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Tools and methods for identifying safety aspects of Interactions and Cumulative Effects

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1 Introduction

SOMOS, short for “safe production of marine plants and use of ocean space”, focusses on the risks and cumulative impacts on human and ecosystem safety due to multi-use activities at sea. The objective of this report is to provide an overview of existing impact assessment methods that are relevant and potentially useful for the assessment of such risks

Prepared at the start of SOMOS, this overview guides further investigations into methods to assess the safety aspects and risks of the combined offshore production of seaweed and wind energy. The factsheet summarizes points of departure for focussing on safety of the marine environment, marine interactions and cumulative effects. Cumulative impacts of activities at sea can have consequences for the marine ecosystem, for the safety of food produced, and for the business case of offshore production.

Figure 1 below describes the workflow to develop a recommended practice. This factsheet describes the methodology for the two left-hand boxes.

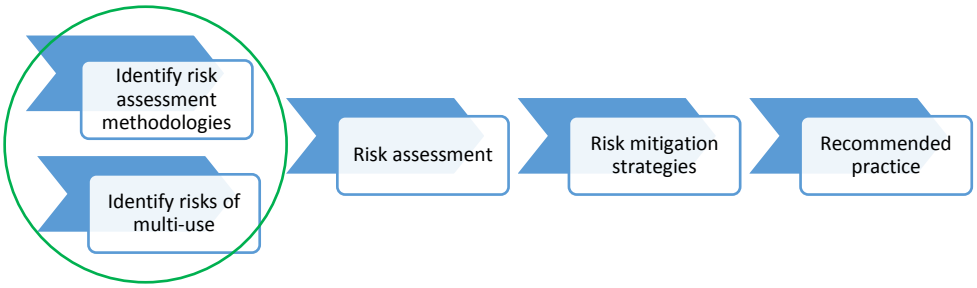

Figure 1: workflow in WP3

2 Risk assessment methodologies

2.1 International standards and norms

International Standards provide specifications for products, services and systems, to ensure quality, safety and efficiency. ISO International Standards are developed by the International Organization for Standardization (ISO), an independent, non-governmental organization. The following ISO standards might be relevant for the offshore production of feed, food and energy:

- ISO 14001:2015 Environmental management systems — Requirements with guidance for use http://www.iso.org/iso/catalogue_detail?csnumber=60857
- ISO 22000 - Food safety management http://www.iso.org/iso/home/standards/management-standards/iso22000.htm
- ISO 31000:2009 — Risk management — Principles and guidelines, provides a set of principles, a framework and a process for managing risk.
- http://www.iso.org/iso/home/standards/iso31000.htm ISO 45001 - Occupational health and safety http://www.iso.org/iso/home/standards/management-standards/iso45001.htm)

Various standards exist for the identification and assessment of occupational health and safety risks. In addition to the ISO 45001 standards mentioned above, the following can be relevant for offshore production of feed, food and energy:

- OHSAS 18001: Occupational Health and Safety https://www.ohsas-18001-occupational-health-and-safety.com/
- ILO-OSH 2001: Guidelines on occupational safety and health management systems http://www.ilo.org/safework/info/standards-and-instruments/WCMS_107727/lang--en/index.htm

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2.2 European directives

The environmental impact assessment Directive (2011/92/EU) and its amendment Directive 2014/52/EU outline the procedure for environmental impact as a procedure to ensure that the environmental implications of decisions are taken into account before the decisions are made. Environmental assessment can be undertaken for individual projects, such as the construction of a dam, motorway, airport or factory, on the basis of Directive 2011/92/EU (known as 'Environmental Impact Assessment' – EIA Directive) or for public plans or programmes on the basis of Directive 2001/42/EC (known as 'Strategic Environmental Assessment' – SEA Directive). The common principle of both Directives is to ensure that plans, programmes and projects likely to have significant effects on the environment are made subject to an environmental assessment, prior to their approval or authorisation.
http://ec.europa.eu/smart-regulation/guidelines/ug_chap3_en.htm

2.3 Scientific frameworks

Over the last decade, marine and maritime policies have embraced the ecosystem approach to manage human impacts on marine ecosystems. These policies ask for integrated/ holistic approaches that address ecological, economic, and social needs.

2.3.1 Integrated Ecosystem Assessment

Integrated Ecosystem Assessments (IEAs) represent an important tool to understand how humans interact with the marine ecosystem. They represent a framework for organizing science in order to inform decisions in marine ecosystem based management at multiple scales and across sectors. Levin et al. (2009) define an IEA as “a formal synthesis and quantitative analysis of information on relevant natural and socioeconomic factors, in relation to specified ecosystem management objectives.” It is an incremental approach, in which integrated scientific understanding feeds into management choices and receives feedback from changing ecosystem objectives.

2.3.2 Cumulative Effects Assessment

Cumulative effects are the incremental impact of the action when added to the other past, present and reasonably foreseeable actions. They have also been defined as “the net result of environmental impact from a number of projects and activities” (Sadler 1996). It is expected that this combination of cumulative pressures can have various (positive and negative) cumulative impacts/ effects on humans and the marine environment.

A Cumulative Effects Assessment (CEA) is understood 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” (Piet et al. 2017). In SOMOS we only consider a (cumulative) effect significant if it has an impact on a relevant ecosystem component.

2.3.3 Integrated Cumulative Effects Assessment (iCEA)

Piet et al.’s iCEA framework consists of four phases: (1) definition of purpose and scope, (2) identification of human activities (sector) and the related pressures and impacts on the ecosystem (impact chain), (3) establishing the individual pressures’/ impact chains’ relative importance by calculating “impact risk”, and (4) evaluation to assess the quality of the underlying information and level of confidence. Impact Risk (the contribution of an impact chain to the risk a specific ecosystem component impacted) is the key concept around which the iCEA evolves.

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2.4 Assessment methods used by Lloyds Register

Based on the Lloyds Register website, a number of potentially relevant assessment tools that are currently in-use by Lloyds Register are identified:

- Mariner: Operational risk assessment software
  http://www.lr.org/en/services/software/mariner.aspx
- Collision analysis
  http://www.lr.org/en/_images/229-80852_Compliance_Factsheet_Collision_Analysis_factsheet.pdf
- 3D risk modelling
  http://www.lr.org/en/news-and-insight/articles/the-next-generation-risk-analysis-tool-explore.aspx

3 Moving forward

The combination of an offshore wind farm with aquaculture is new. Risk assessments cannot build on earlier experiences. There are a number of established, high level procedures and methods for risk assessment (see ISO 31000 standards). They are often process-oriented, i.e. they describe a process to go through, and so-called risk matrices are commonly used for identification of the most important risks. Prior to this, the SOMOS project faces the challenge to identify which risks are relevant, and whether multi-use comes with new risks that are not recognized in sectoral risk assessment.

The methodologies listed above can be used for the assessment of identified risks. When it comes to a novel activity – such as production of food and feed within offshore wind farms – the question is which risks need to be assessed.

SOMOS will identify potential risks before assessment can be done by means of the following methods:

- Review of available peer-reviewed literature on multi-use of offshore wind farms, including among others Michler-Ciuluch et al. (2009), Buck et al. (2010), Klijnstra et al. (2017)
- Review of reports and documents prepared in scientific research projects such as MERMAID, MARIBE, Blauwdruk and VisRisc.
- Interviews with selected persons with hands-on experience in one (or both) of the two sectors, complemented with analysis of sector specific studies on risks
- Consultation with experts on social and ecological cumulative effects, either in person or through organisation of an expert-meeting.

4 References

OSPAR, 2004. Problems and Benefits Associated with the Development of Offshore Wind-farms, Biodiversity Series, OSPAR Commission. Publication Number 212/2004.

Levin PS, Fogarty MJ, Murawski SA, Fluharty D (2009) Integrated ecosystem assessments: Developing the scientific basis for ecosystem-based management of the ocean. PLoS Biol 7(1): e1000014. doi:10.1371/journal.pbio.1000014

Piet G, Boon A, Jongbloed R, van der Meulen M, Tamis J, Teal L, van der Wal JT (2017) Cumulative Effects Assessment: Proof of Concept Marine mammals. Wageningen Marine Research report C002/17.

Sadler (1996) Environmental Assessment in a Changing World: Evaluating practice to Improve Performance. International Study of the Effectiveness of Environmental Assessment Final Report. International Association for Impact Assessment and Canadian Environment Assessment Agency, Canada.

Michler-Cieluch, T., Krause, G. and Buck, B.H., 2009. Marine aquaculture within offshore wind farms: Social aspects of multiple-use planning. GAIA-Ecological Perspectives for Science and Society, 18(2), pp.158-162.

Buck, B.H., Ebeling, M.W. and Michler-Cieluch, T., 2010. Mussel cultivation as a co-use in offshore wind farms: potential and economic feasibility. Aquaculture Economics & Management, 14(4), pp.255-281.

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Klijnstra J. et al. (2017) Technical risks of offshore structures. In: Aquaculture Perspective of Multi-Use Sites in the Open Ocean. The Untapped Potential for Marine Resources in the Anthropocene. Editors: Buck B., Langan R. Publisher: Springer. ISBN: 978-3-319-51157-3

4.1 Links to relevant projects:

Blauwdruk: http://library.wur.nl/WebQuery/wurpubs/485904

MARIBE: https://maribe.eu/

MERMAID: http://www.vliz.be/projects/mermaidproject/project/intro.html

VisRisc: http://www.wur.nl/nl/Dossiers/dossier/Windmolens-op-zee.htm; http://library.wur.nl/WebQuery/wurpubs/fulltext/360260.

5 Justification

This deliverable has been peer reviewed by Marian Stuiver (Wageningen Environmental Research) and Luc van Hoof (project coordinator).

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