



## Review

# An effective set of principles for practical implementation of marine cumulative effects assessment



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## ABSTRACT

The term “cumulative effects assessment” is frequently used yet the underlying principles and definitions are poorly specified. Consequently, there is no consistency or standardisation in approaches leaving marine managers and developers perplexed on how best to discharge their legal obligations to undertake cumulative effects assessment. This paper explores some of the origins of the terminology and re-interprets how these may best be applied to standardise the vocabulary and approaches to cumulative effects assessment.

We define cumulative effects assessment as a systematic procedure for identifying and evaluating the significance of effects from multiple sources/activities and for providing an estimate on the overall expected impact to inform management measures. The analysis of the causes (source of pressures and effects), pathways and consequences of these effects on receptors is an essential and integral part of the process.

Environmental risk assessment concepts, in particular sound problem formulation, have been used to provide a clear structure for cumulative effects assessment. We recommend that risk screening, prioritisation and evaluation should be a critical component of cumulative effects assessment to facilitate a filtering of the complex issues for consideration of the likelihood of exposure of receptors to pressures and the likelihood of a receptor responding to those pressures. This paper is intended to provide practical assistance to marine environmental impact assessment practitioners, marine environmental regulators and policy makers.

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## 1. Introduction

The terms “cumulative”, “in combination” and “collective” are in wide usage by regulators, managers, practitioners and academics engaged in undertaking and evaluating assessments of environmental “effects”, “impacts” and/or “pressures”, however, there is a lack of clarity on how these terms should be defined and applied in environmental evaluation and management operations.

The scale and regulatory drivers for any cumulative effects assessment are critical both in terms of defining the scope of the assessment (to determine which suite of activities, environmental pressures and ecosystem components should be included) and the methodologies which are best suited to making that assessment. However, at present the attempts to develop cumulative effects

assessment methodologies have two main paths depending on whether they are initiated from a legal or a scientific perspective.

The common interpretation of the various legal drivers for cumulative effects assessment is a consideration of which human activities, plans or projects need to be included in the study and then to determine the associated environmental effects and sensitive ecosystem components. Whereas, the common interpretation for scientific evaluations of cumulative effects is how environmental pressures interact to effect ecosystem components and then track these back to the causal human activities. Whilst this may seem a subtle distinction it means that there is a split in research efforts and an incompatibility in the emerging methodologies.

The Marine Strategy Framework Directive stipulates that the management of human activities applies an ecosystem-based context. In this paper we consider whether the application of an ecosystem approach to cumulative effects assessment is also appropriate to other legislative drivers. We believe that the adoption of some common principles will facilitate the consolidation of research efforts towards resolving the conundrum of cumulative effects assessment.

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## 2. The problem

The following list of examples from different European legislative drivers illustrates how different terminologies are used for describing different aims when assessing cumulative, combined and collective effects, which adds considerable confusion:

- Article 6(3) of EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora indicates the need to appropriately assess ‘in-combination’ effects that a plan or project may have with other plans or projects.
- Article 4(3) of the European Environmental Impact Assessment (EIA) Directive (85/337/EEC) (as amended), referring to the screening stage, states ‘the characteristics of the project must be considered having regard, in particular, to ... the cumulation with other projects’. In relation to the content of an Environmental Statement, Article 5(1) of the EIA Directive requires ‘assessment of the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent or temporary, positive and negative effects of the project.’
- The Marine Strategy Framework Directive (2008/56/EC) stipulates that “Marine strategies shall apply an ecosystem-based approach to the management of human activities, ensuring that the collective pressure of such activities is kept within levels compatible with the achievement of good environmental status ...” and “... an analysis of the predominant pressures and impacts including human activity, on the environmental status of those waters which [...] covers the main cumulative and synergistic effects; ...”.

Such legislation places legal obligations on member states to introduce assessment and management measures, thus placing environmental, social and economic burdens on governments and industries. Such obligations include, for example, the collection and evaluation of data in Environmental Impact Assessments, licensing systems for marine activities, protection of species and habitats, the development and implementation of measures to achieve environmental benefits and the sustainable use of marine resources. To ensure that such burdens are proportionate (i.e. allow regulatory decisions to be taken which are both affordable and acceptable to society) it is critical that ambiguity and uncertainty in the terminology is reduced.

This paper has been written on the basis that the identification of commonalities in terminology, objectives and approaches for cumulative effects assessment may allow for more consistent and coherent assessments of cumulative effects (rather than having different approaches for each legislative driver). However, we recognise that the endpoint of assessments to address these legislative drivers may be different. Therefore we need to determine the point of departure—i.e. at what point do the assessment requirements of cumulative effects to comply with

these legislative drivers start to differ significantly necessitating the use of different methods/tools, e.g.

- there is a potential commonality/rationalisation of the data requirements (and some methods) across these legislative drivers (e.g. ultimately MSFD data used in project-level environmental impact assessment (EIA); EIA data used in MSFD assessments or Maritime Spatial Planning)
- there is potential for determining ‘best-fit’ between cumulative effects assessments undertaken at different spatial and temporal scales to apply the principles of ecosystem based assessment and management (e.g. cumulative effects assessments done for project EIAs may inform Maritime Spatial Planning or MSFD scale assessments and vice versa).

Whilst it is implicit that the three legal instruments described above require cumulative effects to be assessed they do not explicitly define the term. Table 1 provides examples of various definitions of CEA from the USA, Canada and Europe.

Whilst the definitions in Table 1 pre-date the Marine Strategy Framework Directive there have been few attempts to update or redefine these terms, hence the lack of clarity in research to develop assessment methodologies. As a step towards determining what is/is not possible this paper explores some of the terminology to identify commonalities that can be applied across the various legislative drivers.

It is irrefutable that the prime objectives of the instruments listed in Table 1 (all of which use the terms “cumulative”, “in combination” or “collective” effects) are the protection and management of the environment. As such, we establish and apply the convention that any definition of terminology should focus on “effects”, “impacts” and/or “pressures” (stressors) to assess if and how they may individually, collectively, cumulatively or in combination interact. It is therefore the combination and interaction of pressures that should be the crux of environmental assessment and management measures. As such our proposed approach deals with the environmental response to single or multiple pressures (from single or multiple activities) rather than the traditional perspective of environmental impact assessments to determine which plans, projects or human activities should be included in the assessment of “cumulative”, “in combination” or “collective” effects. This ensures that all cumulative effects assessments are based on an ecosystem based approach which provides a common structure, whether the impetus is the EU Environmental Impact Assessment, Habitats, Marine Strategy Framework Directives or any other legal or scientific driver.

Applying this perspective provides us with a second convention, which is that the terms “cumulative”, “in combination” and “collective” are effectively intended to achieve the same objective, i.e. to predict and assess the overall impact on environmental features from multiple pressures. These two conventions provide

**Table 1**  
Definitions of CEA.

Cumulative impacts: Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project	EU (Walker and Johnston, 1999)
<i>Impact interactions</i> : The interactions between impacts whether between the impacts of just one project or between the impacts of other projects in the areas	
<i>Indirect impacts</i> : Impacts on the environment, which are not a direct result of the project, often produced away from or as a result of a complex pathway. Sometimes referred to as second or third level impacts, or secondary impacts	
“impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertake such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time”	USA (Council on Environmental Quality, 1997)
“cumulative effects are changes to the environment that are caused by an action in combination with other past, present, and future human actions.”	Canada (The Cumulative Effects Assessment Working Group, 1999)

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