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Lessons Learnt From Linking Global Recommendations With Localized Marine Restoration Schemes and Policy Options by Using Mixed Methods

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In order to advance ongoing efforts in the (still emerging) field of marine restoration, different forms of knowledge must be combined: not only the biological and technical aspects, but also the social and cultural dimensions of marine restoration efforts. This calls for a newly combined array of methods that allows for a bridging of these different knowledge dimensions. Drawing on our experiences from the ongoing knowledge transfer processes of the INTERNAS project (Scientific Transfer of the results of INTERNational Assessments in the field of Earth and Environmental Research into the German policy context), we provide an overview of methods that were used to link global recommendations with localized marine restoration schemes and policy options. Using a mixed methods approach, we were able to capture and understand the pathways of knowledge transfer from globally synthesized scientific knowledge to local realities related to protecting and enhancing marine biodiversity in Germany. With this structured knowledge transfer approach, actionable solutions for marine conservation and restoration activities could be tailored to the specific national and regional circumstances. Using participatory methods, framework conditions like ecological, social, legal, and sectoral value judgment dimensions can be identified. This allows for the development of concerted solutions and creates a common ground for good governance towards marine restoration. When scientists engage not only as experts but also as reflexive facilitators in such participatory processes, it is ensured that more inclusive forms of knowledge are fostered that are necessary to better anticipate the potentials and likely pitfalls that marine restoration efforts may encounter. We conclude that existing knowledge on ecosystems, their goods and services as well as societal expectations need to be understood from the onset in any kind of marine restoration effort.

Keywords: knowledge transfer, stakeholder dialogues, international environmental assessments, marine restoration, methods, modes of participation

INTRODUCTION

Societal demands for resources often go hand in hand with massive alterations of marine habitats. Indeed, the intensive exploitation of marine ecosystems and other effects of human usages (e.g., Burke et al., 2011; Intergovernmental Panel on Climate Change (IPCC), 2013) are largely responsible for the alarming degradation and loss of marine ecosystems (e.g., Gibson, 2006; Duke et al., 2007; Waycott et al., 2009; Beck et al., 2011; Burke et al., 2011). Such environmental degradation results in drastic declines in the value of marine ecosystem services and, subsequently, costs to society (Cesar, 2000; Barbier, 2012; Tadaki et al., 2017). Thus, active restoration of marine systems (marine restoration for short) has been identified as a possible way forward to counteract some of these negative repercussions (Abelson et al., 2016). Such restoration could address for instance the recovery of ecosystem structure and function, which has been identified as one of eight "grand challenges" in marine ecosystems ecology (Borja, 2014).

To advance ongoing efforts in the (still emerging) field of marine restoration, different forms of knowledge must be combined: not only biological and technical aspects, but also social and cultural dimensions. This, in turn, leads to crucial questions that relate to the normative discourse on (1) "What is it that should be shaped and maintained?" and (2) "For whom is the benefit?" (3) "Who pays (and why)?" (4) "What is the expected societal value?" Social value judgments about the environment and its well-being, such as "Who defines how and in which ways marine restoration is to take place and which species are at the forefront of these efforts?" point to questions of how humans live with their environment and with each other (Golley, 1993; Glaser, 2006) and may open the door to contested debates in science and other fields (Tadaki et al., 2017). Questions such as these cannot be answered by only one subset of society, but require a broader discussion and decision-making process to address them in a legitimate way. Sometimes this weighting of arguments and agreeing on ways forward is done at the local level (only), but sometimes the issues to be addressed are so pervasive and widespread that they become relevant to discuss at the global level. In the latter case, one challenge is to agree with a large number of nations on the state of knowledge on the issue at hand, as synthesizing information at the global scale may also show patterns that may not arise in the same way from local/national analyses. Another challenge is to agree on acceptable options on how to proceed. One prominent example of the latter are the sustainable development goals (SDGs), which can be viewed as a strong case-in-point of how a globally agreed-upon process, in which the priorities and concerns of all nations were brought together and systematized, helps to guide implementation at the national level. Notably, several SDGs deal with reducing or reversing environmental degradation, most notably SDG 14: "life below water," and SDG 15: "life on land." Thus, there is a globally agreed consensus that the issue of marine degradation is a global societal priority that needs to be addressed.

POINT-OF-DEPARTURE

The observations above call for a stronger cooperation between natural and social sciences as well as humanities and society at large. As already Abelson et al. (2016) state, "overall, the development of effective, scalable restoration tools and approaches will inevitably be complicated by its broad multidisciplinary nature. Therefore, [...] strong collaboration will be required among ecological, economic, and social experts, as well with private and public stakeholders, to encompass a diverse array of fields into a transdisciplinary co-designed approach" (Abelson et al., 2016, p. 162). Recognizing that there are multiple ways of knowing, resulting in different types of knowledge (e.g., scientific, practical/experiential, local/indigenous), the challenge is often twofold: (1) how to bridge these different knowledge types often found in different groups in society, who may not interact or have the vocabulary to do so, and (2) how to bridge between knowledge realms at different scales, e.g., from global to local or vice versa (Krause, 2014, 2018). Indeed, when insights are gained at the global level, scaling these down to the local level could be highly relevant, but this is an activity that is not often undertaken. International assessments by the UN or intergovernmental bodies gather and condense a huge amount of scientific knowledge from many experts around the world in peer-reviewed and publicly accessible documents (i.e., the assessment itself). Some intergovernmental bodies, e.g., IPBES – the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, explicitly include different forms of knowledge in their conceptual framework and focus on nature's contributions to people (Díaz et al., 2018). International assessments are of particular importance to marine restoration initiatives, as they may function as a justification for nationally and locally required action as they provide information on what type of ecosystem goods and services are globally agreed upon. They, therefore, represent a consensus view on which aspects of a particular issue (like marine restoration) are considered globally by all nations involved in the assessment to be relevant to address, possibly with high priority. Many of these international assessments are explicitly not policy-prescriptive, but some develop and offer policy options (e.g., the IPBES assessments), i.e., options that globally agreed upon as potentially suitable for addressing an issue. Such global insights and policy options must be translated to actionable knowledge at the local/national scale in a way that is coherent with this global perspective. The question of how best to carry out this translation process from global agreement to e.g., national implementation is, however, far from understood. There are likely to be central drivers (e.g., political system), potential opportunities (e.g., current policy development), and barriers (e.g., lack of awareness) that render globally synthesized knowledge more or less accessible to local restoration efforts.

The central question we aim to address with this paper is: What methods are suitable to link the insights from global international assessments to local implementation of restoration measures?

Drawing from our experiences made in the ongoing knowledge transfer processes of the INTERNAS project

(Scientific Transfer of the results of INTERNational Assessments in the field of Earth and Environmental Research into the German policy context), we provide an overview of methods (and our experiences with them) that can be used for co-developing localized marine restoration schemes and policy options. In the INTERNAS project, research on knowledge transfer processes is undertaken through strong cooperation with authorities, policy makers, NGOs, industry, and other stakeholders. The project draws on the wealth of available (scientific) knowledge within international environmental assessments. The inclusion of insights from this globally synthesized knowledge is important as a baseline for the future. On the one hand, marine restoration effects may be difficult to observe if they are distant from shore or the direct exploitation activities. On the other hand, any restoration may have indirect effects, e.g., when these occur in a way that is removed in space or time from the direct restoration measure. Thus marine restoration effects may require observation at larger scales than just where the measures are implemented and benefit from the global perspective which international assessments can provide. Despite the hopes marine restoration raises for beginning to restore the already degraded marine systems, it can also not be seen as a panacea to justify further degradation as timescales for the establishment of natural habitats (e.g., coral reefs) are often different from timescales for restoration (Abelson et al., 2016). Despite these challenges, marine restoration must be regarded as a necessary step toward the improvement of ocean health, as pointed out by the international assessments such as IPBES' regional and global assessment, GEO6, World Oceans Assessment. In this context, capturing and understanding the knowledge transfer pathways from globally synthesized scientific knowledge to local realities that relate to protecting and enhancing marine biodiversity is necessary. This calls for a robust process to elicit knowledge and to contextualize the existing knowledge realms.

METHODS USED IN THE INTERNAS KNOWLEDGE TRANSFER PROCESS

Within the INTERNAS project, a seven-step process of knowledge transfer from international assessments to the national scale was developed that called for an array of mix-methods (Happe et al., 2019; **Table 1**, column A).

The process consists of (1) a first preparatory stage, (2) a first stakeholder knowledge transfer event, (3) assessment and reflection, (4) a second preparatory stage, (5) a second stakeholder knowledge transfer event (6) processing and dissemination of results and (7) post-processing. In its wake, a set of eight different methods (explained below and listed in **Table 1**, column B) can be applied in various combinations to complete these 7 process steps (**Table 1**, column A). In the following, we highlight these mixed methods from the social science realm and the experiences made with these in the INTERNAS project.

Method 1: Stakeholder Analysis

A stakeholder analysis can be understood as a process that "(i) defines aspects of a social and natural phenomenon affected

TABLE 1 | Seven-step process and methods applied in INTERNAS knowledge transfer.

Seven-step process	Possible methods
First preparational stage	Systematic literature review of international environmental assessment. Qualitative content analysis. Stakeholder analysis. Questionnaire.
First stakeholder knowledge transfer event	Semi-structured expert interview. Focus group. Stakeholder dialogue workshop.
Assessment and reflection	Qualitative content analysis and first ontology capture. Questionnaire.
Second preparational stage	Qualitative content analysis. Systematic literature review of international environmental assessment. Stakeholder analysis.
Second stakeholder transfer event	Stakeholder dialogue workshop and second ontology capture.
Processing and dissemination	Qualitative content analysis.
Post-processing	Ontology definition

by a decision or action; (ii) identifies individuals, groups and organizations who are affected by or can affect those parts of the phenomenon (. . .); and (iii) prioritizes these individuals and groups for involvement in the decision-making process" (Reed et al., 2009). A stakeholder analysis should be systematic so that all stakeholder groups affected by or affecting the initiative in question can be included. Typically, methods such as focus groups, knowledge mapping, snowball sampling, social network analysis, etc. form the mainstay for stakeholder analysis. A more detailed overview is provided in Reed et al. (2009).

However, a stakeholder analysis, which ideally includes all individuals, groups and organizations affected by or affecting the marine restoration effort in question, can be time-consuming and costly, and thus pose challenges in its implementation. This requires good knowledge of the stakeholder landscape and their level of engagement in the decision-making processes that are related to issues addressed by the restoration initiative.

Method 2: Systematic Literature Review of International Environmental Assessments

A systematic literature review is fundamental to any research project, as it provides an overview of the topic, identifies and collects important documents within a particular field, and describes the state "of existing evidence" (Dicks et al., 2017) in a more or less standardized, systematic manner. In the INTERNAS project, the focus was on systematically reviewing and capturing knowledge in international assessments. However, our experiences with literature reviews revealed that global assessments are extremely long, and proved, therefore to be very time-intensive for a small team to scan the full reports for relevant text on a particular topic. Also, international assessments

collate a wide range of different literature and offer a systematic review of existing evidence but are rather broad overall. The challenge lies in making these international assessments, which by definition have a rather wide an overarching perspective, relevant, meaningful, and operational for the national policy level. This requires an additional thorough literature review of policy documents, NGO reports, and other gray literature to clarify the specific context of national policies, which render international assessments relevant for the national context. In this context, the particular expertise present in the scanning team may also potentially pose a limitation to the effectiveness of the preparations in terms of the time needed to fully grasp a specific topic, such as marine restoration.

Method 3: Semi-Structured Expert Interviews

The semi-structured expert interview is a method usually conducted with a relatively small sample of experts on a particular topic, and is more open and conversational than a structured interview or questionnaire. Esterberg describes interviewing as a relationship between two individuals that come together "to try to create meaning about a particular topic" (Esterberg, 2002), thereby drawing on a range of different social conventions and cultural knowledge. The interview is conducted by preparing a few questions in a semi-structured interview guideline, which can then be followed up by asking more detailed questions that surface during the conversation (Price et al., 2015). This method is highly suitable if more detailed data and expert knowledge are needed on a specific topic, and helps preparing knowledge transfer events. Its application requires, however, that experts with specific knowledge are appropriately identified (i.e., by a previously conducted stakeholder analysis). Furthermore, the guidelines for semi-structured expert interviews must be clear from the start and must include a thematic focus of interest. For implementing marine restoration initiatives, these interview guidelines must address the respective national policy options. This method is highly suitable to avoid misinterpretations and wrong assumptions from the start on what a marine restoration initiative could and should achieve.

Method 4: Focus Groups

The focus group is a common research method in qualitative social research (Tracy, 2013). Focus groups are used to elicit and discuss different persons' opinions on an issue. They are defined as "a planned discussion among a small group of stakeholders, facilitated by a skilled moderator" and is aimed at investigating "people's preferences and values about a defined topic and why these are held by observing the structured discussion of an interactive group in a permissive, non-threatening environment" (Slocum, 2003). This method is fruitful for exploring an issue, generating ideas, and observing common forms of interaction and discursive formations among participants. They can also be employed to test, review, or evaluate ideas.

In INTERNAS, preparing the focus groups by summarizing some of the recommendations from international assessments

in an easily interpretable manner proved to be useful. This pre-information provided to focus group participants fostered a fruitful discussion with the participants. It is important to note, however, that focus group results reflect the opinions of the group members and are not necessarily representative of the society as a whole. Indeed, data needs to be triangulated to achieve a more full representation of societal opinion (Reed et al., 2009). Despite the difficulties, this method can be employed for preparing other group interaction tools such as thematic workshops or scenario workshops, proposing possible content foci and formats, as well as helping to identify additional stakeholders.

Method 5: Stakeholder Dialogue Workshops/Knowledge Transfer Events

Face-to-face knowledge exchange during live events (e.g., workshops) is the key element of a participatory knowledge transfer process. Stakeholder dialogue facilitates this exchange and also enables combining expertise as well as public values and preferences. Events that include stakeholder dialogues clarify and improve the knowledge base for decision making (transfer from stakeholders to science) and support the implementation of knowledge by stakeholders (Oels, 2006). Thus, using this method, decision-makers can integrate knowledge from professionals, experts, political representatives and interest groups (e.g., NGOs) into the government management of natural resources (Renn, 2006).

In the framework of the INTERNAS project, stakeholder dialogue workshops in which larger groups were gathered were split into sub-groups to encourage more fair and balanced face-to-face discussions and offer personal contacts and networking opportunities. In our experience, such stakeholder dialogues, despite their high level of preparation time, are highly effective, as they enable direct face-to-face networking between participants and exchange of knowledge in a comparatively short time.

Method 6: Questionnaire

Questionnaires are one of the most common methods in empirical social research and commonly used to produce quantitative data for statistical analysis, as they provide pre-structured answers and allow to test a large sample size (Matthews and Ross, 2010). In INTERNAS, this method was used to gain qualitative data in a standardized format on the knowledge of different stakeholders concerning international assessments and their implications for marine restoration (see also Thronicker et al., 2019). Furthermore, it was applied to test the success of knowledge transfer (before and after a knowledge transfer events) as well as to test potential success indicators for knowledge transfer via self-reporting.

Method 7: Qualitative Content Analysis

A qualitative content analysis is a "searching-out of underlying themes in the materials being analyzed" (Bryman, 2004), which can be documents, digitized survey data, protocols, and interview transcripts that are the outputs of the literature

review, semi-structured interviews, focus groups, workshops, and questionnaires. This analytical approach is defined as "a method for systematically describing the meaning of qualitative material. It is done by classifying material as instances of the categories of a coding frame" (Schreier, 2012). The goal is to analyze the written data in terms of their qualitative aspects, such as the descriptions of phenomena and their context, elicitation of mental concepts, social or personal meaning, perceptions, and values (Schreier, 2012). To employ this method, the analyzed documents and the search procedure must be documented (Bowen, 2009). To do that, a coding frame is developed iteratively – first, it consists in part of predefined codes that are of interest to the researcher, which becomes more refined once the material is analyzed and interpreted, and new categories evolve from the material. In that sense, a qualitative content analysis uses the coding of semiotic correlations as a means to extract themes and meanings from the material at hand (Bryman, 2004). Ideally, the coding frame should be developed iteratively by a group of researchers to avoid inconsistencies (Schreier, 2012).

In INTERNAS, the qualitative content analysis was aimed at identifying options for specific policy measures at the national scale, and an identification of actors implementing these options. A thorough analysis of the stakeholders' perception of relevant problems, the perceived opportunities, as well as established links to other policy fields and regions were of crucial importance. This knowledge was, in turn, instrumental for finding potential windows of opportunities for mainstreaming biodiversity into the national context, specific barriers to implementation, and stakeholder interests. An example of a research achievement in this context, based on qualitative content analysis, is the analysis of political positions concerning biodiversity in the reform process of the EU Common Agricultural Policy.

Method 8: Ontology

Knowledge assembled by international assessments can be considered as a baseline status on a given issue from a globally agreed perspective. National stakeholders can contribute to extend this knowledge and complete it by providing national examples and strategies as well as giving feedback on the baseline as it stands from the global assessments. One way to bridge identified gaps and have these filled by national stakeholders is to computerize knowledge via ontologies and record the additional information. An ontology is a machine-readable, logically controlled representation of human knowledge and a crucial and prescient step in data management (Buttigieg et al., 2013; Arp et al., 2015). It is logically structured by clearly defined classes for each entity and by clearly defined relationships (Arp et al., 2015). Thus the baseline status of knowledge can be represented by a so-called basal ontology. This then allows for formalization and standardization of additional knowledge used to bridge gaps between different sectors and that contextualizes different stakeholders' knowledge. Ontologies related to environmental knowledge are often used in combination with the Environmental Ontology – ENVO (Buttigieg et al., 2013, 2016) and the Sustainable Development Goals Interface Ontology (SDGIO, 2019).

In INTERNAS, existing ontologies represented in ENVO and SDGIO were complemented with information collected at stakeholder events that highlighted or defined particular concepts or linkages between different understandings of concepts, such as insect conservation. This step is referred to as post-processing in the INTERNAS process (**Table 1**).

Summary of Methods

The above suite of methods was employed in INTERNAS to capture and understand the pathways of knowledge transfer from synthesized global knowledge to local realities of protecting and enhancing marine biodiversity in Germany.

On a general level, it can be noted that scientists facilitating knowledge transfer processes can choose when and to what extent they bring in their opinion as a regular citizen in addition to bringing in their expertise. In the following section, we showcase an example of how the INTERNAS process was developed and how it affected discourses on marine restoration at the German national level.

SHOWCASE OF THE INTERNAS KNOWLEDGE TRANSFER PROCESS

In June 2019, INTERNAS conducted a stakeholder workshop on "Protection and Use of the German North and Baltic Sea." The UN World Ocean Assessment (WOA) (United Nations (UN), 2016) and the Global Environment Outlook (GEO 6) of the United Nations (UN Environment, 2019) published in May 2019 were selected as a basis for the workshop. Options for action corresponding to the workshop's topic were identified in the global IPBES report (The Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES), 2019), also published in May 2019, using qualitative content analysis.

Before the above-mentioned stakeholder workshop, a focus group explored the ideas, opinions, and main topics of interest (Stewart and Shamdasani, 1990; Tracy, 2013) relating to the "Protection and Use of the German North and Baltic Sea." Participants of the focus group meeting included a representative of the Federal Maritime Office as an expert in marine spatial planning, an action artist focusing on marine waste, a representative of the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research – AWI North Sea Office, a project manager of the German Marine Research Consortium, an expert in marine biodiversity research and stakeholder dialogues, and a scientist specializing in coastal management. In the focus group, the results and possible courses of action from the environmental reports were discussed and further potential stakeholder groups were identified concerning their relevance for the German context.

Subsequently, selected representatives from nature conservation organizations, research, national and regional authorities, arts, journalism, tourism associations and industry (e.g., offshore wind power, fishery, mussel and shrimp farming) were invited to the stakeholder workshop on "Protection and Use of the German North and Baltic Sea." There, INTERNAS

was introduced by a short project presentation and keynotes were given by a selected set of experts, ranging from state-level authorities to legislative representatives. The participants discussed potential national activities on "Protection and Use of the German North and Baltic Sea" in four thematic groups: (A) Reduction of the loss of species and habitats; (B) Ecosystem management of marine areas; (C) Sustainable land use, sustainable land management; and (D) Orientation of fisheries toward sustainability (**Table 2**). Contextualized core messages were developed in each thematic group for the final workshop product (compiled in **Table 2**). These were then combined into a final statement by the workshop participants (INTERNAS, 2019) and sent to the addressees specifically identified by the participants, including the German IPBES Coordination Office. In conclusion, the participants agreed that the format of a 1-day workshop was well suited for the transfer of contents of international environmental assessments into the German policy context. The workshop also served to network relevant national actors who could contribute to the concrete implementation of marine restoration and for direct political advice on how to foster actionable restoration measures. We also noted that adjustments are still necessary in the transfer process concerning national uptake of globally synthesized knowledge. Overall, the chosen approach allowed for the transfer of scientific information and elicited feedback from national stakeholders on the options for action that had been previously formulated in international assessment reports.

TABLE 2 | Central topics and core messages regarding marine restoration efforts developed in the INTERNAS knowledge transfer process.

Central topics	Core messages
(A) Reduction of the loss of species and habitats	– Promote consistent mainstreaming of biodiversity in politics and administration. – Establishing and effectively managing well-networked protected areas.
(B) Ecosystem management of marine areas	– Establishing, bindingly defining and controlling breaks in use for ecologically sensitive areas. – Make an accessible, comprehensive, and continuously updated noise mapping. – Prohibit disposable plastics and address their routes of entry into the sea.
(C) Sustainable land use, sustainable land management	– Make data on marine ecosystems and their uses publicly available. – Enable early, iterative and long-term participation in planning and implementation processes. – Carry out a regular reassessment of spatially effective uses. – Coordinate marine use and marine protection across departments and sectors.
(D) Orientation of fisheries toward sustainability	– Promoting technical development and innovation for ecosystem-compatible fishing methods. – Training fishermen towards more sustainability. – Upgrading sustainable fishing practices.

SYNTHESIS

Based on a structured knowledge transfer approach, actionable solutions for marine conservation and restoration activities can be tailored to the specific national and regional circumstances. Indeed, getting access to and structuring different kinds of stakeholder knowledge relating to existing framework conditions like ecological, social, legal, and sectoral value judgment dimensions, enables the development of concerted solutions and creates a common ground for good governance for marine restoration. The normative questions introduced at the beginning, (1) "What is it that should be shaped and maintained?" (2) "For whom is the benefit?" (3) "Who pays (and why)?" (4) "What is the expected societal value?" could also be used in the future as guides in identifying which stakeholder interactions are necessary to increase our understanding of marine restoration and their outcomes from different angles.

From the stance of marine restoration, the question (1) "What is it that should be shaped and maintained?" supports the detection of misalignments in the aims of a specific restoration measure. For example in the case of the ongoing resettlement efforts of the native European Oyster (*Ostrea edulis*) in the North Sea, this question needs to be explicitly tackled. Different motivations are possible, such as cultural, economic, or ecological. One can argue that the species should be present in a certain area due to cultural (as part of the local cultural place-identity) and economic reasons (locally detected private market request for a sale and distribution in restaurants and to tourists), or due to ecological reasons, because the species role in the corresponding ecosystem is highly relevant, e.g., as holding central functions as a keystone species. This can be done by conducting a stakeholder analysis and workshop to manage and define initial expectations. By identifying beneficiaries of a given (marine restoration) measure through a stakeholder analysis, different actors of the restoration effort can be addressed and involved. For instance, as stated in the core messages of the INTERNAS workshop, fishers were identified as one of the central change agents that should be included and directly capacitated toward more sustainable approaches within their working routines. Thus, by making the beneficiaries to change agents for marine restoration, the results have a higher chance to become a long-term asset (Gill et al., 2009).

Aside from the identification of central beneficiaries and change agents, the question on the financing of marine restoration measurements (see question 3) "Who pays, and why?") follows as a result of the identification of "What" or "which aspect" of the marine ecosystem (service) is the central target for restoration. By setting forth a clear definition of the "what," the willingness to fund a project renders to be more justified since comprehensive valuation critically depends on communicating the nature of ecosystem services to the potential beneficiaries (Shogren et al., 1994; Loomis et al., 2000; Johnston et al., 2013). By applying the knowledge-inclusive methods mentioned above this central question can be jointly defined. Indeed, when it comes to societal values, the overarching combination of anthropocentric and ecocentric

mindsets should be applied in considerations around restoration projects. As described in Glaser (2006), there is an essential need to recognize the central importance of social dimensions in ecosystem management.

Many funding institutions, such as EU Horizon 2020, Belmont Forum, have called for more efforts to enhance the relevance of science to society (Krause and Schupp, 2019). This implies enabling diverse (or at least distinctly plural) forms of participation by experts and societal actors in scientific work. In this endeavor, scientists need to consider themselves as reflexive facilitators (Tadaki et al., 2017), who foster such participation. Indeed, the core of such activities is to identify what different knowledge systems mean to different people (O'Neill et al., 2008) and may be articulated in the forms of narratives, metaphors, ethical roles all of which root in specific ontological frameworks (Euzen and Morehouse, 2011; Pröpper and Haupts, 2014). The methods described above are aimed at supporting researchers and practitioners to be more knowledgeable and transparent about the strengths, limitations, and utilities of different methods of knowledge capture and transfer.

To this end, this selection of methods can be viewed as a contribution to marine restoration in the sense that without an ethical positioning with a scientific underpinning (Tadaki et al., 2017), as well as guiding principles with societal and political acceptance from the start, any marine restoration effort is prone to fail. In this regard, the yet nascent discourse of how to obtain and maintain a social license to operate is central (Newton et al., 2020). There is a direct need to balance the top-down approaches of the recommendations for action (in our case for marine restoration) to national as well as local realities and acting capacities. Hence, insights are needed on how knowledge about certain aspects of the Sustainable Development Goals is transferred within a domain and/or to one or more different domains of science and society (International Council for Science (ICSU), 2017). This entails focusing on the dialogues at the science-policy-stakeholder interface since these affect the relationships not only between the different scientific disciplines, but also the multiple sets of stakeholders outside academia, all of which have different forms of interpretation of sustainability (Markus et al., 2017; Krause, 2018). Face-to-face knowledge exchange during workshops is the key element of a participatory process in knowledge transfer. It is facilitated by stakeholder dialogue and enables the combining of expertise as well as public values and preferences.

CONCLUSION

The role of the UN's SDGs must be recognized as a globally-agreed ethical consensus in the efforts of how to transform societies and place them onto more sustainable pathways. Indeed, the SDGs are becoming increasingly important as a point of reference for science and society alike, since meeting these standards requires recognizing the linkages between different SDGs and the potential trade-offs between them. In order to address difficult questions (such as which of the goals is more relevant in a given ecosystem under certain marine resource use schemes and what trade-offs can be expected), interdisciplinary research from the marine sciences needs to engage in meaningful and productive dialogues and collaborations with ocean and coastal managers as well as with other beneficiaries. With this approach, the potential of multiple stakeholders and scientists to act as change agents for successful outcomes of marine restoration efforts can be enhanced.

We conclude that for any kind of marine restoration effort, existing knowledge on ecosystems, their goods and services as well as societal expectations need to be understood from the start. We argue that in mixed methods that include some mode of participation, the participating scientists should consider themselves as both reflexive facilitators as well as objective experts who represent the public interest in marine restoration.

AUTHOR CONTRIBUTIONS

GK: co-project lead of INTERNAS; responsible for workshop, data collection, and lion part of writing. CW: preparation of Workshop, data collection, and method review writing. A-KH: preparation of workshop, data collection, and writing. JH: workshop preparation and moderation. PB: workshop preperation, conceptualization and ontology capture, and writing. NF, JS, and CK: workshop support, data collection, and writing. HW: co-project lead and workshop preparation. KR: workshop preparation and moderation, and writing. All authors contributed to the article and approved the submitted version.

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