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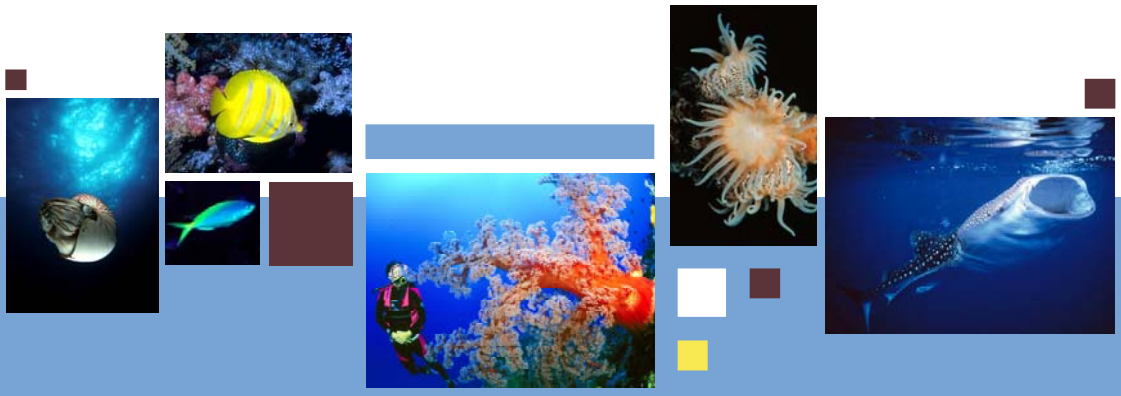

Threatened Marine Ecological Communities Workshop Report

September 7th & 8th, 2009
Canberra

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Final Report - Outcomes of the Marine Ecological Communities Workshop (7-8 September 2009)

1. Purpose

To present a summary of the outcomes of a workshop regarding the definition and assessment requirements for listing marine ecological communities (MECs) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2. Background

The EPBC Act provides for the listing of all threatened ecological communities in the Australian jurisdiction. A model for assessing and listing terrestrial based ecological communities is in place and is well tested. A similar model for dealing with freshwater aquatic ecological communities is under development and work on developing a model for dealing with marine based ecological communities is now underway.

A vital aspect of the process for assessing a threatened ecological community for potential listing under the EPBC Act is the interpretation and assessment of the listing criteria contained in the *Environment Protection and Biodiversity Conservation Regulations 2000* (the Regulations) (Reg. 7.02). The six criteria were adapted from international guidelines for threatened species (IUCN) and cover elements of an ecological community's conservation status. The criteria determine under which category an ecological community is eligible to be listed (Critically Endangered, Endangered or Vulnerable).

Additional explanation for the application and interpretation of the criteria is contained in the 'Guidelines for ecological community nominations for listing, changing the status or delisting under the EPBC Act[1]' (the Guidelines). The Guidelines provide indicative thresholds for each of the categories for each of the six criteria. For example, under Criterion 1 (decline in geographic distribution), for an ecological community to be listed as critically endangered it must have declined by ≥ 95% of a former known distribution. The Guidelines also present key concepts relevant to the description and assessment of threatened ecological communities e.g. problems of scale, relevant timeframes, condition and dealing with uncertainty.

The focus of EPBC Act listing activity to date on terrestrial, largely vegetation-based, ecological communities has meant that the listing criteria and how they are interpreted (through the Guidelines) have not been tested and applied to other types of environments (e.g. marine and some types of freshwater aquatic communities). The nomination of several wetland/river systems and marine ecological communities in the last two years has highlighted the need to ensure the criteria and Guidelines are capable of dealing with these systems.

Of the two MECs recently nominated for listing as threatened under the EPBC Act – the Port Phillip Bay Deep Canyon Marine Community and the Giant Kelp Forests of the East and South Coasts of Tasmania, the Giant Kelp ecological community has been prioritised for assessment and the assessment completion date is set at 31 March 2012. Consequently, work to test the current listing criteria and Guidelines for use on MEC assessments can be now be done using a working example.

[1] Available on the internet at: http://www.environment.gov.au/biodiversity/threatened/pubs/nominations-form-ecological.doc

3. Process

A workshop was held on 7-8 September 2009 by the Department of the Environment, Water, Heritage and the Arts (the department) and the Threatened Species Scientific Committee (the Committee) to bring marine scientists and other experts from across Australia together to examine how, from a technical point of view, MECs can be defined and assessed under the EPBC Act.

Delegates included experts from CSIRO, Geoscience Australia, universities, Australian Institute of Marine Science (AIMS), Department of Agriculture, Fisheries and Forestry, Bureau of Rural Sciences, consultants and representatives from the department.

A discussion paper was prepared and circulated to workshop delegates as a prelude to the workshop. It aimed to introduce key concepts of listing ecological communities under the EPBC Act and to highlight some of the potential challenges in assessing MECs for listing.

The discussion paper identified a number of potential issues that may need to be considered when applying the criteria and guidelines to MECs and these formed the focus of workshop discussions. The key questions addressed were:

- How should MECs be defined for the purposes of assessment under the EPBC Act?
- Are there any specific MECs that should be considered a high priority for listing?
- How applicable are the current listing criteria and guidelines for assessing MECs under the EPBC Act and what changes (if any) are required?
- Are existing data sufficient for assessing MECs for listing under the EPBC Act? If not, what alternatives are available to ensure listing criteria can be met?

In recognition that different marine environment types might pose different opportunities and challenges for EPBC Act assessment, breakout groups based upon broad environment types (deep-sea and pelagic; intertidal and reef; and other benthic) were used to explore each of the above areas. Five breakout sessions were held with each group, which focussed on defining MECs and analysing the listing criteria by addressing specific questions (see Table 1). Delegates assigned themselves to the breakout group they had greatest expertise and/or interest in.

A session was also held to specifically explore how the listing criteria might be applied to the nominated Giant Kelp Forests of the East and South Coasts of Tasmania ecological community. This was undertaken using 6 small groups of approximately 6 people. Each group was asked to apply each of the listing criteria to the nominated ecological community.

Plenary sessions were held before each set of breakout sessions which provided introductory presentations on key concepts, followed by open discussion. This included a presentation by Professor Nic Bax on the 'Azores Principles'[2], scientific criteria and guidance for identifying ecologically or biologically significant marine areas and designing representative networks of marine protected areas in open ocean waters and deep sea habitats. A panel session was also held after each breakout session. Discussions at the workshop focused on the technical issues regarding the listing of MECs, as rigorous science is the fundamental basis for ensuring the usefulness and effectiveness of legislative protection. Issues relating to the implications of listing and management of listed entities were not discussed at the workshop although some elements were introduced.

[2] Available on the internet at: http://cmsdata.iucn.org/downloads/cbd_azores_marine_bro_04.pdf

Table 1. Breakout sessions and questions addressed by each breakout Group.

Breakout session 1 – Defining Marine Ecological Communities
Breakout Groups: (1) deep-sea and pelagic (2) intertidal and reef (3) benthic
Questions: A) What are the physical and biological parameters needed to accurately define your group of MECs (e.g. benthic MECs)? B) How do you determine the national extent of these MECs C) What are some examples from your group of MECs which you consider to be priorities for EPBC Act protection? (keeping in mind they must be on a national scale and not already receiving effective protection)
Breakout session 2 – Analysis of Criterion 1
Breakout Groups: (1) deep-sea and pelagic (2) intertidal and reef (3) benthic
Questions: A) Does this criterion 'work' for your group of MECs? B) What are the challenges/impediments/ issues for applying the criterion to marine systems? C) How can the criterion and/or guidelines/ thresholds be adapted to better capture your MECs? D) How do we best measure the criterion in marine ecosystems? E) What data are currently available to assess against this criterion for your MECs
Breakout session 3 – Analysis of Criterion 2
Breakout Groups: (1) deep-sea and pelagic (2) intertidal and reef (3) benthic
Questions: A) Does this criterion 'work' for your group of MECs? B) What are the challenges/impediments/ issues for applying the criterion to marine systems? C) How can the criterion and/or guidelines/ thresholds be adapted to better capture your MECs? D) How do we best measure the criterion in marine ecosystems? E) What are the key threats to your MECs? F) What data are currently available to assess against this criterion for your MECs
Breakout session 4 – Analysis of Criteria 3 and 4
Breakout Groups: (1) deep-sea and pelagic (2) intertidal and reef (3) benthic
Questions: A) Do these criteria 'work' for your group of MECs? B) What are the challenges/impediments/ issues for applying each criterion to marine systems? C) How can each criterion and/or guidelines/ thresholds be adapted to better capture your MECs? D) How do we best measure each criterion in marine ecosystems? E) What data are currently available to assess against these criteria for your MECs?
Breakout session 5 – Analysis of Criteria 5 and 6
Breakout Groups: (1) deep-sea and pelagic (2) intertidal and reef (3) benthic
Questions:
A) Do these criteria 'work' for your group of MECs? B) What are the challenges/impediments/ issues for applying each criterion to marine systems? C) How can each criterion and/or guidelines/ thresholds be adapted to better capture your MECs? D) How do we best measure each criterion in marine ecosystems? E) What data are currently available to assess against these criteria for your MECs?
Group session – Application of listing criteria to the Giant Kelp Forests of the East and South Coasts of Tasmania nominated ecological community
Groups: 6 table groups of mixed delegates.
Questions: A) Can the current six listing criteria (including the indicative thresholds contained in the Guidelines) be applied to the Giant Kelp Forests of the East and South Coasts of Tasmania nominated ecological community? B) If not, what new thresholds can you suggest? C) Where are the data gaps & how can we fill them? *Also consider how giant kelp's inter-annual flux, ability to regenerate, patch sizes, connectivity/viability and data quality affect the application of the criteria to the nomination.*

4. Outcomes

The workshop was attended by 36 delegates and all contributed actively to breakout group discussions. There was also significant engagement by delegates during panel sessions and following the plenary presentations.

Overall, the results of the breakout sessions and the group work on the nominated Giant Kelp Forests of the East and South Coasts of Tasmania ecological community have provided the department and the Committee with sufficient material to pave a way toward assessing MECs under the EPBC Act. The following sections provide an analysis of the outcomes of each workshop activity and highlight key issues discussed in the plenary sessions. A summary of the results for each breakout group and the group work on the Giant Kelp nomination are provided at Appendix 1.

4.1 Defining marine ecological communities

Defining the ecological community is the most important part of the assessment process when considering an entity for listing under the EPBC Act. The definition must clearly set out what is protected under the legislation. It needs to be clearly explained in a way that is meaningful from an ecological sense and in a manner that allows identification of the ecological community *in situ*. It shouldn't be ambiguous and should clearly distinguish it from other ecological communities that may be associated with it.

When defining ecological communities for the purpose of listing under the EPBC Act the full geographic extent of the ecological community in Australia also needs to be described. Describing the national extent ensures that all occurrences of the ecological community, regardless of administrative boundaries, are captured by the definition and therefore afforded national protection.

Each of the three breakout groups ((1) deep-sea and pelagic; (2) intertidal and reef; and (3) benthic) were set the task of answering specific questions regarding how their group of MECs (e.g. benthic MECs) could be best defined and described. There was significant agreement between groups on key elements required to accurately define MECs for the purpose of listing. There were also particular issues that need to be considered for specific groups of MECs.

It was agreed by all groups that both biological and physical characteristics need to be described (where they are known) for each individual MEC and that these would be unique to a given MEC. It was noted that physical parameters tend to drive the biotic components of an MEC.

A common recommended approach was to define dominant or characteristic species (or assemblages or taxonomic groups) and to then build on the MEC definition by describing its physical characteristics. It was noted however that there may be some MECs for which biotic information is poor and definitions based primarily on physical characteristics may be more appropriate in such cases. Common physical characteristics that may be important in defining individual MECs included depth, substrate, geomorphology, temperature, water velocity and flow, dominant currents, acidity, salinity, light penetration, nutrient levels and the presence of upwellings or eddies.

There was agreement that using bioregions to describe national extent (e.g. by referring to IMCRA) was a practical approach. The use of surrogates and modelling was also discussed as a potential predictive tool for defining the national extent of MECs.

The breakout groups discussed a number of challenges for defining MECs. It was generally agreed that the spatial change in environments can be gradual, subtle and complex; the interactions of organisms can be unknown or poorly understood; and the physical, chemical and biological

determinants of an ecological community can be difficult to define. Boundaries are inherently blurred by marine systems (e.g. through local and large scale currents, temperature and nutrient gradients and the non-sedentary nature of vast numbers of organisms) and the level of 'community' scale information is often much less for marine communities compared to terrestrial ones.

A common challenge identified was how to take account of species or structural differences across the geographic range of an individual MEC. For example, with MECs in the pelagic zone there is considerable challenge in determining the boundaries of a MEC where there is active spatial movement of some organisms to exploit food resources or habitats (e.g. migratory species), where currents move other species from place to place (e.g. jellyfish) and where temporal changes in water temperature and currents affect the MEC.

4.2 Criteria analyses

The breakout sessions used to analyse the individual listing criteria worked well. Five breakout sessions for each of the marine environment groups (deep-sea and pelagic; intertidal and reef; and benthic) were used to look at Criterion 1, Criterion 2, Criteria 3 and 4 and Criteria 5 and 6. While not all of the set questions were always answered by each group, the report back session that followed each breakout session provided additional material that supplemented recorded responses.

4.2.1 Criterion 1 analysis: decline in geographic distribution

Criterion 1 aims to measure the impact of past events on the extent/area of the ecological community. For terrestrial ecological communities, assessments often (but don't have to) compare current extent with estimates of pre-European extent of vegetation.

There was general consensus between breakout groups that Criterion 1 could be applied to some, but not all, MECs. For all MECs, the availability of historical baseline data was considered a potential challenge. It was also noted that the spatial definition (national extent) of the MEC would need to be very clear and that natural variability of some marine systems needs to be understood and taken into account when assessing against this criterion.

Two main concerns with the indicative thresholds for Criterion 1 contained in the Guidelines were discussed. The first concern was that the existing thresholds are set too high (e.g. a 95% decline in extent is required to trigger the Critically Endangered category and this may be beyond the potential point of recovery of some marine communities). The second concern was that appropriate thresholds will vary between different MECs due to the variable life history characteristics of marine organisms and the inherent variability of some marine communities. It was suggested that appropriate thresholds may need to be determined on a case-by-case basis.

4.2.2 Criterion 2 analysis: small geographic distribution coupled with demonstrable threat

Criterion 2 provides for the listing of ecological communities that have a small geographic distribution and for which a threatening process exists within a given timeframe. It recognises that a small ecological community has an inherently greater risk of extinction if it is subject to a threatening process.

Criterion 2 was found by all groups to be applicable to many MECs. Some specific examples of inherently small or restricted MECs for which the criterion would be most relevant were provided (e.g. intermittently closed and open lagoons (ICOLs), seamounts and some benthic faunal communities). Pelagic MECs were found to be less amenable to assessment under this criterion due to their more broadly defined and spatially variable nature.

Consideration of the indicative thresholds contained in the Guidelines found that the thresholds may need to be changed to accommodate MECs. Thresholds and threats were also likely to be difficult to quantify due to general data deficiency of many marine systems.

The concepts of fragmentation and connectivity, which are addressed under this criterion when considering patch size distribution of an ecological community, were found to be potentially problematic for MECs. Fragmentation can be a positive characteristic of many MECs due to the high degree of connectivity in the marine environment provided by oceanic and local currents. For example, a MEC that is threatened by invasive species may be more resilient if it exists in a large number of small, fragmented patches (as opposed to a single patch or small number of localised patches) because of the decreased likelihood of the invasive species establishing in all patches of the community. It was suggested that 'small geographic distribution' needs to be re-defined to accommodate assessment of MECs.

The breakout groups also identified some ways of measuring the information required to assess MECs against this criterion. They also provided examples of key threats likely to impact on a range of MECs.

4.2.3 Criteria 3 and 4 analysis: loss or decline in functionally important species and reduction in community integrity

Criterion 3 refers to native species that are critically important in the processes that sustain or serve a major role in the ecological community, and whose removal would potentially precipitate a negative structural or functional change that may lead to extinction of that ecological community. The criterion has two inseparable components for assessment: there must be a decline in the population of the functionally important species, and restoration of the ecological community is 'not likely' to be possible within a specified threshold timeframe. The decline of the functionally important species must be halted or reversed to ensure continuation of the ecological community.

Criterion 4 recognises that an ecological community can be threatened with extinction through on-going modifications that do not necessarily lead to total destruction of all elements of the community. Changes in integrity can be measured by comparison with a benchmark state that reflects the 'natural' condition of the ecological community with respect to its abiotic and biotic elements and processes that sustain them. The criterion recognises detrimental change to component species and habitat, and to the processes that are important to maintain the ecological community. The regeneration aspect of thresholds relates to re-establishment of an ecological process, species composition and community structure within the range of variability exhibited by the original community.

Criteria 3 and 4 were considered by the breakout groups in one session. Combining these criteria in the workshop allowed for similar concepts such as functionality and integrity to be discussed and demonstrated the similar way in which these two criteria and thresholds are applied.

All breakout groups found that Criterion 3 could be applied to MECs where functionally important species could be demonstrated (e.g. dominant sea grass species in seagrass communities, coral species or groups on coral reefs, krill in certain pelagic communities). The groups agreed that data to demonstrate decline in the functionally important species would be required to meet the criterion which may be available, but taking account of natural variability in species abundance or distribution may be a challenge. It was also noted that restoration timeframes as well as generation times may not be known for functionally important species and this could affect the ability of an MEC to meet this criterion.

Groups agreed that Criterion 4 could, in theory, be applied to many MECs because they are significantly impacted by a range of threats. The ability to demonstrate the impact of such threats

and any consequent reduction in the integrity of the ecological community may be relatively easy for some MECs (e.g. seamounts impacted by trawl fishing) but it is likely to be challenging for most. Lack of baseline data and, in many cases, a lack of understanding of how the ecological processes in the MEC work, may hinder assessment under this criterion.

For both Criteria 3 and 4 all groups noted that knowledge of the species which compose the MEC, understanding of natural variation, and understanding of the interrelationships and functional importance of species and processes are required to demonstrate that the criterion has been met. Groups also noted that data deficiency will hinder the ability to validate assumptions about natural variability and recovery timeframes. It may also prevent there being an accurate baseline to measure from.

The indicative thresholds contained in the Guidelines were again thought to require careful treatment and possible revision for MECs on a case-by-case basis. They were found to be too prescriptive for open systems such as those in the marine environment. The concept of generations and generation times (as referred to in the Guidelines) was also found to be problematic for applying Criteria 3 and 4. The high variability in life histories of marine organisms posed challenges, making the broad timeframe based thresholds difficult to apply. One suggested approach was to use a 'risk assessment' process rather than the threshold approach as it may be more capable of taking anthropogenic influences into account. For Criterion 3, it was suggested that the term 'recovery of function' be used instead of 'restoration' because restoration implies some form of human intervention despite the Guidelines requiring that it is independent of human intervention.

A range of examples were given by each group of how to measure Criteria 3 and 4 in MEC's and data availability. However, it was noted that much of the information required may be costly to acquire or access.

4.2.4 Criteria 5 and 6 analysis: rate of continuing detrimental change and quantitative analysis showing probability of extinction

Criterion 5 deals with the rate of continuing detrimental change in an ecological community. Continuing detrimental change refers to a recent, current or projected future change for which the causes are not known or not adequately controlled, and so is liable to continue unless remedial measures are taken. Detrimental change may refer to either i) geographic distribution or populations of critically important species, or ii) degradation or disruption of an important process. The detrimental change can be observed, estimated, inferred or suspected. Natural fluctuations do not normally count as continuing change, but an observed change should not necessarily be considered to be part of a natural fluctuation unless there is evidence for this. 'Ecological judgement' or a heuristic approach may be exercised to apply this criterion if adequate data are not available.

Criterion 6 can include any form of analysis that estimates the extinction probability of an ecological community based on known characteristics of: important species or components, habitat requirements, ecological processes, threats, and any specified management options. The Committee recognises that this is an emerging area of science and will examine any acceptable modelling (with the concomitant use of peer review).

These two criteria were considered by the workshop in a single breakout session in recognition that historical application of these criteria in the terrestrial environment has shown that they are difficult to apply. The challenge in applying these criteria to terrestrial environments is a lack of data to provide sufficient evidence that an ecological community is eligible for listing.

All groups agreed that there is scope for Criterion 5 to be successfully applied to MECs and that, in some cases, it may be easier to apply than other criteria. This is primarily because long time series data for marine systems that are required for most other criteria is frequently unavailable but more recent data and modelling showing recent and predicted changes can be easier to obtain.

There was also agreement between the breakout groups that there are challenges to applying Criterion 5 to MECs, such as the quality of data available (baseline and ongoing monitoring) and the possibility of using surrogates. Commercial fishing data was suggested as a potentially useful source of information to use when assessing this criterion.

All groups indicated that it may be possible in some circumstances (such as where there is a functionally important species which could be used as a proxy/surrogate) to apply Criterion 6 to MECs. Suggestions included using a population viability analysis approach.

Common challenges in the application of Criteria 5 and 6 included data availability and the ability to take account of natural variability in individual MECs. It was noted that species knowledge, monitoring and mapping are basic assessment requirements but there may be a lack of these data available for MECs.

A number of suggestions were made to improve the applicability of Criteria 5 and 6 to MECs. It was suggested that the wording of Criterion 5 be revised to take into account that a downward trajectory of a number of species is possible as the current wording doesn't appear to allow for this event to be acknowledged. It was also suggested that the Guidelines should better take into account the susceptibility of a MEC to decline and its potential for recovery. One group also questioned if the current thresholds in Criterion 6 are applicable to MECs. It is likely that these would need to be examined on a case-by-case basis.

A range of examples were given by each group of how to measure Criteria 5 and 6 in MEC's and of key available data. Commercial fisheries data and observer data from seismic surveys and offshore oil platforms were suggested as potential information sources but that caution should be exercised when interpreting such data in terms of their accuracy and level of specificity. The use of modelling was considered by the groups to provide significant potential benefit in relation to assessments against Criterion 6.

4.3 Application of listing criteria to the Giant Kelp Forests of the East and South Coasts of Tasmania nominated ecological community

A nomination to list the Giant Kelp Forests of the East and South Coasts of Tasmania as a threatened ecological community under the EPBC Act was received in March 2009. In August 2009 it was included on the Finalised Priority Assessment List set by the Minister for Environment Protection, Heritage and the Arts with an assessment completion date of 31 March 2012. It therefore presented an excellent opportunity to the workshop for testing the application of the listing criteria and Guidelines to an active MEC nomination.

Two introductory presentations were delivered to delegates. The first presentation outlined the history and major components of the nomination. The second presented new material about the distribution of the dominant species in the ecological community (*Macrocystis pyrifera* – giant kelp) showing a broader global extent of the species. Six groups of delegates then applied each criterion to the Giant Kelp ecological community.

It was noted that the new information about a global *M. pyrifera* distribution has implications for determining the national extent of the ecological community given the nomination is only for the south and east coasts of Tasmania. If the full distribution within the Australian jurisdiction is to be

considered then the ecological community may extend more broadly to southern Australian waters (e.g. Victoria, South Australia). The new distribution information created uncertainty in the applicability of the extent and decline data presented in the nomination for assessing Criteria 1 and 2. Consequently, some groups chose to apply the listing criteria to the ecological community as nominated (i.e. just the Tasmanian extent) while other groups applied the criteria to the broader southern Australian extent.

4.3.1 Criterion 1 – decline in geographic extent

There was consensus between the groups that this nomination has the potential to be eligible for listing under Criterion 1 but that data are currently not clear enough to present a coherent case. This conclusion was irrespective of the doubt surrounding the national extent of the ecological community as it is presented in the nomination.

Groups determined that, depending on which figures of decline are used (as various estimates of decline are presented in nomination), a figure of up to 89% decline could be demonstrated and the ecological community may therefore be eligible for listing as vulnerable or endangered under this criterion. However, if national extent is extended to beyond Tasmania (as indicated by as yet unpublished taxonomic investigations) then the ability to trigger under this criterion may be further hindered (i.e. increased extent but unknown decline of entire range). It was agreed that this is an issue which needs to be resolved. It will depend largely on the importance of particular kelp height and density in defining the ecological community.

It was suggested that the indicative thresholds associated with this criterion be lowered as even a decline of 65% across the range of the ecological community (as some data in the nomination suggest) would be significant. Using these figures and the current thresholds the ecological community wouldn't meet the requirements for listing under this criterion.

The groups noted that it is also vital to understand the natural characteristics of the dominant species which has a known inter-annual fluctuation in range i.e. is an observed decline simply part of its natural cycle? Other factors (e.g. threats) that could indicate that the variation is not part of a natural cycle would need to be identified or ruled out.

4.3.2 Criterion 2 – small geographic distribution coupled with demonstrable threat

It was determined that using the current indicative thresholds the ecological community probably meets the 'restricted' (and possibly 'very restricted') distribution requirements if only the Tasmanian distribution of *M. pyrifera* is taken into account. This would make it eligible for listing as endangered or critically endangered. It is possible that assessment would show that the ecological community has only a 'limited' (possibly restricted') geographic distribution if the broader *M. pyrifera* was used.

It was noted that 'small geographic distribution' may need to be re-defined to accommodate assessment of MECs. Specifically, patch size as a determinant of restricted distribution may be problematic because fragmentation in the marine environment may be a positive indicator of survival/dispersal rather than an indicator of negative levels of disturbance. It may also be a benefit in providing resilience to certain threats (e.g. invasive species).

The second component of the criterion, demonstrating threat and its impact on potential loss of the ecological community, was also tested and sufficient evidence was thought to be available. Climate change was considered by the majority of groups to be a real threat to this MEC. It was noted that threats can be compounding i.e. the assessment doesn't have to just look at individual threats and

their impacts but can make a case for combined effects of threats (e.g. climate change, urchins, Japanese kelp etc.).

4.3.3 Criterion 3 – decline in functionally important species

There was general consensus that this criterion could trigger at a minimum level of Vulnerable based on the documented decline in *M. pyrifera*. *M. pyrifera* is the structurally dominant, canopy forming species in the community and provides substrate, food and shelter for many other species. However, it was noted that more information is required on the restoration and recovery potential of the dominant species and associated timeframes. Some questions were also raised about the appropriateness of the timeframes and percentages in the current indicative thresholds for assessing a kelp dominated ecological community; although no suggested changes were offered.

4.3.4 Criterion 4 – reduction in ecological community integrity

Most groups found that it is likely that the requirements for listing under this criterion could be easily met for at least the Vulnerable category when examining the ecological community as nominated (i.e. Tasmanian distribution of *M. pyrifera* only). This may also be the case if the broader extent is taken into account as the threats are similar but additional information would be required.

As noted above under Criterion 3, the structural function that *M. pyrifera* provides in the ecological community can be clearly demonstrated and the impacts of key threats (e.g. urchin grazing, exotic kelp species invasion and possibly climate change) on the dominant species are also well documented. A case for listing could be made simply on the basis of loss of structural integrity of the ecological community. It was noted however that more information is required about the natural variability and restoration potential of *M. pyrifera*.

4.3.5 Criterion 5 – rate of detrimental change

It was suggested that this criterion could be triggered and the ecological community be eligible for listing in the vulnerable category by inferring from data (Tasmania only) a 10 ha/year decline over 50 years and the expected continuation of threats. However, it is unknown if sufficient data exists to trigger the criterion if the broader extent of the dominant species is taken into account. It was noted that a reference point for measuring the rate of decline is required and there may not be sufficient data across the full range of the EC.

4.3.6 Criterion 6 – probability of extinction or extreme degradation

All groups agreed that there is currently insufficient information to meet the requirements of this criterion. It was noted that modelling may prove useful in the future but that none are currently known.

5. Overall summary and next steps

When considering all of the results for each workshop activity and the plenary discussions a number of broad outcomes are apparent. The overall feeling of delegates by the end of the workshop was positive with most seeing that listing MECs under the EPBC Act was both possible and beneficial.

The following broad outcomes are noted:

- Common biological and physical characteristics to be used in defining MECs can be identified but national extent and taking into account the high degree of connectivity in marine systems will be important.

- The listing criteria were, in general, broadly applicable to MECs but some minor amendments to criteria wording are suggested (e.g. to Criterion 3).
- The indicative thresholds for each criterion require careful application to MECs and are likely to require revision or amendment to fully accommodate assessment of MECs.
- The open nature of marine systems, in particular the high degree of connectivity provided by oceanic and localised water currents, can pose significant challenges to assessing MECs.
- Understanding and taking into account the natural variability of individual MECs will be important for assessing each of the criteria.
- The availability of data, in particular historical or baseline data, are likely to be limiting factors in the ability of most individual MECs to meet most criteria.
- There is a general perception that the guidelines need to be better able to deal with uncertainty as this is inherent in the marine science sphere.
- There is interest in following the development and application of the Azores Principles as a potential future tool to aid MEC assessment under the EPBC Act.
- The definition, particularly national extent, of the Giant Kelp ecological community requires clarification before assessment against the criteria can be completed.
- The Giant Kelp ecological community may meet the requirements for listing under the EPBC Act in at least the Vulnerable category.

A number of the above workshop outcomes suggest that amendment to the listing and/or Guidelines may be required to ensure that MECs can be adequately assessed for listing under the EPBC Act. However, the department believes that amendments to the listing criteria are unlikely to be necessary as the concerns and challenges noted by workshop delegates could be accommodated by amendments to the wording of the Guidelines. This would avoid the need for legislative change and could be dealt with as an administrative and policy measure by the Committee.

The primary concern that amendments would need to address is the appropriateness of the quantitative thresholds contained in the Guidelines. It is unlikely that new thresholds could be determined given the vast range of MEC types, making a general set of quantitative MEC thresholds impossible. The issue could be addressed however by altering the wording of the Guidelines to make it clearer that where existing quantitative thresholds are not appropriate others may be used if a rigorous case can be presented. Marine related examples of how key concepts could be applied to MEC assessments would also be a useful addition to the Guidelines.

Noting the outcomes listed above, the Department and Committee will ensure that MECs can be adequately assessed for listing under the EPBC Act through a process of amending the Guidelines. In addition, as the assessment of the Giant Kelp ecological community progresses and as assessments of any new MECs are undertaken it is expected that amendments and incorporating MECs into listing processes will be an iterative process that is refined over time.

Appendix 1

Collated responses for all breakout sessions and group work

Definition of MEC			
	Benthic	**Intertidal & Reef**	**Deep-sea & Pelagic**
Question A : What are the physical and biological parameters needed to accurately define your groups of MEC's?	• Species • Depth • Latitude • Water temperature/flow etc • Tides, tidal currents • Scale – temporal & spatial • Geomorphology • Uniqueness • Degree of disturbance • Ecological function • Presence of 'boundaries' & how 'hard' they are • Bioregions (scale) <u>Examples of Benthic MEC's:</u> seagrass systems, MPB Micro phyto benthos, filter feeding beds (worm beds), mangroves, corals, soft sediment communities, rhodoliths, sponge gardens, flat platform reefs	Biology most important Dominant species generally used to define at first level (biotic components): • Composition • Species groups and assemblages • Taxonomic groups Then refine that using: • Latitude (temperature & variability driven by currents) • Depth • Water movement • Substrata/particle size • Salinity Also useful: • Region • Phylogeny • Population structure • Biogeography and history • Water quality	Questions in coming to a definition: • Does 'community have to be a place or a space? • Can we draw lines around the assemblages, not just locations? • What makes up the 'critical habitat' for communities (e.g. upwellings)? • Benthic – substrate characteristics, focus on species protection • Pelagic – trophic value Defined by physical and biological characteristics • Geomorphology • Depth • Current • Substrate, exposed substrate • Hydrocarbon vents • Acidity • Light penetration • Temperature • Habitat forming life • Food source • Fronts • Nutrients • Trophic structure • Ratio of predators • Key foraging areas

Question B How do you determine the national extent of these MEC's?	• Depends on how well we can answer Question A • Broadscales (e.g. remnant *Posidonia* NSW coast, but can't for example scale-up to tropical/temperate seagrasses) vs. discrete/disparate MEC's (e.g. Westernport infauna) • Physical parameters • Bioregions → extent within & between	• Species differences • Structural differences • & make sure they are reflected in the definition. • Existing mapping useful	• More $$ required for mapping • Ensure use of the new Marine & Climate Super Science Initiative • National representative marine areas. • IMCRA • Key population centres. • Geographic representation. • Potential habitat maps – depth range, temperature range, substrate type, so can predict community location.
Question C What are some priority examples?	• Seagrasses esp. *Posidonia* (small, fragmented patches on NSW coast) • Port Phillip Bay soft benthos • Westernport Bay infauna • Gulf St Vincent soft-sediment fauna	• Problems for assessment but important for protection = intertidal MECs (e.g. rock platforms) • Saltmarshes – increase in diversity as move away from equator, mangroves taking over, nowhere to retreat to (Peter Bridgewater an expert) • Mangroves – temperate mangroves under most threat • Marine coastal lagoons (ICOL – intermittently closed/open lakes/lagoons) • Coral reefs – tropical shallow & sub-tropical reefs • Shellfish reefs - see nature conservancy report – global assessment (Australia = native oyster) • Slope reefs - sub scuba area (e.g. coral sea) • Supralittoral beach wrack communities • Stromatolites in Shark Bay • Seagrasses • Tropical estuaries • Kelp beds • Groundwater fed beach springs (connected to an unconfined aquifer).	• Sea mounts & associated cold water coral communities, also the community associated with the open water column above and adjacent to the sea mount. Sea mounts are a subset of exposed rock/escarpment/undersea & mid-slope ridges • Canyon Heads and shelf incising submarine • Exposed Hard Substrate • Stalked crinoids, basketwork eels, • Hydrocarbon Vents & associated seep communities • Possibly methane vents where rapid accumulation of sediments e.g. offshore from Perth and the LHI rise • Possibly hydrothermal vents near Macquarie and Heard islands • Key foraging areas of certain species • Epi- & Meso-Pelagic Communities e.g. associated with upwellings, annual eddies or sea mounts aggregations • Abyssal plain • Communities defined by current activity (which is predictable enough) e.g. SEA current) • Disruption of the pelagic vertebrate community (and therefore the ecosystem) through the removal of high order predators such as sharks and tuna

Criterion 1			
	Benthic	**Intertidal & Reef**	**Deep-sea & Pelagic**
Question A: Do these criteria 'work' for your group of MECs?	• Yes for select ECs, may be applied to other ECs in future as more data becomes available. • Threshold figures? – 95% too high. Not possible to quantify. Consider specific context for each case (eg different sea grass ECs). Will this reduce impact of case?	• Could work • BUT national extent may not be clear in definition • Some MECs may actually increase in size (e.g. mangroves extending their range) • Would work particularly well for saltmarsh • May also work for ICOLs • Won't work for intertidal rock platforms	Need to be careful/aware of natural variability. How to account for this? Also that whole communities of pelagic fish may move in response to climate change, boundaries may not be appropriate • Decline in Distribution Pelagic communities • Not really, unless fishery independent data is available. • Also assumes there is a boundary – less useful a criterion for a motile group of species – no boundaries. • Natural variability in migratory paths can confound, also shifting communities due to climate change effects Deep Benthic communities • Yes, but challenge to get data to measure • Don't like the numbers, thresholds don't apply, concept does, but risk assessment a better approach. • Don't have the data to know what the threshold is • Yes they can be applied, you need time-space data to capture decline in range esp. for pelagic, mobile spp • Bioregion listing may work better in marine environment. • Pelagic is a 3 dimensional picture – depth and horizontal. • Corals and sedentary systems, very similar to terrestrial systems.

Question B:
What are the challenges/impediments/ issues for applying each Criterion to marine systems?
	• Historical Data
	• Scale
	• Need good quality nominations (backed by research/data)
		• How much do you rely on models? Can they be validated?
		• Need to be very clear about how you define the national extent. e.g. saltmarsh occurs around the country but not threatened in the north, highly threatened in NSW.
		• Lots of specimens in museums awaiting identification – a huge potential resource for looking at distributions - Taxonomic impediment.
		• Historical Dimension
			• Pelagic
			  • Need to consider oceanographic changes that may cause communities to shift spatially
			  • Need to include bathymetry
			• Deep Benthic
			  • Data deficient
			  • Thresholds don't apply well to marine, although concept of thresholds is good
			  • Bathymetric definition

Question C: How can each criterion and/or guidelines/ thresholds be adapted to better capture your MECs?	• Critically Endangered: 95% decline figure is too high but figures may be possible on a case by case basis, depending on community, e.g. different sea grass EC's	• The numbers (%'s in thresholds) need attention	No responses recorded
Question D: How do we best measure each criterion in marine ecosystems?	• Time series samples • Needs to be an EC that is well studied	• Biophysical models are coming • Which surrogate is crucial (some perform poorly) • Extend aerial photography etc. back in time?	No responses recorded
Question E What data are currently available to assess against these criteria for your MECs	No response recorded	• Historical records (aerial photography, satellite imagery, museum records) → need $ to unlock! • Historical reconstructions	No responses recorded

Criterion 2			
	Benthic	**Intertidal & Reef**	**Deep-sea & Pelagic**
Question A: Do these criteria 'work' for your group of MECs?	• Yes, e.g. Westernport Bay Vic (North Arm Benthic Fauna) • Spencer Gulf Cuttlefish	• Yes – More 'do-able' than Criterion 1 • Would work for small things – ICOLs (depending on how it is defined), stromatolites	Threat & Small Distribution a. Pelagic i. Yes if part of range is restricted to particular sites e.g. foraging or breeding, some sort of aggregation of a community of organisms, not just a species ii. Generally doesn't work for pelagic b. Deep Benthic i. Sea mounts - yes

Question B: What are the challenges/impediments/ issues for applying each Criterion to marine systems?	• Scale – bioregional approach? At this stage based on fish & benthic
	• Quantifying threats
	• Levels of uncertainty.
		• Critical areas les likely for marine
		• Thresholds
		• Need to bring in notion of fragmentation (and role of connectivity in marine system – it's a different issue for MECs)
			• Pelagic
			  • Hard to define spatially
			• Deep Benthic
			  • Data deficient
			  • Thresholds difficult to quantify

Question C: How can each criterion and/or guidelines/ thresholds be adapted to better capture your MECs?	No Responses recorded	• Numbers (1000ha etc) need attention • Bring in fragmentation too	No responses recorded

Question D: How do we best measure each criterion in marine ecosystems?	• Time series sample • Needs to be well studied area (nominator needs to provide evidence /research)	• Inventory etc • Remote sensing if possible • Threat assessments	No responses recorded
Question E: What are the key threats to your MECS?	• Covered previously.	• Size = small • Humanity • Inherent Risk of catastrophic events	No responses recorded
Question F: What data are currently available to assess against these criteria for your MECs	No responses recorded	No Response recorded	No responses recorded

Criteria 3 & 4 (C3 and C4)			
	Benthic	**Intertidal & Reef**	**Deep-sea & Pelagic**
Question A: Do these criteria 'work' for your group of MECs?	C 3 • Yes – e.g. for seagrass EC's • Fish species? • Lobsters (threatened by sea urchin) in Tasmania • Need good data (lack of data for with some EC's e.g. Port Phillip) C 4 • Yes – e.g. fish stocks (but have to consider regeneration w. positive human intervention) • Could be relatively easy to demonstrate	C 3 • example: Coral Reefs = Yes, with definitions e.g. Can we demonstrate that coral (as the functionally important species) has declined? If no, then can't use criterion 3. Yes, if you can define functionally important and it has declined by a known level • Coral reefs may be an easier thing to apply this criterion to than many other MEC types. • Distinguishing natural change is problematic • Restoration term a problem C 4 • Possibly, interpretation depends on the MEC • Can use collection data as a proxy for abundance (e.g. 300 specimens of one species, 1 specimen of another species in same time frame, know survey history – e.g. kelp means may be able to infer relative abundance of two species) C 4 - No responses recorded	C 3 • Example – Sea mounts = Yes • Key species is cold water coral b/w 600 – 1000m • 1 Decline is "severe" therefore • 2 Possibly eligible for listing as Endangered • 3 Restoration is unlikely in the 'near future' therefore also possibly triggers endangered BUT… • Issues for the marine environment include: i. 'condition' of EC at different depths ii. Thresholds not accurate for marine environment → better ones will need to be developed for fish, invertebrates, other…organism dependent iii. No data/knowledge of 'generation time' for the coral sp. Which forms the sea mounts C 4 • Example – Sea mounts = Yes… • If the threat is trawling and the key species is removed from the EC • C 4 is hard to apply • For pelagic – no response recorded

Question B: What are the challenges/impediments/ issues for applying each Criterion to marine systems?	C3 • Time frames could be longer in marine, timeframes may not be appropriate for MECs, and subsequent variation of meaning of terms such as 'generation' • Evidence *Posidonia* not returned >100 years yet other species can return in a few years • Demonstrating functional importance • Clash between guidelines & fish management 'best practice' • Natural variability vs. anthropogenic (difficult to determine baseline and therefore position to position to measure decline) C 4 • Similar to criterion 3 • Needs to be tightly demonstrated to work with stakeholders (use e.g.)	C3 • Understanding natural variability • Data deficiency re naturalness & timeframes • Baselines may have slid before we measure them • Understanding complex nature of the MEC (i.e what is functionally important?) • Don't know to the nearest order of magnitude how many species are on coral reefs • Lack of data to know when we reach trigger level C 4 – No responses recorded	C 3 • Data deficiency and therefore the ability to validate assumptions • Knowledge of species • Distribution &/or amount of cover • Baseline data • Parameters required for survival e.g. water temperature C 4 • Data deficiency on rate of recovery • Knowledge of species • Distribution &/or amount of cover • Baseline data
Question C: How can each criterion and/or guidelines/ thresholds be adapted to better capture your MECs?	• Risk assessment approach might be better (must be anthropogenic) • C3 would need quality data to support • The wording "3 generations or whichever is longer" – creates confusion	C 3 • For 'Decline of a functionally important spp threshold = i. Concerns on the prescriptive nature of time frame and percentage (i.e. last 10 years or 3 generations) ii. Concerns on the 80/50/20 % to open or dynamic systems • For 'Restoration timeframe' = i. 'Restoration' Wording could confuse public – does this mean 'recovery of function'? ii. Timeframe of 'immediate future' (i.e.10 yrs or 3 generations) will be vary for each coral group • Term restoration implies some form of human intervention even though guidelines say it's not dependent on human intervention – suggest recovery of function of the community be used in place	• For cold water coral (sea mounts) • Decline of functionally important species should allow for more than one species being functionally important • With the thresholds, there is not enough space for 'uncertainty' which is standard in the marine environment • A risk assessment process rather than a threshold approach would be more appropriate • Colonial organisms such as coral reefs (sea mounts) are not well suited to the concept of 'generations' • Thresholds would have to be determined on a case-by-case basis • We have no knowledge on what makes a 'viable' EC • Structure is defines by animals species in this type of 'community' (as opposed to the terrestrial where vegetation make up the 'key spp' or community)

		• Timeframes vary with coral group • Possibly need different thresholds for every different MEC. • Significant concerns about thresholds and whether prescriptive thresholds are useful at all (same as for timeframes) • MECs in an open system are naturally extremely dynamic so the 80, 50 20 % decline thresholds not useful • Generations vary enormously – e.g branching corals more rapid than others C 4 - No responses recorded	
Question D: How do we best measure each criterion in marine ecosystems?	C 3&4 • Good data on fish (biomass) • Epiphytes on seagrass (good indicator but different variables to consider) • Shoot density for seagrass themselves • Habitat fragmentation • Known thresholds • Use conceptual models of each EC • Community response can be complex → shift to indicator species for disturbance (including invasives)	C 3 • Repeated sampling over the relevant time frame C 4 - No responses recorded	C 3 • Pelagic i. Not always easy to identify the 'key' species in Pelagic MEC's ii. Trophic level iii. Siza spectrum • Benthic i. Spatial extent ii. Percentage living vs. dead iii. Acoustic tools such as sonar iv. $$$ where do we get funding to enable mapping/assessment? C4 - No responses recorded
Question E: What data are currently available to assess against these criteria for your MEC?	C 3 & 4 (As Above) • Good data on fish (biomass) • Epiphytes on seagrass (good indicator but different variables to consider) • Shoot density for seagrass themselves • Habitat fragmentation • Known thresholds • Use conceptual models of each EC Community response can be complex → shift to indicator species for disturbance (including invasives)	C 3 • There is very good data for a subset • Much more poor for full range • New programs coming on line • Some aerial photography	C 3 • Pelagic i. SST ii. Range of fisheries data e.g. bycatch, but these are not always specific in their information (i.e. may say sharks, but not which spp of shark) iii. Modelling • Benthic i. Baseline mapping ii. Preliminary statistical assessment iii. Lacking oceanographic data on: 1. deep sea temperature, 2. deep sea circulation iv. lacking biological data but we have chemical v. lacking historical information C 4 - no response recorded

Criteria 5 & 6 (C5 & C6)			
	Benthic	**Intertidal & Reef**	**Deep-sea & Pelagic**
Question A: Do these criteria 'work' for your group of MECs?	C 5 • Scope for this to work, but data challenges. Monitoring, inventory, mapping are basic requirements. Use surrogates. • More likely to trigger act than C3. C 6 • yes if EC is based on key habitat forming species species (eg kelp) which can be used as a proxy	C 5 • Yes, possibly more so than others esp. for coral reefs, algal reefs. can use work done in recent years • Esp. not needing past information so much • Plus the 'or' provides some flexibility in how you list them (variance across MEC) C 6 • Not doable (or at least very difficult) Maybe only for key species • Small number of ECs that are reliant on functionally important species = PVA type (or similar) approach might work • Different models of extinction than PVA	C 5 Rate of continuing detrimental change: • Yes, but with constraints– e.g. data quality, surrogates could be used • Lack of baseline data • also can't measure *rate of change* without ongoing monitoring • Percentage change through time maybe definable through fishing effort and fishing data • There is redundancy in ecological roles p e.g. is one shark sp. drops out (becomes extinct or functionally extinct), another sp. will increase. Spp. composition can change without compromising ecosystem function • Include measure of vulnerability when considering C 6 • hard for pelagic, losing top order predators may not effect the ecosystem too much as other opportunistic species will fill the niche- BUT depending on how the community is defined this spp could be used to measure EC decline. But possibly could be applied to species such as SBT with fisheries data • 'probability of extinction' Need to clarify which spp. are indicators for extinction • Include discussion of commercially harvested spp. economic viability vs. biological viability

Question B: What are the challenges/impediments/ issues for applying each Criterion to marine systems?	C 5 • Monitoring, mapping and inventory are basic requirements • Need controls • Need to know natural variation (noise) (and need good information on species/assemblage first) • There are no meta-databases (good example is WALIS –WA Land Information System). • Temporal • Quantify / qualify key drivers in system (biotic & abiotic) C 6 • Scale – national extent, broader scale more difficult to monitor. • Modelling.	C 5 • Defining species re major role >1? Is functional grouping possible? • Defining 'degraded' or 'disrupted' with care • Showing intensification across geographic distribution is possible (via remote sensing of surrogates?) • Need to allow for dynamics of system so you know when it goes outside what is expected (e.g. cycles in macroalgae communities) • Need to understand functionally important species or groups C 6 • Getting community level focus, tools & interpretations (an active area of research) • Breadth across all of geographic range (more likely model)	• 5 - Lack of data no historical/baseline data exists to support this for sea mounts • Possibly fishing data could provide some information but hard to quantify – could be possible for certain types of ecosystems, and for certain types of fishing pressure such as trawling
Question C: How can each criterion and/or guidelines/ thresholds be adapted to better capture your MECs?	• No responses recorded	• C 5&6 - May need to recognise (by changing wording in criterion 5) that a downward trajectory of a number of species is possible and useful for triggering criterion • Numbers in thresholds unknown if they are applicable (80%, 50%, 30%)?	• The guidelines/thresholds need to deal with uncertainty better, the process for getting better information (mapping) is expensive and no one has the resources to provide/create it. • Acoustic data can be used to look at deep sea coral • Taking into consideration the vulnerability and potential for recovery – needs to happen – not currently captured but the guidelines and could deserve batter treatment by the guidelines – vulnerability of coral is high for example

Question D:
How do we best measure each criterion in marine ecosystems?
	• Cover & Distribution of important native species (& invasives)
	• Underwater video (quantitative)
	• Aerial photography over (long) period of time then permanent transects (i.e. must be backed by in-situ work)
	• •Published work on EC e.g. spectral analysis
	C 6
	• •Fragmentation e.g. kelp beds via R.O.V. & lepidochronology (measuring thickness of sheaths) used in Europe – shows history of particular beds, and indicates fragmentation.
		C 5
		• Detailed study of recent 'performance'
		C 6
		• As required by newer models
			• Commercial fisheries data – not particularly reliable
			  • Some is non target spp data
			  • Not accurate or species specific
			  • Usually best or only data available
			• Observer data – seismic data, offshore oil platforms, not always accurate – not good for population measurement but possible to use for distribution or occurrence
			• For corals, deep water – only a handful of scientific surveys carried out, most info is from commercial fisheries

Question E: What data are currently available to assess against these criteria for your MECs	• Museum collections & databases • Fisheries data sets • Census of marine life of Australia (?) • Approximately 5 international databases • WORMS (World Record of Marine Species). • Universities and their databases. • ERIN & ANHAT • Industry information • ALA (Atlas of Living Australia). C 6 • aerial photography ROV would show fragmentation.	C 5 • Lots from case studies C 6 • Emerging new models	• Commercial fisheries data – not particularly reliable • See above

Application of listing criteria to the Giant Kelp Forests of the East and South Coasts of Tasmania nominated ecological community

Criterion 1: Decline in Geographic Distribution	
Group 1:	• Is there enough information? - data quality not adequate to make a decision, but there is anecdotal evidence • If we take the 11,000ha historical figure and the 1300ha extant figure the community does not trigger on this criterion. New taxonomy info = would probably not trigger over its entire extent) • 65% loss of a community is thought to be significant & due to this species' life cycle we think this criterion should apply at some level (En, Crit. En.). • Means that the thresholds fro this criterion would need to be changed for this EC to trigger (but also need good quality information/data)
Group 2:	The title of the nomination should be changed to reflect the species name and the national extent (including the other states) • In broad content – support C1 o As temperature increases, species are pushed south into restricted range, therefore yes, decline can be clearly implied • Move thresholds lower for marine, but don't forget natural variability • Thresholds need to be lower particularly for non-direct human impact

Group 3:	Yes it can be applied
	• Defining the 'kelp' as a community but defining the community within there is insufficient information
	• We assume that the Tasmanian fauna is different however previous EPBC examples
	  o Mangroves – different fauna are supported across geographic range
	  o Mound springs as a group
	• Question if declining numbers are correct
	  o Is this our decision?
	  o This needs to be checked
	  o See table on page 13 of guidelines, last two lines,
	  o Acknowledge it may be a naturally limited

Group 4:	Yes, could be • For the EC, noting that it is not just *M. pyrifera* but the distinct invertebrates etc. that coexist with it • Decline by 89% • Need to work more on what true national extent of EC is – it may not be just Tasmania, and there are questions about the extent in the nomination

Group 5:	Big question – has there been a decline? Probably yes
	• Broader geographic range
	• Risk of warming, already demonstrable shift along coasts
	• Current thresholds may be set too high for MEC's
	  o If losing EC from natural processes e.g. reduction not from direct human impact
	  o E.g. possibly ↓30 – 50% outside range of natural vulnerability
	• IMCRA Bioregions

Group 6:	Today, no: Future, maybe • What is natural flux of community, natural variability? • What levels of decline cycles have occurred before? 90%? Did it recover? • Alginates Australia – 1st in business, earlier date may be problematic (tend to underestimate) have data back to 1965. Operated NW coast of Tasmania • Baseline in time? Is the alginates data a good baseline? • Various evidence shows there has been a decline but not clear enough to trigger this Criterion

Criterion 2: Small Geographic distribution coupled with demonstrable threat	
Group 1:	Possibly eligible as Endangered • Small geographic distribution? – No, but according to the guideline thresholds would probably be considered 'restricted' and therefore trigger as Endangered. • Part 2, threats: depends on which threat you choose – climate change could cause EC to be lost in the 'near' future,
Group 2:	Given greatly reduced area of seafloor within shelf compared to land area of Australia, thresholds for area could be proportionally reduced? No one really keen on that though. But perhaps revisit from marine perspective. • Should support National Barcoding System to assist with taxonomy • C 2 should be able to be applied, so long as geographic distribution can be defined. Threats seem real and measurable
Group 3:	Does not apply, information issue for kelp • Climate change is a threat – sea level would assume the species will adjust its distribution accordingly – rise in sea level of 8-22m therefore there is a risk of drowning • Distribution is at best limited • The extent to which it would be lost and how long – who knows?
Group 4:	• It is 'restricted' or 'very restricted' depending on resolution of actual extent issue • Could be lost in >10 yr (Matthew McArthur) or >60 yrs (Frances Michaelis) = the medium term future • Consider combination of El Nino, invasions, temperature rise

Group 5:	• 770ha vs. 1300ha (Prof. Karen Edyvane could clarify)
	• Yes possibly:
	  o Restricted < 10,000 ha (probably not very restricted)
	  o Limited < 100,000ha
	• What does this mean for functional integrity

Group 6:	• Small geographic distribution seen as a negative while demonstrable threat seen as a positive • Patch size • Fragmentation seen as a positive in marine system • Care with thresholds • 1 degree and rising, extreme events, storm • Urchin invasion, fishing – crayfish, abalone, epiphytes • Bathymetry important (not just horizontal distribution), water column height too • Ratio of current extent to 'potential' extent

Criterion 3 Loss of Functionally Important Species	
Group 1:	Possibly eligible as Vulnerable • Based on current thresholds • Could demonstrate substantial decline and be not likely to recover (depending on which threat – assume in the medium term future climate change↑ water temps & introduced species threats could cause the community to be considered 'not likely' recover in the 'near future') • The thresholds should use the concept of 'recovery' rather than restoration
Group 2:	Yes, eligible • Although recovery hard to predict. Likely to need support re sediment & urchin reduction

Group 3:	Unsure if it is eligible, need more information
	• It is important in the community
	• Is there really a reduction in the area?
	• As with Question 1, need more information
	• Again if taken at face value it does show a reduction
	  o For Tasmania
	  o Possibly not for Australia

Group 4:	Decline of *M. pyrifera* (functionally important species gives structure & function) • Likely to trigger 'Vulnerable' i.e. substantial decline but depends on verification of extents • Nascence of information means we cannot answer restoration potential
Group 5:	• Substantial decline – 45% over 20 years • Kelp (abalone? – fisheries data?, lobsters – urchin predation) • Need info on recovery timeframes (essential for triggering this) o Need to assess sediment impacts/and 'barrens' issues o Reintroduce large lobsters to prey on urchins – smaller lobsters don't eat them
Group 6:	Possible, yes • Data & knowledge, sound threshold dependent • Is the Functionally important species demonstrable as lost, extent of restoration • If not enough time between being hammered • Structure – height of kelp fronds, different expressions on community • Phenotypic plasticity – depth to grow? • Duplicates Criterion 1 because the kelp is the dominant species • 80% - number? 50% would be catastrophic for kelp's recruitment and dispersal • Numbers of predator species may be massive impact on adjacent communities – export but flow effect not part of criteria • Restoration?? Transplanting? Tests in translocation

Criterion 4: Reduction in Community Integrity	
Group 1:	Yes - Possibly Vulnerable • Part 1: Vulnerable as for Criterion 3 - substantial decline is likely due to threats • Part 2: Disruption of process – is not quantifiable at this time
Group 2:	No response recorded
Group 3:	Needs to be rewritten in light on further information i.e. Distribution & associate community • Hard to quantify the kelp as a community including South Australia
Group 4:	Vulnerable • Integrity defined on basis of Kelp itself • Yes there is reduction of kelp = substantial
Group 5:	No response recorded

Group 6:	Partial overlap in Criteria 3 & 4 in marine environment • No based on nomination info but can do more work • Demonstrate reduction in integrity but key part is: do you have to demonstrate recoverability/regeneration timeframe? • Re-establishment of structure, function etc – with variability between impacts or if impact continuing, TIMEFRAME?? • Indicators – loss of diversity, loss of fishery (abalone, crayfish) • Kelp forest (water column) link vs. replaces with stumpy version? Can grow quickly • Regeneration difficult – need to know more about recruitment • If can quantify reduction in area – function?

Criterion 5: Rate of continuing detrimental change	
Group 1:	Possible → Yes • Vulnerable, based on the likely continuation of threats
Group 2:	No response recorded
Group 3:	Information is available – not presentable clearly • Yes it is being degraded by urchins, water turbidity, warm water
Group 4:	• Rate – 10ha/year loss = substantial • A) = serious • Could also address under B)
Group 5:	No response recorded
Group 6:	• Validate data – declines measured at point in time or projected future change - temperature • Known critical temperature threshold for gametes • Element of precautionary principle – temperature range (but Minister can't take into account precautionary principle when listing) • Possibly o Need more data (e.g. tank work experiments on gametes) o Further investigation of thresholds • Spread of sea urchin data (& work on sea urchin barren elsewhere e.g. underwater rocky reef)

Criterion 6: Quantitative analysis showing probability of extinction.	
Group 1:	Possible • Not easy to trigger on this Criterion but if modelling was available you would possibly be able to generate the information
Group 2:	No response recorded
Group 3:	No response recorded
Group 4:	Not enough data
Group 5:	No response recorded
Group 6:	No, not enough data • But could be conceptually modelled

Suggested New Criteria & /or Other Changes	
Group 1:	• None
Group 2:	• Linking of community to natural processes, threats then become a disruption of natural processes
Group 3:	• Clarify the taxonomy of the kelp species and therefore its national extent o If Tasmania only, would probably qualify o Request the application is rewritten to address taxonomy and therefore distribution. The discrepancies with numbers provided in the table for population extent • Validity of the application in working with the criteria for EPBC = the criteria work
Group 4:	• None
Group 5:	• None
Group 6:	• Contact FRDC for Report on urchin barrens & fisheries