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Lessons from stakeholder dialogues on marine aquaculture in offshore wind farms: Perceived potentials, constraints and research gaps

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ABSTRACT

Drawing on a case study in Germany, this contribution explores the practical application of offshore aquaculture within offshore wind farms in view of the different stakeholders involved. Using a transdisciplinary research approach, an understanding of the rationalities and interests among the different involved stakeholder groups was explored. Offshore wind energy is high on the political agenda in Germany. The vast spatial requirements however inherit potential user conflicts with competing, and under current legislation excluded users such as fishermen. Solutions for combining sustainable uses of the same ocean space have thus seen increasing interest within the research community in Germany and in Europe over the past years. This paper was inspired by and presents the outcomes of a stakeholder analysis and in particular a stakeholder workshop. Central focus was placed on academics and private as well as public stakeholders engaged in current research efforts of combining offshore wind farms and aquaculture in the German North Sea. The paper identifies the overall acceptance of such a multi-use scenario in society, opportunities and constraints as perceived by the stakeholders, and key research gaps. The results confirm the assumption that there is a clear need, and also willingness on behalf of the policy makers and the research community, to find sustainable, resource- and space-efficient solutions for combined ocean use.

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1. Introduction

The idea to combine offshore wind farm turbines as fixation point for aquaculture or to co-use an offshore wind farm site by installing aquaculture farms in between several wind turbines has seen considerable attention over the course of the last years (see for instance in the case of Germany: [1–3], The Netherlands: [4], Belgium: [5], UK: [6], France: [7]) (see Fig. 1).

While a significant body of research exists covering individual uses for offshore platforms, the interaction between these multiple uses has not been covered to a full extent on a European scale. This has changed with the recent call of the European Commission "Ocean of Tomorrow", issued under the FP7 in 2011, which reflects the current state of "European Strategy for Marine and Maritime Research" (see Fig. 2).

In a first step, the aim of the call is to establish offshore platforms that can combine various functions, such as aquaculture, wind and solar energy, and transport services within the same infrastructure. It is believed that this could offer significant benefits in terms of economics, optimizing spatial planning and minimizing the impact on the environment.

In Germany, no commercial offshore aquaculture farm exists yet. To date, all attempts to move bivalve aquaculture off the coast to a more hostile environment within wind farm areas are on a pilot scale. Various projects including scientific studies on the biology, techniques and system design, economic potential, Integrated Coastal Zone Management (ICZM), and the regulatory framework as well as potential synergies with offshore wind turbines have been investigated. A number of projects are underway to test the feasibility of offshore farming in the Exclusive Economic Zone (EEZ) of the German Bight, such as the ongoing project Offshore-Site-Selection (OSS). Here, wind farm planners as well as representatives of fisheries, economics and science are together suggesting future sites with best conditions for the cultivation of various aquaculture species.

In its wake, the multi-disciplinary project "Open Ocean Multi-Use" (OOMU) funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety was initiated [23,24]. This project was a follow-up project of a series of multi-use

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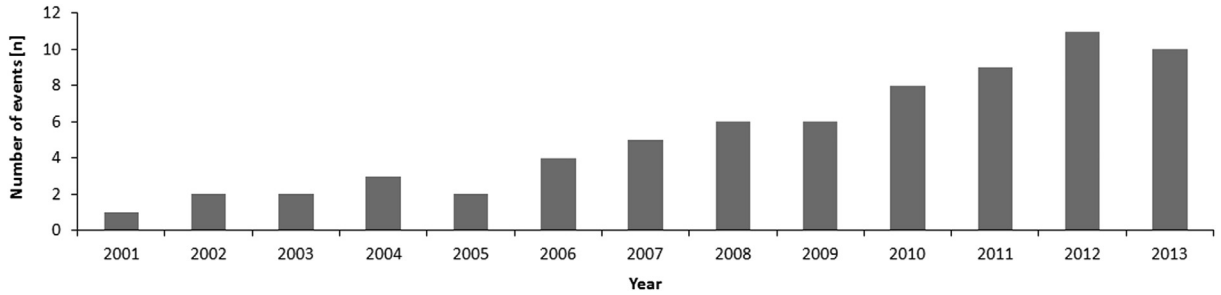

Fig. 1. Graph shows a timescale with the number of events worldwide in which the combination of aquaculture within offshore wind farms was discussed [8–22].

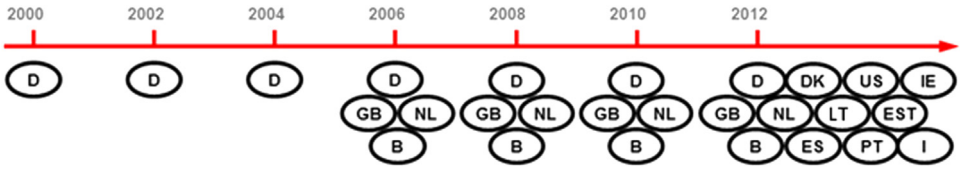

Fig. 2. Countries involved in aquaculture ⇔ wind farm combinations on a time line.

projects combining aquaculture with offshore wind farms (see results e.g. in [2,3]). Central focus of the OOMU-project was to gain more insight into the biological, socio-economic and technical aspects as well as to develop practical solutions for potential problems encountered by integrating aquaculture installations into offshore wind energy facilities. One of the key questions of the socio-economics sub-project was to identify the acceptance of such a multi-use scenario in society at large by addressing the various stakeholder groups simultaneously. By this it was hoped to detect hidden agendas, conflicts and allies, all of which directly and indirectly affect the reasoning of these groups in regard to multi-use of offshore areas. Thus, the approach used here is a transdisciplinary one, meaning that next to the interdisciplinary discourse among different strands of scientific disciplines, a range of different stakeholders from the private–public nexus is involved in the research effort [25].

The main motivation to broaden the scientific community and to include various forms of knowledge is based on the insight that successful and applicable solutions of many environmental and social problems, such as sustainable food production and renewable energy production, can only be found if actors and natural processes at the local, regional, national, and global level are conflated [26]. Much of this is related to social learning. Thus, knowing is an act of participation in complex "social learning systems" [27]. Beginning in the 1970s, the notion of social learning gained attention in many disciplines such as political science, in which the role played by advocacy coalitions in processes of societal change and learning was underlined [28]. Today, social learning can be regarded as an essential element of policy development and implementation. The sustainability-science approach is especially dependent on the inclusion of participatory elements in knowledge production [26]. By including the knowledge and interests of the diverse range set of stakeholders in the very beginning, this issue can be understood as learning of whole societies as a common endeavour [29,30]. Indeed, it is not sufficient for only experts to be knowledgeable about the type of multi-use concept discussed in this paper. To remain meaningful, the public has to be included in the knowledge production in order to understand processes that take place in our economies, environment and societies which in turn will affect the outcomes of our research.

The objective of this contribution is to explore the practical application of offshore aquaculture within offshore wind farms from the perspective of the different stakeholders involved. The consideration of combining different uses is driven by the notion to meet the quest of spatial scarcity in the marine realm [1]. Our premise is that a multi-use concept combining sustainable marine energy and food production would benefit from a better understanding of the rationalities and interests among the different stakeholder groups involved. The identification of potential benefits and constraints, and the formulation of key research gaps may help to guide policy makers and the research community towards tailored, problem-focussed solutions to meet the challenge of sustainable offshore aquaculture.

2. Methodology

The OOMU project is part of a successive series of multi-disciplinary research projects that were initiated as early as 2001 with a focus on combining offshore wind energy and marine aquaculture [31,32,1,3]. The stakeholder workshop presented in this paper therefore builds on outcomes of previous workshops and interviews initiated in 2003 by the German shellfish growers in Emmelsbüll-Horsbüll [12] as well as by socio-economic scientists in 2005 in Bremerhaven [33]. While previous projects studied potentials for mussel and algae farming in offshore wind farms, the OOMU project focused additionally on fish aquaculture in an IMTA concept.[1] Many of the stakeholders have been part of the ongoing research process since its very beginnings and still remain to date.

This paper primarily reflects on the outcomes of a stakeholder workshop that was conducted on September 7th, 2011 in Bremerhaven, Germany. The stakeholder workshop was part of a broader stakeholder analysis that was conducted within the OOMU-project to identify key stakeholders and their potential roles, attitudes, and concerns regarding an aquaculture/wind farm integration at the offshore location "Veja Mate".[2] The stakeholder analysis was

[1] The aim of IMTA is the creation of a manageable small ecosystem with several species of different trophic levels combined in one system in the right proportions, each utilizing waste products or the biomass generated by another member of the system. While fish functions as the "fed" component producing waste, seaweed and shellfish act as the "extractive" part more or less in an ecosystem services manner.

[2] *Veja Mate* is the second wind farm to be realized under the planning authorization of *BARD Engineering*. In August 2009, Germany's Federal Maritime and Hydrographic Agency (BSH) granted planning approval for the new offshore wind farm that will border *BARD Offshore 1* to the western side. In total, 80 wind turbines will be installed on an area of 50 km^2. *Veja Mate* is the case study example within the OOMU project.

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