IDENTIFYING AND MANAGING MARINE PROTECTED AREAS: USING SCIENCE EFFECTIVELY

K. Hiscock ([1])

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ABSTRACT

One of the imperatives that came out of the World Summit on Sustainable Development was to develop a representative network of marine protected areas by 2012. The report of the Summit specifically mentions the identification of those protected areas based on scientific information. Another imperative from the Summit was "Halting the loss of marine biodiversity". Using science to identify areas for protection and to halt the loss of biodiversity essentially requires taking an objective and structured approach using available information to support defensible decisions about protection and management. Criteria to identify protected areas are well-established. We have an understanding of marine ecosystems sufficient to develop an approach to 'duty-of-care' or 'good stewardship' of the biodiversity of the oceans. The duty-of-care appoach is particularly advocated in this paper and the urgent need to apply that approach rather than to continue just talking about it is identified.

IDENTIFYING PROTECTED AREAS

The requirement from the World Summit on Sustainable Development to develop a representative network of marine protected areas (mpa's) by 2012 based on scientific information follows more than 30 years of sporadic activity in different parts of the world and to different levels of success to establish mpa's. The criteria that are used to identify areas are well established but subject to occasional revision and redefinition usually because of some new political initiative. Using science also means using research to inform decisions about where there are areas that most need protection. For instance, because threatened or rare species occur there or because the species or habitats that might be lost as a result of human activity are unlikely to recover because of their growth rate, longevity or reproductive biology.

Areas are likely to be established to protect:

1. Examples (usually 'the best') of particular habitats within a biogeographical area. Examples may be selected at the level of landscape features such as 'estuaries' or 'lagoons' or 'reefs' or might be more limited habitat features such as 'rockpools' or might be based on key structural species such as 'seagrass beds', 'horse mussel beds' or 'kelp forests'.
2. 'Special' features. These might be unique to a particular location or might include a species that is endemic to an area or where an area has a high proportion of the global population of a species.
3. Commercial species, especially breeding or nursery locations.
4. Declined, sensitive or threatened marine features.

There will also be marine protected areas for archaeological or geological features that may incidentally protect marine species and biotopes.

The criteria that are used to identify potential marine protected areas may include: Typicalness (Representativeness); Naturalness; Size; Biological diversity; Critical area; Importance (including Rarity), and Sensitivity. Other more practical criteria may also be applied including: Situation (adjacent to a terrestrial protected area?); Intrinsic appeal, and Feasibility (see, for instance, [i]). Such criteria are perpetually being re-invented and, doubtless, improved slightly on each occasion. One of the latest and most important iterations is by the OSPAR

[1] Marine Biological Association of the UK, Plymouth , UK . E-mail: k.hiscock@mba.ac.uk

Commission for the Protection of the Marine Environment of the North East Atlantic (www.ospar.org). Their criteria are listed below.

Ecological criteria/considerations

(1) THREATENED OR DECLINING SPECIES AND HABITATS/BIOTOPES. [Include Rarity' as information on decline is often lacking.]
(2) IMPORTANT SPECIES AND HABITATS/BIOTOPES. [Refers to global ('Proportional importance') and UK ('Regional importance') distribution and population numbers.]
(3) ECOLOGICAL SIGNIFICANCE. [Includes 'Dependency'.]
(4) HIGH NATURAL BIOLOGICAL DIVERSITY.
(5) REPRESENTATIVITY.
(6) SENSITIVITY.
(7) NATURALNESS.

Practical criteria/considerations

(1) SIZE (meaning extent of the feature being considered – usually, the bigger the better).
(2) POTENTIAL FOR RESTORATION.
(3) DEGREE OF ACCEPTANCE.
(4) POTENTIAL FOR SUCCESS OF MANAGEMENT MEASURES.
(5) POTENTIAL DAMAGE TO THE AREA BY HUMAN ACTIVITIES. [Degree of threat.]
(6) SCIENTIFIC VALUE.

Applying selection criteria is greatly assisted if scientifically sound structures are in place to organize data, for instance, to assess rarity and to classify biotopes so that the same biotopes from different locations can be compared.

HALTING THE LOSS OF MARINE BIODIVERSITY

Another imperative from the World Summit on Sustainable Development was "Halting the loss of marine biodiversity". Using science to manage human activities throughout the marine environment requires obtaining an understanding of the distribution of habitats and species and their particular sensitivities to human activities as well as their likely natural variability. The scientist has a box of tools to draw from according to the environmental protection requirement at hand. The tool box is likely to include the resources listed below.

- Survey data: what is where and how much is there?
- Literature: biology of species, effects of impacts, distributions, economic importance etc.
- Structures to organize complex data into usable information.
- Analysis tools to show trends and identify links between change/differences and factors.
- Criteria to establish 'marine natural heritage importance'.
- Criteria to establish 'sensitivity'.
- Decision aids - making objective links between information and action.
- Dissemination tools.

Much of the information to support decision-making can be obtained by understanding the biology of species and biotopes using available literature. The Marine Life Information Network (*MarLIN*) programme (based in Plymouth, UK) has been established to provide information on the biology and sensitivity of species and biotopes (see www.marlin.ac.uk) specifically to support marine environmental management, protection and education. *MarLIN* also brings together existing survey information to match sensitivity assessments and is developing GIS tools to present maps of seabed wildlife sensitivity to decision-makers. The *MarLIN* Web site is multi-layered and readers should explore the range of information available on the site. Figure 1 is a screen-dump from the start of the sensitivity pages for the maerl species *Phymatolithon calcareum.*

Basic Information	Taxonomy and identification	General biology	Habitat preferences and distribution	Reproduction and longevity	Sensitivity	Importance

Maerl
Phymatolithon calcareum
Sensitivity
Adult

Phymatolithon calcareum forming a maerl bed. Loch Carron, West Scotland. Image width ca 20 cm.
Image: Keith Hiscock

View benchmarks

Physical Factors				
Click factor name to view rationale	**Intolerance**	**Recoverability**	**Sensitivity**	**Evidence / Confidence**
Substratum Loss	High	Very low	Very High	Moderate
Smothering	High	Very low	Very High	Moderate
Change in suspended sediment	High	Very low	Very High	Moderate
Desiccation	High	Very low	Very High	Moderate
Change in emergence regime	High	Very low	Very High	Moderate

Fig. 1 Part of the *MarLIN* Web site (www.marlin.ac.uk). Links are provided to view more detailed information, access references to source material etc.

MANAGING AREAS – USING SCIENCE EFFECTIVELY

Management, including undertaking environmental assessments and interpreting results of biological monitoring, requires structure and information. Often, decisions to manage a human activity and the way decisions were reached need defending. Effective use of data and information for marine environmental protection and management has recently been reviewed by Hiscock *et al.* [[ii]]. The approach developed by the *MarLIN* programme to supply high quality concise scientific information relevant to management can be incorporated into the sort of decision tree commonly applied (whether or not the manager realises it) to decision making. Making the objective link between information and action is illustrated in Figure 2.

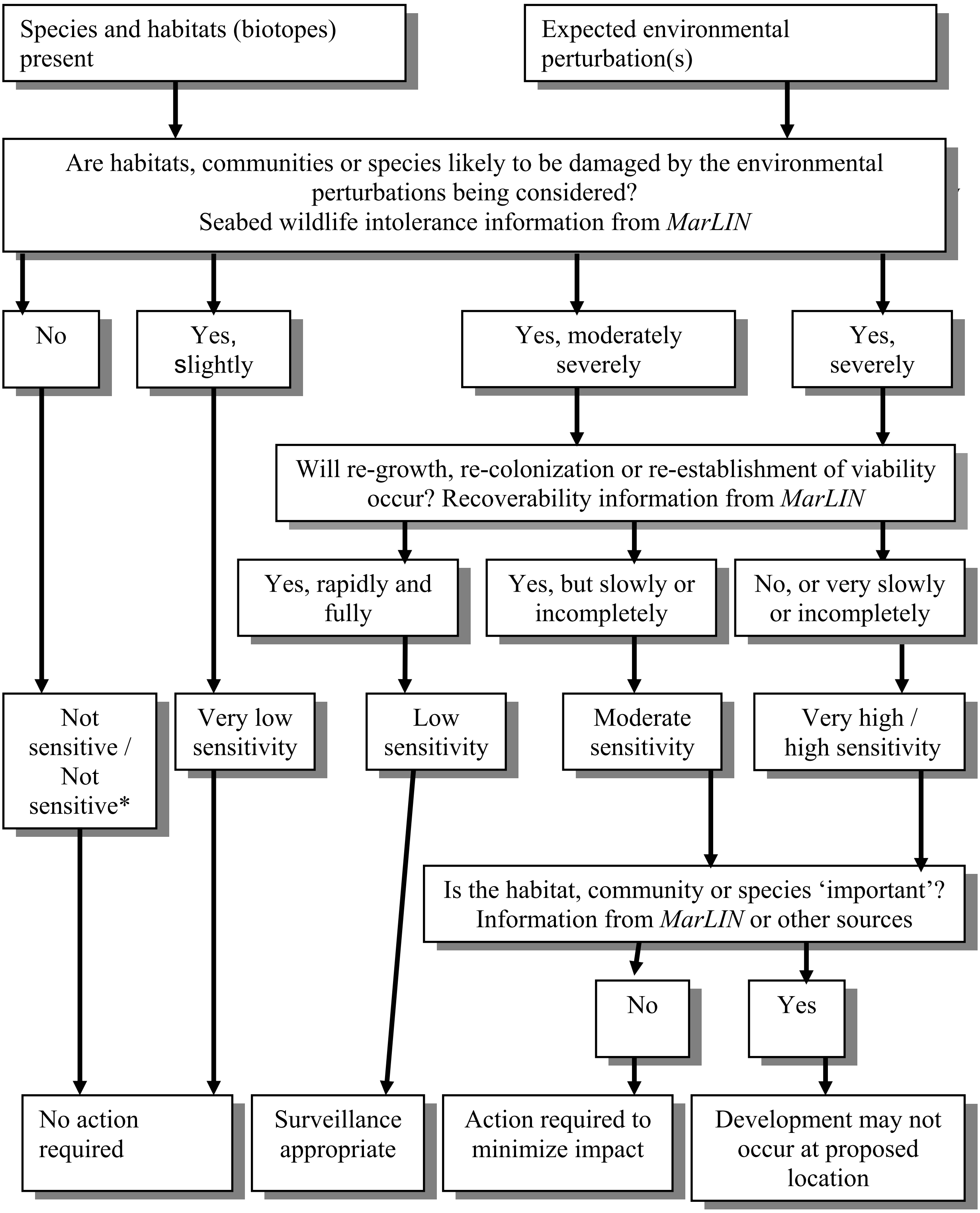

Fig. 2 A 'decision tree' for environmental management incorporating concepts of sensitivity, recoverability and importance [iii]

CONCLUSION

Mpa's in their various forms are worthwhile only if there is a regime of managing human activities that protects biodiversity. Some parts of the world already have a high density of mpa's, often with inadequate management to protect them and often with inadequate protection of the marine environment outside of them. While mpa's have a role in the suite of measures to protect the marine environment, it now seems most important to advocate and pursue an overall 'duty-of-care' for our oceans and seas, and to do it now rather than continue just talking while biodiversity is being conspicuously damaged. Duty-of-care needs to be based on scientific knowledge and its application to managing human activities to ensure the diversity of content of our oceans and seas forever. The approach developed by the *MarLIN* programme for Britain and Ireland is advocated at *Pacem in Maribus* 30 for widescale use.

References

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