. health, education, etc), post-hazard epidemics, loss of lives..)*								
Extreme climate events	*Environmental impacts:*	**(***identify the assets/values from P1-P5 that are affected***)**								
	Social & Economic Impacts	(*identify the social & economic assets/values affected*)								

Coastal urban development	*Environmental Impacts*: Housing, roads, recreation areas, etc on coastal foreshores and adjacent areas (beaches, dunes, wetlands, bays, islands, estuaries), sewage, groundwater, stormwater, algal blooms, local hydrology and meteorology,…	**(***identify the assets/values from P1-P5 that are affected***)**								
	Social & Economic Impacts	(*identify the social & economic assets/values affected*)								
River discharges	*Environmental Impacts*: freshwater plumes, water extraction for agriculture, dam-building, sediment loads, pollutant loads, nutrient loads, on nearshore reefs, fish stocks, seagrasses,	**(***identify the assets/values from P1-P5 that are affected***)**								

	etc										
	Social & Economic Impacts	(*identify the social & economic assets/values affected*)*Eg navigation channels, coastal stability, foreshore erosion, flooding/drowning of lowlands,..*									
Coastal Wetland Conversion	*Environmental Impacts*: loss of natural habitats – saltmarshes, mangroves; loss of coastal protection, loss of carbon sinks/sources, loss of useful connections with other ecosystems, potential release of unwanted gases (methane, H2S), Introduction of	**(***identify the assets/values from P1-P5 that are affected***)**									

	unwanted species,…										
	Social & Economic Impacts Introduction of pests, diseases, shift in livelihoods, loss of information and cultural sources,…	(*identify the social & economic assets/values affected*)									
Land Reclamation	*Environmental Impacts*: loss of natural habitats, change in hydrology, change in sediment cycling to and from beaches, modification of natural hydrology, increased water turbidity and nutrients, destruction of donor sites, loss/reduction of biodiversity, offsite	**(***identify the assets/values from P1-P5 that are affected***)**									

	pollution									
	Social & Economic Impacts Increase in number of illegal households, shift in livelihoods, decrease/increase in land value	(*identify the social & economic assets/values affected*)								
Port facilities	*Environmental Impacts*: Terrestrial infrastructure and access, channels and designated port ownership/vesting of coastal waters, sea dumping, change in hydrology, oil/fuel spills	**(***identify the assets/values from P1-P5 that are affected***)**								
	Social & Economic Impacts Increase in number of	(*identify the social & economic assets/values affected*) *Eg:*								

	illegal households, shift in livelihoods, decrease/increase in land value	*contamination of seafood, loss of fishing grounds, interference with aquaculture sites, increased risk of oil spills and groundings that affect fishing and aquaculture*								
Oil and gas exploration and production	*Environmental Impacts:* Seismic surveys, drilling, platforms, pollutants, oil spills,..	**(***identify the assets/values from P1-P5 that are affected***)**								
	Social & Economic Impacts	(*identify the social & economic assets/values affected*) *Eg : Loss or contamination of fishing grounds,…*								
Fishing	*Environmental Impacts*: Impacts of live-fish fishing, trawling etc on harvest on population size and structure, impacts on non-target species, impacts on	**(***identify the assets/values from P1-P5 that are affected***)**								

	habitat									
	Social & Economic Impacts	(*identify the social & economic assets/values affected*) *Eg loss of subsistence fisheries, decrease in CPUE, serial depletion of valuable species, ..*								
Aquaculture, including sea cages and on-shore ponds	*Environmental Impacts*: pollution of waterways, loss of shoreline habitat, shallowing of channels, disruption to groundwater, vector for disease to native species, escapes impact on native species, escapes of non-native species, excessive use of antibiotics,	**(***identify the assets/values from P1-P5 that are affected***)** *Eg impacts on local hydrology, alienation of natural habitats and species, nutrient and chemical pollution, …*								

	eutrophication, biodiversity loss,....									
	Social & Economic Impacts Reduction in income of true residents (foreign investors gain), loss of livelihood (lives) during fish kills, price increase of associated commodities	(*identify the social & economic assets/values affected*) *Eg mangrove loss impacts on fish stocks, …*								
Eutrophication from coastal sources	*Environmental Impacts*: pollution of coastal waters and habitats, biodiversity loss, increase in pest species,..	**(***identify the assets/values from P1-P5 that are affected***)** *Eg Seagrass and corals affected by algal growth, algal blooms, etc*								
	Social & Economic Impacts Reduction of access to recreation and resources,	(*identify the social & economic assets/values affected*) *Eg reduction in navigable waterways, loss of subsistence fishing grounds, impacts on valuable fish*								

		species....								
Tourism islands and development s	*Environmental Impacts*: Litter, nutrients, boat scours, moorings, other development impacts, Biodiversity loss, coastal erosion, sewage, potable water, vectors of diseases	**(***identify the assets/values from P1-P5 that are affected***)** *Damage to seagrass beds, coral reefs, change in hydrology, smothering, turbidity, Exceeds island carrying capacity*								
	Social & Economic Impacts Transmitted diseases, acculturation, loss of identity (dignity), price increases, people/community displacement	(*identify the social & economic assets/values affected*)								
Marine Debris	*Environmental Impacts* Impacts on native species including mammals, reptiles and birds; impacts on	**(***identify the assets/values from P1-P5 that are affected***)**								

	fisheries foodchains, aquaculture systems, …									
	Social & Economic Impacts coastal amenity, fishery values, foreshore land values,..	(*identify the social & economic assets/values affected*)								
Power generation	*Environmental Impacts*: waste heat, radioactive wastes from accidents, habitat alienation from coastal infrastructure,..	**(***identify the assets/values from P1-P5 that are affected***)**								
	Social & Economic Impacts community shifts (from shifts in thresholds)	(*identify the social & economic assets/values affected*)								
Desalination facilities	*Environmental Impacts*: Hypersaline water, waste heat, waste nutrients,	**(***identify the assets/values from P1-P5 that are affected***)**								

	habitat alienation from coastal infrastructure,..									
	Social & Economic Impacts	(*identify the social & economic assets/values affected*)								
Foreshore protection with hard substrates	*Environmental Impacts:* Habitat conversion, enhanced erosion from hard substrates,..	**(***identify the assets/values from P1-P5 that are affected***)**								
	Social & Economic Impacts	(*identify the social & economic assets/values affected*)								
Mining	*Environmental Impact* Loss of habitat, slope stability and protection, biodiversity, low water quality, hazardous chemicals, ore spills	**(***identify the assets/values from P1-P5 that are affected***)**								
	Socioeconomic Impact	(*identify the social & economic assets/values*								

	Reduction of access to natural resources by local peoples, displacement of IPs, loss of ancestral domain, ..	*affected*)									

Appendix 4 Grading Statements

UNITED

NATIONS

Regular Process/WP.5

30.August 2012

Original: ENGLISH

Regional Scientific and Technical Capacity Building Workshop

on the World Ocean Assessment (Regular Process)

Bangkok, Thailand

17–19 September 2012

Grading Statements

This set of statements provides guidance and a basis for scoring and grading of the Indicators established to assess and report on the Parameters.

Marine Biodiversity *(this deals with the structural and functional aspects of biodiversity)*	
P1: Quality of Habitat for Species	*applies to habitat components and what is best understood about their status and trends expressed in terms of habitat quality for species*
Very Good (>7.5-10)	All major habitats are essentially structurally and functionally intact and able to support all dependent species
Good (>5-7.5)	There is some habitat loss, degradation or alteration in some small areas, leading to minimal degradation but no persistent substantial effects on populations of dependent species
Poor (>2.5-5)	Habitat loss, degradation or alteration has occurred in a number of areas, leading to persistent substantial effects on populations of some dependent species
Very Poor (0-2.5)	There is widespread habitat loss, degradation or alteration, leading to persistent substantial effects on many populations of dependent species
P2: Populations of Species and Groups of Species	*applies to the major structural components and what is best understood about their status and trends expressed in terms of populations and groups of species (abundance, size/age structure, geographic distribution); this includes threatened species which may be assessed by species or as groups of species*
Very Good (>7.5-10)	Only a few, if any, species populations have declined as a result of human activities or declining environmental conditions
Good (>5-7.5)	Populations of a number of significant species but no species groups have declined significantly as a result of human activities or declining environmental conditions

Poor (>2.5-5)	Populations of many species or some species groups have declined significantly as a result of human activities or declining environmental conditions
Very Poor (0-2.5)	Populations of a large number of species or species groups have declined significantly as a result of human activities or declining environmental conditions
P3: Ecological Processes	*applies to what is best understood about the status and trends (abundance, distribution, rates) in the main ecological processes and effects of human activities*
Very Good (>7.5-10)	There are no significant changes in ecological processes as a result of human activities
Good (>5-7.5)	There are some significant changes in ecological processes as a result of human activities in some areas, but these are not to the extent that they are significantly affecting ecosystem functions
Poor (>2.5-5)	There are substantial changes in ecological processes as a result of human activities, and these are significantly affecting ecosystem functions in some areas
Very Poor (0-2.5)	There are substantial changes in ecological processes across a wide area of the region as a result of human activities, and ecosystem function is seriously affected in much of the region

Marine Ecosystem Health *(this deals with the processes affecting biodiversity)*	
P4: Physical and Chemical Processes	*applies to what is best understood about the status and trends in the main physical and chemical processes (abundance, distribution, rates) as a result of human activities. The grading scale is based on a gradient in impacts of change.*
Little change/impact (>7.5-10)	There are no significant impacts of changes in physical or chemical processes as a result of human activities
Some change/impact (>5-7.5)	There are some significant impacts of changes in physical or chemical processes as a result of human activities in some areas, but these are not to the extent that they are significantly affecting ecosystem functions
Major change/impact (>2.5-5)	There are substantial impacts of changes in physical or chemical processes as a result of human activities, and these are significantly affecting ecosystem functions in some areas
Extreme change/impact (0-2.5)	There are substantial impacts of changes in physical or chemical processes across a wide area of the region as a result of human activities, and ecosystem function is seriously affected in much of the region
P5: Outbreaks of Pests, Invasive Species, Diseases and Algal Blooms	*applies to what is best understood about the status and trends in the main outbreaks (frequency, distribution, densities). These matters are considered here as symptoms of ecosystem health.*
Very Good (>7.5-10)	The incidence and extent of diseases and algal blooms are at expected natural levels, and there are insignificant occurrences or outbreaks of pests, and the numbers and abundance of invasive species are minimal
Good (>5-7.5)	Diseases or algal blooms occur occasionally above expected occurrences or extent, and recovery is prompt with minimal affect on ecosystem functions; pests sometimes present and have been found at levels above natural occurrences but with limited ecosystem impacts; the occurrence, distribution and abundance of invasive species are limited and have minimal impact on ecosystem functions
Poor (>2.5-5)	Diseases or algal blooms occur regularly in some areas above natural levels of occurrence or extent; occurrences of pests require significant intervention or have significant effects on ecosystem function; occurrence, distribution and abundance of invasive species trigger

	management responses, or have resulted in significant impacts on ecosystem functions
Very Poor (0-2.5)	Disease or algal blooms occur regularly across the region at unnaturally high levels; occurrences of pests or invasive species are uncontrolled in some areas and are seriously affecting ecosystem functions

Factors Affecting the Environmental Values: Pressures/Threats *(this deals with high level pressure/threat factors that are, or are likely, affecting the biodiversity and environmental values of the bioregion)*	
P6: Impacts on Environmental Values	*applies to what is best understood about the status and trends in the main factors affecting the biophysical environment*
Very Good (>7.5-10)	There are few or negligible current impacts from this factor, and future impacts on the environmental values of the region are likely to be negligible.
Good (>5-7.5)	There are minor current impacts in some areas, and future impacts from this factor on the environmental values of the region are likely to be minor and localised
Poor (>2.5-5)	The environmental impacts of this factor are currently significantly affecting the values of the region, and serious environment degradation is likely to occur within 50 years.
Very Poor (0-2.5)	The current and predicted environmental impacts of this factor are widespread, irreversibly affecting the values of the region, and widespread and there is serious environment degradation, or this is likely across the region within 10 years.
Impacts on Social and Economic Values	*applies to what is best understood about the status and trends in the consequences/importance of main pressure/threat factors affecting the social and economic values*
Very Good (>7.5-10)	There are few or negligible environmental current impacts from this factor, and future consequent impacts on the social or economic values of the region are likely to be negligible.
Good (>5-7.5)	There are minor current environmental impacts in some areas, and future consequent impacts on the social or economic values of the region are likely to be minor and localised
Poor (>2.5-5)	The environmental impacts of this factor are currently significantly affecting the social or economic values of the region, and serious degradation is likely within 50 years.
Very Poor (0-2.5)	The current and predicted environmental impacts of this factor are widespread, irreversibly affecting the social or economic values of the region, and there is widespread and serious further degradation and impacts, or this is likely across the region within 10 years.