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RESEARCH

Analysis across case-based global sustainability projects: an emerging challenge for ocean conflict research in the Anthropocene

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Abstract
A growing number of global ocean conflict studies over the last decade have set out to advance sustainability in the Anthropocene. Many of these research projects use multiple case studies to extract lessons for wider contexts. The methods used by these studies, and the extent to which their results have validity beyond the individual case study, often remain unclear. This paper explores the challenges in performing cross-case analysis within what we denote as case-based globally focussed sustainability projects (CB-GSPs) and indicates solutions by combining information from semi-structured interviews with leading scientists from eight CB-GSPs. We identify six distinct challenges that are common across these studies with regard to generating actionable knowledge through cross-case analysis. Based on these findings, we propose a set of best practice recommendations for scientists, project partners, and funders to co-produce actionable knowledge for global projects on ocean conflict.

Keywords Cross-case analysis · Ocean conflict · Global sustainability · Research project design and practice

Ocean conflict research

For studies on global ocean sustainability challenges to be relevant and actionable across local to global scales, active marine social sciences are essential (McKinley et al. 2020). Much research on global ocean sustainability has represented humanity as a monolithic force (the "Anthropos") thus simplifying the diversity of contexts, social dynamics, and power relations (Biermann et al. 2016) behind conflicts.

At the same time, maritime disputes have been at the core of global empire-building for centuries (Carvalho & Leira, 2022), and the law of the sea is a developing body of international

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agreements, treaties, and customs which reflect the political character of the sea and support order, productivity, and peaceful relations among users. Over time, the ocean realm is increasingly affected by competition and conflicts (Jouffray et al. 2020), and the manifestations of these differ between system levels. While global factors such as fishing subsidies are often prominent conflict drivers (Skerrit et al. 2023), their embeddedness into case-specific contexts shows that regionally rooted knowledge is needed to understand social dynamics and conflicts.

There is no quintessential definition of conflict in the social sciences. There is, however, a general consensus that conflicts revolve around material and immaterial resources and involve haves and have-nots (Collins 2022:3). Resources in this understanding include natural (e.g., land, energy, and minerals) and economic resources (e.g., money and technology), but also cultural (e.g., identity and reputation) and social resources (e.g., social networks). Important to note here is that these resources—e.g., energy or social relations—do not in and of themselves produce conflict. Only a change in the condition of these resources can produce conflict. Such changes can relate to how accessibility and control of resources are politically organized; how the benefits of resources are distributed among groups; how much people contribute to making resources available and are appreciated for it; and how the environmental harms that come from resource use are felt. When people feel that justice in any one of these conditions is violated, there is potential for conflicts to develop (adapted from Moore 1978: 15-44). To turn potential conflicts into overt conflicts requires that people experience grievances, i.e., the emotions that come with losing something dear, and they need to overcome the fear of losing life chances, defeatism, and acquiescence. The open conflict thus presupposes a process where people, often together with others, reconsider and reinterpret current conditions of resources, what mutual obligations underpin these, and how they feel about it in terms of fairness and justice (Collins 2022: 3-5).

International studies on ocean conflict and other marine governance issues (e.g., Pinsky et al. 2018; Spijkers et al. 2019 from international relations) employ globally applicable models and concepts. An increasing number of global studies, however, are relying on case studies. While there are examples of single case studies employed to demonstrate a general finding (e.g., Estévez et al. 2020), many studies now rely on multiple case studies selected across world regions, cultures, and climate zones (e.g., Balvanera et al. 2017, Bellanger et al. 2020; Alexander, 2020)[1]. The knowledge and tradition of working with a single case study of a marine human-nature complex are long-established in subjects such as maritime anthropology and marine sociology. But important questions remain unanswered on how these case study traditions are applied and integrated into inter- and transdisciplinary scientific analyses that aim to go beyond individual case contextuality and complexities to produce insights and solutions on global issues. As climate change, population growth, and competition for resources advance, the global increase in ocean conflicts arising from inequity and inequality is a prime example and our focus here.

The number of projects in transdisciplinary global sustainability research that use multiple case studies has grown over the past decade, in line with global initiatives such as Future Earth. This development builds on an earlier generation of integrated, in-depth, long-duration case studies that focussed on specific world regions. In the ocean and coastal realm, examples are the MADAM project for North Brazil (Saint Paul and Schneider, 2010), SUCOZOMA for the Baltic Sea region, and SPICE for archipelagic Indonesia. From these earlier efforts, a new type of contemporary global sustainability research appears to have developed that we here call "case-based global sustainability projects" (CB-GSPs). CB-GSPs employ multiple case studies to explore commonalities and contrasts in order to gain insights on global environmental sustainability issues. This implies the need to find a middle ground between generic (internationally relevant) and specific knowledge relating to one or several case studies.

State of the art: Case studies in sustainability research

The social sciences, including anthropology, sociology, psychology, political science, and others, look back on over a century of case study work (Aswani 2019). There is also a long history of case studies in natural science research, including and preceding Darwin's famous study of finches on the Galapagos Islands (Flyvbjerg 2006) to the present day with the long-term ecological research sites (LTERs)[2]. Case studies can support theory building by providing detailed, fine-grained, multifactorial insights which allow for contextually grounded understandings of individual and system behaviors. They are a classical approach to asking "how and why" questions in complex situations where the boundaries between a focal issue and its context are often

[1] In the same spirit of working locally for global sustainability, in 2015, FAO published the voluntary SSF guidelines (https://www.fao.org/in-action/globefish/fishery-information/resource-detail/en/c/338797/) that have been implemented in different regions, giving rise to different comparative studies; see The Small-Scale Fisheries Guidelines. https://link.springer.com/book/10.1007/978-3-319-55074-9

[2] https://lternet.edu/core-research-areas/

unclear (Yin 2009; Grantham 2021). Case studies are often concerned with explaining particular processes rather than with formulating more generally applicable "truths." Case studies (of the human world) examine the ideas, interpretations, and perspectives of people involved using diverse approaches: scholars of historical cases use archival data (diaries, reports, etc.), while human geographers and interdisciplinary sustainability researchers work with an exploratory, sometimes action-based, research approach, which triangulates diverse data sources and relies on the active participation of multiple stakeholders (e.g. Pereira et al.; 2020; Norström et al. 2020).

Comparative case studies can attribute causality in situations where many different causes may be responsible for an outcome while it is not feasible or desirable to use a control group or (quasi)-experimental design. They can thus explore how context influences an outcome and how to tailor an intervention to context to move towards intended outcomes (Goodrick 2014; Benasso et al. 2022). Comparative case studies support middle-range theory development, a term coined by Robert Merton (see Udehn and Hedström, 2009) which refers to theories located midway between knowledge which is specific to one case and knowledge in "general theory" with its (claim to) universal applicability. As an important part of middle-range theory building and testing, case study comparisons provide a fine resolution that can reveal deeply contextual perspectives on the relationships that drive system dynamics in specific contexts (Grantham 2021). In this approach, quantitative methods can strengthen standardization and comparison of the complex social-ecological dynamics of case studies (Flyvbjerg 2006; Grantham 2021). Qualitative methods can be employed to assess contextual depth and detail. Mixed-method approaches combine these respective strengths and enable triangulation of qualitative and quantitative data to reveal commonalities and differences across case studies.

While multiple case studies became prevalent in interdisciplinary research in the late 1990s and early 2000s, subsequent efforts, such as the development of the social ecological systems framework (Ostrom 2009; Poteete et al. 2010), created synergies between case-based learning and more widely applicable cross-case analysis.

Objectives

This paper explores the institutional context and methods of case study-based approaches in collaborative global ocean (conflict) research. We identify major challenges and offer solution pathways and best practices for scientists, local non-academic partners, and members of funding consortia to improve cross-case study analysis in global sustainability and ocean (conflict) research.

We explore the following questions: What are the challenges for reliable and effective cross-case research in global ocean conflict and sustainability research projects, and what is the scope for those who participate in, fund, and administer such projects to support the generation of actionable ocean and coastal sustainability knowledge for the Anthropocene?

Methods

The research proceeded in six steps: (1) the identification of key variables for the analysis of the CB-GSPs, (2) the selection of relevant ocean research projects, (3) the design of a semi-structured interview script to guide interviews with those responsible for the selected projects (4) the execution of the interviews, (5) the analysis of the interview data, and (6) the review of conclusions with representatives of other ocean focused research projects in May 2023.

As the first step, a series of online focus group discussions on cross-case analysis were held. Several of these included mostly NOCRISES[3] research team members, but an inter-project meeting of 13 global ocean research projects funded by the Belmont Forum was the key to identifying key variables of interest. As the second step, a compilation of interdisciplinary ocean research projects was carried out by various co-authors conducting online searches for global ocean projects that were either operating or had finished in recent years, and asking diverse colleagues to point out relevant projects. Eight relevant projects were thus identified, and the semi-structured interview was designed in view of the criteria established under (1). As we were searching for recent and current global projects, the total number of projects found was small and has not increased in the year of subsequent discussions we have had on this work. We would thus argue that selection biases are likely to be negligible.

The semi-structured key informant interviews (KII) were then conducted. This task was shared by several co-authors (MG, SS, NH, IvP, and AP) who conducted online semi-structured discussions with key scientific staff of the identified global ocean projects. Interviews covered at least four main questions (listed in Appendix, Data Table A). Due to the small number of interviewees (who were thus considered key informants), pretesting was found to be neither necessary nor feasible. Key informants were the lead scientists of the selected ocean CB-GSPs. Interviewers recorded Zoom meetings or took notes.

The analysis of interview data was performed in an iterative qualitative manner, reading notes and viewing

[3] The first initiative for the research here reported came from the NOCRISES project (further details in the Acknowledgements).

interview recordings, with the aim of summarizing and identifying themes. Analytical categories were thus developed related to the main challenges, solutions, and related stakeholder-specific best practices to facilitate cross-case analysis in ocean conflict CB-GSPs. Finally, on the occasion of an inter-project meeting between representatives of six global ocean projects (of which five were not included in the selected eight) to identify shared findings and recommendations[4], the major recommendations of this paper were confirmed.

Results and discussion

The objectives, funders, operation period, and number of cases or countries for the eight current and recent[5] ocean (conflict) studies[6] examined for this paper are presented in Table 1. Conflict is either explicitly mentioned or strongly implicit in the objectives of all projects in Table 1, and it is therefore an important connecting feature of these projects, with natural resource use conflicts as the prevailing conflict type.

Case-based global sustainability projects

Seven of the eight projects explicitly adopt a multi-case approach to address wider, global ocean issues, supporting our initial concept of an emergent type of "case-based global sustainability projects" (CB-GSPs) for the ocean realm. One project was described as explicitly not using a case-based approach (ONE OCEAN HUB) but working in five countries and explicitly seeking co-analysis between what arguably might therefore also be denominated as "cases" here.

All ocean-conflict CB-GSPs listed in Table 1 are supported by research teams with considerable experience in their respective case study regions, and all aim for effective and meaningful analysis across regions and/or case studies. Their cases are multiple local, regional, national, or specific environments such as deltas or islands. These projects have dual objectives: to collect locally grounded and actionable case study information to develop solutions as well as to generate knowledge synergies on themes of global relevance. Their objectives also include the development of generic concepts, theories, frameworks, and tools which are to be widely, and ideally globally, applicable. Column 6 of Table 1 indicates that qualitative and mixed-method approaches which focus on participation and inclusion are typically used[7].

Changes in social science career development strategies have contributed to CB-GPSs becoming a main feature in the contemporary global ocean and coastal sustainability science. While theoretical developments in the social sciences were classically published in books, editorial interests, scientific metrics based on indexed journals, and institutional career demands have shifted knowledge production in the social sciences and humanities towards publishing journal articles. Researchers are also increasingly required to show the international relevance of their work, so multi-author, collaborative analyses of multiple cases in journal articles have become an academic strategy (e.g., Guillotreau et al. 2018).

There are clear potentials for research across cases in the global ocean sustainability, governance, and conflict realms. The complexity and multi-level character of challenges in research and practice frequently force researchers to review the limits of their disciplines and the analytical scales and levels they focus on. With its context-specific focus on the social, ecological, technical, and other processes that drive a specific system and its outcomes, the case study approach allows for a contextualized, in-depth understanding of a specific complex system situation. Cross-case analysis can then investigate a focal issue, such as ocean conflict, in relation to the differing contexts of diverse bounded systems (the cases). The comparative approach juxtaposes commonalities and differences between cases. Case typology development then seeks "to minimize within-group variance while maximizing between-group variance" (Bailey 1994:1; Glaeser 2023a, b).

Box 1 summarizes the main results of our interviews with project scientists on project-specific approaches, strengths, and challenges (for full interview responses, see Data Table B, Appendix). Points 1–3 in Box 1 highlight the importance and high expected potential of a case-based approach in global ocean research. Five of the seven representatives of ocean (conflict) CB-GSPs interviewed for this paper reported collaborative learning and capacity-building in the project team and transfer of knowledge between cases as key in their projects, and three emphasized the importance of indicators for their cross-case analysis

[4] This took place May 23–24th 2023, in Berlin, Wissenschaftsforum Germany, with representatives of ShipTRASE, Multiframe, Oceanfront, ONE OCEAN HUB, MARISCO, and the German CRA Oceans projects (BMBF 03F0845A). Recommendations produced at this workshop can be viewed under https://hifmb.de/event/transdisciplinary-research-for-ocean-sustainability/

[5] As of June 2022

[6] Table 1 only includes projects with an intended global reach, not projects that focus on single global regions such as SPICOSA, GOBAMP (I & II), EMPAFISH (https://cordis.europa.eu/project/id/6539/reporting/es), or AKTEA (http://akteaplatform.eu/who-we-are/) which are, however, all suited to network diverse cases in regional settings into larger social-ecological units (Glaser & Glaeser, 2023a, b).

[7] See Dahlet et al. (this Special Issue) on methods in ocean conflict research.

Table 1 Selected case-based global ocean sustainability research projects (CB-GSPs)

Project name	Globally relevant project objectives	Period	Funder	Number of case studies	Case Study Level	Stated approach/methods for cross-case analysis
NOCRISES (Negotiating ocean conflicts among rivals for sustainable and equitable solutions) (www.nocrises.de and https://www.youtube.com/watch?v=Pf_Riy3tDGU)]	Understand conflict generation and dynamics; co-develop tool(s) to prevent, mitigate, and manage ocean conflicts	2020–2023	Belmont Forum/JPI Oceans [Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans) is a Pan-European intergovernmental platform that increases the efficiency and impact of research and innovation for sustainably healthy and productive seas and oceans]	8 regions (Canary Islands/Spain Hawaii, Seychelles, coastal Bangladesh, Azores, Fiji, Papua New Guinea, North Brazil)	Sub-regional	Collaborative approach using a core set of methods across case studies: governance mapping, process tracing, cultural consensus analysis, artistic productions with community engagement
OCEANS PACT (Ocean sustainability pathways for achieving conflict transformation) [https://oceanspact.eu/index.php]	Enable scaling up of insights, tools, and conflict resolution practices that foster global ocean sustainability; promote social cohesion and reflect local normative aspirations, "while fostering wider sustainability imperatives"	2020–2023	Belmont Forum/JPI Oceans	6 regions (South Africa, India, Brazil, Norway/Barents Sea, Baltic Sea, USA)	Mixed, cross-level	Action-oriented, co-designed, transdisciplinary processes that softly guided solution-oriented case-specific inquiry; drawing methodological, analytical, and transformative insights across cases
GULLS (Global understanding and learning for local solutions) [http://www.marinehotspots.org/index.php/featured-projects/gulls]	Create predictive systems to inform about the consequences of coastal changes; deliver alternative options for adaptation and transformation within coastal communities; define their long-term economic, social, and environmental implications	2013–2018	Belmont Forum	6 regions (Brazil, India, Mozambique Channel, Southern Benguela (South Africa), the Solomon Islands, South East Australia)	Regional-national	Vulnerability assessments, social modelling, and ocean literacy sharing; conducted jointly by participants from Australia, Brazil, India, Madagascar, Mozambique, New Zealand, South Africa, the UK, and the USA across all case studies
ONE OCEAN HUB (Fair and inclusive decision-making for a healthy ocean whereby people and planet flourish) https://oneoceanhub.org/	To support integrated, evidence-based, and inclusive responses to multiple threats to the ocean; to bridge disconnections in law, science, and policy and integrate governance frameworks to balance multiple ocean uses with conservation and sustainable fisheries with socio-economic and cultural factors; to advise on coherent, flexible, pro-poor, and gender-sensitive, climate-proofed and transparent laws and policies across human rights, sciences and technology, and trade & investment realms	2020–2024	Global Challenges Research Fund (GCFR), UK	Initially, 5 regions (Ghana, Namibia, South Africa, Solomon Islands, South East Atlantic) were reduced due to budget cuts to South Africa, Ghana, Namibia, and regionally South Pacific and Caribbean	Regional-national	Initially, 5 research programs across disciplines (law and arts, policy, informatics, education, history, anthropology, and philosophy) to integrate biology, physics, chemistry, oceanography, ecology, mathematics, socio-environmental sciences, and law then moved to overarching themes and global international working group for cross-learning

Table 1 (continued)

Project name	Globally relevant project objectives	Period	Funder	Number of case studies	Case Study Level	Stated approach/methods for cross-case analysis
MULTIFRAME (Assessment Framework for successful development of viable ocean multi-use systems) https://hubs.belmontforum.org/groups/multi-frame-project/	To increase the knowledge base and capacity of public and private actors for ocean multi-use systems, by providing open-source tools, assessment results, and best practice examples. Support actionable decision-making on optimal combinations of uses, with consideration for equitable distribution of benefits while avoiding/minimizing harm	2020–2023	Belmont Forum/JPI Oceans	6 case countries: Sweden, Mozambique, Norway, USA, Brazil, France	Sub-regional	Multi-use data bank; participatory development of multi-use scenarios for case study regions, compatibility matrices
TBTI (Too Big to Ignore) [http://toobigtoignore.net/]	Addressing issues and concerns affecting the viability and sustainability of small-scale fisheries through a global research network	2010–present	Multiple supporting organizations	6 world regions: Africa, Asia and Oceania, Europe, Latin America, Caribbean, North America	Global	Interactive governance and governability assessment framework (GAF) frameworks, survey templates
DELTAS (Catalyzing action towards sustainability of deltaic system deltas) https://www.researchgate.net/publication/303503444_Catalyzing_action_towards_the_sustainability_of_deltas	Pull together interdisciplinary expertise, global human capital and resources, modelling frameworks, data, and local partnerships to understand the workings of these complex coupled socio-ecological systems and inform sustainable management and policy decisions	2013–2017	Belmont Forum Coastal 2012–Coastal Vulnerability	3 delta regions: Ganges-Brahmaputra Delta, Mekong Delta, Amazon Delta	Regional	Range of approaches, including theoretical framework development, co-development of integrative modelling framework and decision tool, data consolidation and dissemination, development of vulnerability indices, and outreach and communication of research products
V2V (Vulnerability to Viability) [https://www.v2vglobalpartnership.org/]	A transdisciplinary global partnership and knowledge network with 100 members from Africa, Asia, Canada, and internationally to identify factors contributing to the vulnerability of SSF and engage collaboratively with small-scale fishing communities, key NGOs, government, university partners, and others to enhance SSF viability	2020–2027	Canada SSHRC partnership	12 case studies: Bangladesh, India, Indonesia, Japan, Malaysia, Thailand, Ghana, Malawi, Nigeria, Senegal, South Africa, Tanzania	National sub-regional	Transdisciplinary, community-engaged research in six countries in Asia and six countries in Africa

(GULLS, V2V, and DELTAS). Defining key analytical areas that allow for learning across cases while recognizing contextual differences was also seen as central for cross-case analysis by three project representatives (ONE OCEAN HUB, V2V, and OCEANS PACT).

Box 1 Summary of interview results on cross-case analysis in selected ocean-based CB-GSPs

1. ***How central to the project was the intention to analyze across case studies to generate globally relevant results?*** For 6 projects, cross-case analysis was said to be very or reasonably central, while the interviewees on ONE OCEAN HUB stated that contextual in-case learning rather than case comparison was the focus in the diverse regions this project operates in but that the global relevance of results was also central and the focus of a project working group.
2. ***What was the project's approach to analyzing across case studies?*** All projects developed a coherent approach, and all but the ONE OCEAN HUB project had a shared research agenda for all in-project cases. The GULLS, NOCRISES, and V2V projects rely on shared methods to facilitate analysis across cases; ONE OCEAN HUB allows methods and agendas to emerge as part of in-country transdisciplinary work; and OCEANS PACT is developing analytical guidance for a set of (predefined) analytical areas (including drivers & root causes of conflicts and power dynamics).
3. ***Strengths of the adopted approach:*** 5 of 7 project-related respondents reported collaborative learning and capacity-building in the project team, with effective contextually embedded learning and transfer of learning between cases as strengths. The implementation of cross-case analysis through indicators (GULLS, V2V, and DELTAS), and the definition and development of shared key analytical areas to allow for learning across cases in the light of contextual differences were also seen as central strengths.
4. ***Challenges of the adopted approach.*** Progress in cross-case analysis was seen to be challenged by (1) a target conflict between the need for flexibility and contextual grounding of "within-case" work and the quest for widely applicable results to support global analysis (GULLS and ONE OCEAN HUB). One trade-off being between the local applicability and relevance of indicators and their usefulness for global analysis (GULLS and MULTIFRAME). (2) Weaknesses in capacity-building for non-academic participants in case study teams (V2V). (3) The development, or danger, of (case-based) "scientific silos" within projects (GULLS, OCEANS PACT, and NO CRISES). (4) Differences in case/country teams' (a) capacities, (b) funding levels, (c) disciplinary composition, and (d) how teams apply a method (MULTIFRAME and NOCRISES). (5) Different starting dates for funding country/case study work hamper collaborative planning and implementation across case studies. (GULLS and NOCRISES).

Major challenges in global ocean sustainability and conflict research

Below, we identify and discuss six key challenges for ocean-related CB-GSP effectiveness based on co-authors' discussions and key informant interviews: (1) Inception and characteristics of a project (2) Selection of case studies (3) Communication, language, and participation (4) Project design with (a) Organizational structures and processes and (b) Research methods (5) Timing, funding, and political and institutional contexts (6) Funders' project administration structures and processes.

Inception and characteristics of a project

NGOs, the private sector, and local communities (and also local government) are often not involved in formulating ideas during the development stage of a project proposal but only participate during later stages of a project as contributors, contractors, implementers, or research subjects. This can cause misunderstandings, lower these stakeholders' interest and commitment, make it difficult to recognize and fulfil their capacity-building needs, and generate conflict and disaffection. For transdisciplinary research to become more effective, it is critical that the study focus be co-developed by all important contributors and stakeholders. To achieve this, research agendas and processes need to be co-developed at the case study level in the early design phase of a project. A shared understanding of the theoretical framework in which co-developed research questions are situated is also required so that the meaning of core concepts, the research methods to be employed, the types of data to be collected, and the main project implementation steps are agreed at the outset. These discussions between project members and other key stakeholders, including those from outside academia, will allow the identification of key project context variables and capacity limits. Funding bodies need to allocate resources and time so that project design phases can be employed to confirm and build trusted relations and processes on the basis of which local stakeholders and partners, as well as case study researchers from different regions of the earth, are able to engage (Breckwoldt et al. 2021). Collaborative and inclusive initial design and implementation phases between academic and non-academic project participants, as well as across disciplines and case study teams, reduce the risk of "scientific silos" and conflicts in CB-GSPs.

A main challenge for case-based projects, which aim for global analytical relevance, is to select methods and tools that are appropriate, applicable, and relevant across multiple case studies. Globally relevant transdisciplinary science needs to engage with issues and processes that are important for regional and local actors while also allowing for comparison across sites. Different research approaches may be required in different social and cultural case contexts and/or by different members of an interdisciplinary research team with diverse types and levels of expertise. If project co-development focuses

on intercultural consensus-building to use diverse combinations of quantitative and qualitative methods at the case level while securing a shared methodological core to allow cross-case analysis, this might become a strength of CB-GSPs.

Selection of case studies

Case-based research requires clear case selection criteria that relate to commonalities and differences across cases. Contemporary global sustainability projects face a number of obstacles to a methodologically robust case selection. In the NOCRISES project, case studies started with agreed, science-led criteria. These criteria referred to the development status of a country (low, high, and middle) and location in one of the global ocean change hotspots (Hobday et al. 2014). At the same time, the quest for longer-term, grounded science to link to policy and change processes led to quality criteria for case study teams: team members were to have local and regional connectedness, and leading case study scientists were to be well-linked in relevant networks for their case study regions. At the proposal stage of the NOCRISES project, six case regions (Hawaii, the Torres Straits, coastal Bangladesh, the North-East Atlantic, the Canary Islands, and the Seychelles) were selected according to these criteria. The first project year showed differences in the regional and local grounding of different teams in their respective case study regions and in the ease with which key non-academic stakeholders in different regions accepted becoming "part of a case study." Some NOCRISES case study teams were already actively involved in research in "their" regions and able to embed NOCRISES project objectives within their longer-term collaborations and networks. Other country teams, though familiar with the setting and problems in "their" case regions, met with diverse obstacles such as regional resistance and political turmoil, a lack of timely case study funding, and resistance by local communities to what they saw as "helicopter research" driven by external agendas. The COVID pandemic added challenges such as the inability to connect with people in lockdowns, the fear of getting or spreading infection, and local reluctance to speak to people wearing facemasks. Thus, some originally planned case studies were dropped; the original systematic case study selection criteria were not fully implementable.

At the same time, opportunities arose for establishing new NOCRISES case studies in regions not originally selected. Interested academics of those regions from the networks of NOCRISES team members indicated readiness to collaborate, even with some own funding, and two new PhD candidates brought their own scholarships a few months into the project. Thus, one existing case study (Bangladesh) was strengthened, and a North Brazilian case study was added to the NOCRISES project.

Our interviews revealed that such adaptation in the selection of case studies is common in global multi-case projects. While a scientifically well-framed, robust approach to case selection advances globally relevant analysis, the realities of working with existing networks and the need for other contextual factors to be favorable (e.g., funding, local community and partner interest and approval and a committed case research team) require an adaptive and "opportunistic" approach to case study selection. This creates the challenge of identifying the meaning and contribution of each individual case study in international/global analyses, which can be addressed by a typology of cases.

A promising approach to assessing the meaning of results from a case study for a global research question is archetype analysis. Where representative "archetypal" patterns are identified, for instance in human–nature interactions or conflict development trajectories, the insights gained through archetype or syndrome analysis can strengthen causal analysis, facilitate meta-analysis of diverse data in sustainability research, and thus support the transfer of knowledge between places and system levels (Eisenack, 2012; Sietz et al. 2019; Oberlack 2019). Archetypes can be discrete units or nested within each other (Lüdeke et al. 2004). Situating case studies within a typology of coastal and marine social-ecological systems (CM-SES) (see Glaser and Glaeser, 2023a, b; Glaeser 2023b) applies the principles of archetype analysis to the marine and coastal realms. In line with this, we argue that to be globally relevant, cross-case analysis needs to be situated within a consistent case typology.

Communication, language, and participation

To achieve coherent analysis across cases, an inclusive project design phase should produce a set of objectives and questions within an agreed conceptual and theoretical framework that is understood and accepted by all project participants. Since most project teams include scientists and practitioners with multiple backgrounds and experiences, some mutual clarification of discipline-related jargons and specific context is usually needed. A sharing of relevant publications or "prepared for purpose" materials on pertinent topics and an in-person kick-off meeting to align and discuss procedures and expectations and foster interactions in the project team may prove helpful to link disciplines and forms of knowledge. The recognition of local knowledge as a legitimate and valuable element and eye-level engagement between scientists and the holders of such knowledge are key conditions for in-depth,

well-grounded case studies (Breckwoldt et al. 2021, Proulx et al. 2020).

To transport locally and regionally rooted diversity into global analysis, inclusive and effective methods for participation and communication are required. This is a key challenge for CB-GSPs. In each case study context, it is important to understand what aspects of the research can inform the day-to-day activities of non-academic stakeholders and how best to involve local stakeholders in respectful knowledge exchange and communication about research goals, processes, results, and outcomes.

Open, frequent, friendly, and inclusive communication within a project and between a project and its wider stakeholders in a supportive and collaborative atmosphere increases the motivation of participants, and the depth of inclusiveness, and thus improves research quality. Working with local champions from beyond academia that can link research to action is important. Virtual meetings enable networking across the globe, but language barriers can disadvantage whole regions (e.g., English language deficits across North and North-East Brazil prevent representatives of local and regional stakeholders from effectively engaging in international meetings). Language and digital access can also bias against the inclusion of less educated or less affluent stakeholder groups. Such groups may then be spoken for rather than contribute themselves, or their views and knowledge may be excluded. Virtual meetings between case study teams across time zones carry good potential, but there are challenges in terms of inclusiveness and in coordination. Sharing the burden of inconvenient online (night or early morning) meeting times between project members across the globe is one of them. Linking globally requires special efforts, in particular from practitioners for whom other priorities may prevail. All groups which are expected to engage in globally focussed sustainability analysis need clearly defined terms and objectives for their involvement, and the articulation and agreement of benefits, time, and deliverables from the research back to participants involved in case studies (e.g., communities and governments) needs to be ensured.

Project design

Project design covers the institutional and organizational features of a project. It needs to be guided by how research methods are expected to achieve effective project operation including cross-case analysis.

(a) Organizational structures and processes Clear and effective project structures and processes and agreed roles for all involved are important for achieving project goals. Accessible and regular communication channels for all project participants are needed, along with mechanisms for conflict resolution and procedures for including novel and local perspectives. An agreement on the sharing and use of case study data is needed. Most funding programs lack guidelines on these, and with few exceptions, funding is not currently available to resolve issues that need to be addressed before project proposals are finalized. The early project development stage requires a coordinated and funded effort that includes all prospective project members in co-design, co-production, and co-delivery efforts, and clarity and agreement on what the project requires from individual participants with respective resources (Fleming et al. 2023).

Globally relevant analysis is unlikely to emerge in an entirely self-organized manner. Project design needs to assign responsibilities, and include processes and structures for cross-case analysis. Since many project members may focus their work at the case level, the responsibilities for cross-case analysis need to be explicit and clear. They may be embedded in the project structure through thematic work packages that operate across case studies (as in the OCEANS PACT and the GULLS projects, Table 1), or specific members of case study teams may be assigned to collaborate across cases to drive a project's cross-case study analysis (as in the NOCRISES project).

(b) Research methods Selecting research methods and tools has implications for project design, with specific challenges for cross-case analysis. In some projects in this study (OCEANS PACT and ONE OCEAN HUB), each case study followed its own methodological approach with a focus on shared themes. This limits the options for local stakeholders to determine key issues. In contrast, where issues and problems to be addressed by the research are determined at the case study level, they may differ between case studies, and cross-case analysis becomes difficult where results were generated in differing case contexts with different research methods and on different key issues.

Three of the global ocean-conflict-related research projects discussed here (GULLS, NOCRISES, and V2V) apply a core set of shared methods across their cases, thus avoiding some of these challenges. We now briefly explore the pros and cons of applying the same method across several case studies in ocean conflict research. In an exemplary fashion, we focus on the potentials and challenges of three methodological approaches that are used by the NOCRISES project for case-based and cross-case ocean conflict research: Governance mapping, art-based creative approaches, and process tracing.

Governance mapping (GM) examines the structure and functioning of a governance system as it responds to a system stressor. In seven easily understandable steps,

GM enables groups of affected people to agree on "who" makes governance decisions on the stressor in question, "what' the powers and responsibilities of these actors are, and "how" these are exercised (Dutra et al. 2019). GM can be undertaken with participants that hold diverse positions towards the system stressor in focus. Vave et al. (in review) outline how formal and informal rules, norms and regulations address conflicts and related challenges in ocean governance, and discuss how such typically plural and contradictory institutional contexts influence governance decisions. They find that GM can reveal the cultural characteristics of informal governance systems and their different impacts across world regions. GM also reveals the diverse recollections of stakeholders: In Fiji and Hawaii, GM showed that ethnic, traditional leaders determine informal governance rules, in Bangladesh, the method revealed local economic and political power holders to set informal governance rules with polarizing effects on the distribution of benefits and costs arising from stressor-related governance decisions. The seven GM steps allow flexibility at the level of the individual case and facilitate the identification of actual and latent conflicts. These features bear clear positive potential for cross-case analysis.

The knowledge of participants in a GM group is reflected in the data obtained. GM group members' partial understanding of governance systems may indicate systemic problems but can also show the constraints of the GM approach. Recent NOCRISES case studies using GM (Bangladesh and Fiji) show that while the method reveals issues at the case level, it does not support communities with their resolution. An additional step might enable GM, at the case level, to address conflict management and resolution. With this, cross case analysis will have a solid case-level approach that also includes conflict management and transformation paths.

On the positive side, GM has been capable of identifying shared issues and conflict types across case studies, such as corruption, even where individual pieces of case research focussed on different system stressors (e.g., fish scarcity and disaster management). Since inclusive research requires key issues to be identified locally, these are likely to differ between cases. It remains an open question whether, for GM to generate wider and practice-relevant knowledge across cases, individual cases need to focus on the same governance challenge. There is thus a possible target conflict between the need for the inclusive, locally led choice of focal issues for GM and the potential of GM for delivering results beyond the case study level. Nonetheless, GM is an important method for ocean conflict studies with a clear potential for cross-case analysis.

Art-based creative approaches are a newcomer among the growing diversity of inclusive, enabling methods in transdisciplinary sustainability and conflict research which directly involve local stakeholders. They can involve a variety of culturally embedded arts and creative practices exercised by often relatively powerless conflict parties to (co-)produce a creative output to express their experiences and visions of a better future in often non-verbal ways (Strand et al. 2022). Local leadership is crucial in the process of identifying the focus of and the specific creative approaches (e.g. painting, stitching, sculpture, music, story-telling, film-making) to be used in a creative practive intervention (CPI) (Galafassi et al. 2017; Heras et al. 2021).

Art-based interventions enable culturally specific creative work at the level of a case study region (e.g., embroidery by rural coastal women in Bangladesh[8]). The process of creating artistic products and these products themselves can facilitate the expression of the positions and experiences of otherwise excluded stakeholders in an ocean conflict. In a multi-stage facilitation process (consisting of problem identification, idea development, implementation, exhibition, and outreach), CPIs can contextualize conflict environments at the case level while, as observed in NOCRISES fieldwork in Bangladesh and Brazil, also providing "emotional release" to the artist. Early NOCRISES results show that, by supporting knowledge exchange and capacity building among creative agents, CPIs can also enable community building and empowerment. Both the process of developing and implementing creative practices and the artistic end product(s) can help to transform conflict situations into avenues towards positive future change (Glaser et al. 2023, Galafassi et al. in preparation).

CPIs in NOCRISES ocean conflict research have involved (non-local) art facilitators who co-developed artistic processes and products with local people. The major aims of the CPIs formulated in the NOCRISES project were empowerment, skill sharing, capacity building, knowledge exchange, and community building. Beyond shared ethical standards, CPIs, guided by artists and art facilitators, challenge scientists to engage with unfamiliar quality criteria for the creative process. Conflicts between the arts and sciences can thus occur. International artists and art facilitators engaged in NOCRISES case studies have for instance stated: "Art is about more than communication;" "Art aims not to communicate but to express;" and "Art and artists should not be instrumentalized for

[8] NOCRISES fieldwork (see https://www.leibniz-zmt.de/en/news-at-zmt/news/overview/embroidery-art-and-coastal-conflicts-exhibition-on-the-displacement-of-women-in-bangladesh-as-a-result-of-the-blue-economy.html(

communicating scientific messages"[9]. People in case study regions who generate creative outputs are also likely to develop their own objectives for engaging with a CPI. In Bangladesh, women displaced by a large-scale Blue Economy energy/seaport investment sought not so much to express and communicate their painful experiences of displacement, as researchers expected them to, but sought new skills and income sources from their CPI engagement. The divergence between the CPI objectives of local people and pre-formulated project aims also appeared in a Brazilian CPI in November 2022 (Galafassi et al, in prep) where again, the search for new skills (in this case, the making of an animated film) prevailed among local participants of the CPI while the project sought to "envoice" them by facilitating their creative work. Responding to emerging local objectives can lie beyond the capacities of creative practice facilitators and scientists in ocean conflict research projects. But target conflicts between art facilitators, researchers, and local artists need to be identified, local priorities taken seriously, and included early in project design.

Art-based creative approaches allow culturally rooted art forms to generate and show (possibly otherwise inaccessible) knowledge. If such case-level knowledge is linked and compared beyond the individual case study, this supports cross-case analysis. With the growth in globally accessible media and the increasing importance of "the visual"[10], CPIs expand the opportunities for a wider understanding, in particular of the experiences of marginalized conflict parties, beyond the boundaries of the individual case and beyond academia into arenas that affect decision-making and public perceptions.

Process tracing (PT) is known as a political science method (Beach 2017), but it is also an established wider research tradition. To understand causality, within-case analysis is done based on the chronological order of events. Reasoning (causal attribution) then links an outcome to the events that led up to it. PT is therefore also described as "doing history backwards" (Boonstra and de Boer 2014: 263). By mapping out both local and global events in time, scholars aim to either discover (induction) or test (deduction) the explanatory power of causal mechanisms. Counterfactual reasoning is often used to unveil causal mechanisms. In maritime studies, a deductive approach towards PT tends to be most frequently used (Boonstra et al., 2023).

PT is particularly suited for studying complex causal interactions between variables. Complex causality can include the following features: low proximity (many intervening variables between cause and effect), high multicausality (many variables operating together to produce an outcome), interactivity (none of the causes alone is sufficient to produce the outcome), non-linearity (a process exhibiting threshold effects), and equifinality (the same cause is linked to the same outcome through different causal mechanisms depending on contextual conditions) (Boonstra et al., 2023). With its explicit attention to complex causality, PT is an attractive method for interdisciplinary and cross-case analysis of marine conflicts (Spijkers and Boonstra 2019).

As an original within-case method, PT is not automatically applicable in cross-case analysis. A number of studies explore ways in which PT can be used for cross-case analysis (Beach and Pedersen 2016; Bennett and Checkel 2015; Trampusch and Palier 2016; Beach 2017; Saylor 2020; Waldner 2015; Garcia-Montoya and Mahoney 2020, Beach et al. 2022). The crux of PT in cross-case analysis is to distinguish case-specific or non-systematic mechanisms or processes and their parts from systematic ones (Beach and Pedersen 2016: 309) by paying attention to contextual conditions, causal and process homogeneity (Beach and Pedersen 2016: 89-90; Beach et al., 2022) and process heterogeneity. Based on these suggestions, Boonstra et al. (this Special Issue) argue that the comparison of studies using PT needs to account for differences regarding (a) the focus of the study (macro and micro phenomena especially); (b) theorization (deductive and inductive reasoning especially); (c) the perspective on causal mechanisms (deterministic and probabilistic perspectives especially); and (d) generalizability (is casing and case selection made explicit). Cross-case comparison becomes problematic when studies using PT differ too much on these four aspects. In a recent paper, Beach et al. (2022) offer a methodological pathway towards comparative, cross-case PT that iteratively integrates increasingly diverse cases.

PT has great potential for CB-GSPs primarily because the method can examine the interaction between social and ecological drivers as well as emergent behavior, both central features of global processes which are conventionally understood from a systems perspective (Schlüter et al. 2019). This is the reason why PT was used in the NOCRISES project to compare causal pathways of cases that feature the same outcome (namely, conflict). Nevertheless, as pointed out, cross-case comparison is challenging due to the different disciplinary backgrounds of

[9] Social scientists entering natural science-led sustainability research in the 1990s also feared and rejected instrumentalization. Learning from this somewhat parallel earlier experience of power balance in building interdisciplinarity might be drawn from how a now mainstream social science in sustainability research sets out to work with the arts.

[10] For example, see www.artsfortransformations.earth

the involved scholars, and because case studies are implemented with different approaches towards focus, theory, philosophy of science, and case selection. This diversity has to be observed and accounted for in the comparison of cases. Boonstra et al. (2023) point to a lack of attention to the micro-sociology of conflicts—i.e., to how conflicts are caused by a series of events in time and space in which people interact with different emotions and interpretations, and to "external validity,"—i.e., to what populations, settings, and variables in the causal mechanisms that have been identified can be generalized. These new ways of using PT in maritime studies are reflected in NOCRISES work. For example, the population of cases which studies in NOCRISES currently aim to generate knowledge about is still quite broad; for instance, in terms of "marine environments" or "natural resources," case studies are situated in deltas, islands, and other coastal landscapes. Explaining how these different categories or "sets" (Mahoney 2021) are related is instrumental for making valid comparisons.

This short section shows that the choice and implementation of research methods greatly affect the potential for cross-case analysis in ocean conflict research. A deeper discussion of rapidly developing methods in cross-case ocean conflict studies is outside the scope of this article but taken up in other articles in this SI (Boonstra et al 2023.; Dahlet et al. 2023) as well as in a further recent work (Vave et al. under review) and offers promising terrain for additional research.

Timing, funding, and political and institutional contexts

Regulatory differences for fieldwork between case study regions including diverse travel restrictions and lockdowns related to the COVID pandemic hampered cross-case coordination. Case studies also progressed at different speeds because of the need to respect and not overtax local communities in very different contexts.

Those who fund and administer global research projects also have important impacts on how cross-case research can be implemented. International research collaborations that are based on globally distributed case studies are often co-funded from different national sources and administered individually by the national agencies that fund the various country/case teams. For instance, the Belmont Forum, an important funder of CB-GSPs in the 2020s, relies on national co-funding of its global research. This is an important step forward for global sustainability research which, however, still faces some key obstacles. To co-develop ideas, coordinate the implementation of research methods, and collaborate in data analysis, the teams in a CB-GSP need to cooperate during all stages of project development. This requires a shared common project timeline in which different stages of a project (early design, start of funding, and reporting periods) are synchronized across case studies. So far, this has often been difficult to achieve. The NOCRISES project is but one example. The official project start was June 2020, with funding expected from the USA, Germany, Sweden, and Australia. South Africa was to be a funder as well, but backed out of the approved project, resulting in uncertainty and delays for two case studies. These were eventually resolved, but the delays made the synchronization of case study planning and implementation across the seven case studies of the project impossible. Some case studies had to start work as their funding arrived on schedule, while others still waited for their funds a full year into the 3-year project. This is not an unfamiliar scenario in current CB-GSPs, and it greatly reduces projects' potential for cross-case analysis. Where funding delays affect some, but not all of a project's case study work, the concerted development of shared approaches within that project, and thus its global reach and relevance, become very difficult to achieve, and the likelihood of conflicts within the project.

Other projects report similar experiences. A GULLS project report states: "More could have been achieved with higher levels of funding, including ear-marked funding for project oversight and international coordination. One country has not yet received its funding a year into the project"[11]. In an online meeting of the then 13 funded Belmont JPI Oceans projects on Friday, June 18th, 2021, several of the projects, all of which are CB-GSPs, reported staggered and delayed funding and associated problems with collaborative planning, initiation, and coordination of fieldwork across case study regions. Project members and leaders saw this as endangering projects' coordinated planning, data collection, and analysis, all core requirements of global sustainability research work.

The NOCRISES, GULLS, and ONE OCEAN HUB projects witnessed funding delays or cuts from some partner countries which resulted in the loss of selected case studies and up to a full year difference in starting times between case studies. Situations in which some members of an international project team are funded and

[11] Source: GULLS project presentation to Belmont Mid-term Meeting, September 2014, Rotterdam, The Netherlands, accessed online June 10, 2021.

under pressure from their national funding agency to deliver as promised while other members are not funded or funded much later and therefore unable to progress in line with their funded colleagues obstructed coordinated within-project work planning and introduced imbalances and conflict sources into project teams. Such dynamics, caused by the funding and administration structure, impede the establishment of the collaborative processes so important for analysis across case studies. A centrally administered or reliably synchronized disbursement of funds for CB-GSPs would greatly strengthen the options for cross-case work in global research. Such one-stop disbursement processes may also reduce funding asymmetries within CB-GSPs between Global North and Global South case study research.

Funders' project administration structures and processes

The implementation of CB-GSPs is hampered where such projects, or parts of them, are simultaneously subject to more than one set of funding, administration, and monitoring procedures for the same work. Where diverse funders' national guidelines are being followed, key stages of subprojects (such as the design phase, contracts of key staff, exchange of results, preparation of publications, and other outputs) are likely not to coincide, and concerted cross-case work can thus be (and has been reported to have been) impeded or even prevented. In the global projects funded by the Belmont Forum, members of the funding consortia require reports according to their different national criteria, formats, and time schedules, while additional global-level project reporting requirements follow yet another format, timeline, and internal logic. Multiple reporting requirements, to national funders, and to an international consortium hamper project progress by taking up scientists' time for multiple reporting. Target conflicts that are linked to diverse funder-specific objectives also appear. This undermines consensus-building in project teams. A single, internationally agreed approach to proposal writing, funding, and reporting in which CB-GSPs undertake each requirement only in relation to one institution, in line with one set of criteria, is needed. Multiple national reporting schedules and styles, with an additional level of international reporting, often with different criteria and timelines, reduce the periods during which in particular senior researchers can focus on actual research, can cause target conflicts in project teams, and undermine project potentials, in particular those for cross-case research. In international projects with nationally funded and administered sub-budgets, an international financial report also appears unnecessary. It is needed only if budgets are internationally allocated and distributed, an arrangement which would also greatly support the potential for cross-case analysis.

A single consistent reporting format and time schedule will render research in CS-GSPs more effective as a truly global pursuit of agreed objectives across case study teams, in line with shared criteria. We suggest that coordinated, simultaneously disbursed, reliable funding and "one stop" reporting for all CB-GSPs to a single institution is needed to enable such progress.

Summary and outlook

There are important key actors and roles during the planning, implementation, analysis, and conclusion phases of ocean conflict-related and other CB-GSPs that affect the success of these projects and of their cross-case analysis in particular. Best practices for globally relevant and locally meaningful case-based sustainability research are depend on an actor's position within or towards a research project.

As a summary of our results, Fig. 1 presents the main challenges faced by ocean (conflict) CB-GSPs in their quest to generate internationally relevant and meaningful results while also focusing on the contextual grounding and relevance of project work in the individual case study region. In order to more firmly establish the link between reseach and practice, Fig. 1 also links our findings and ideas for the solution of the identified main challenges to a set of best practice recommendations for three main actor/stakeholder types in CB-GSPs: project scientists (including leaders and team members), other project partners and stakeholders, and funders. Best-practice recommendations are presented with attention to the project stage.

Figure 1 reflects the consensus we encountered that scientists from diverse countries, disciplines, and institutions as well as non-academic local partners and funders have essential roles in case-based, transdisciplinary global research, and it summarizes the key results of this paper. By linking identified challenges to proposed solutions (on the left side) and then "unpacking" these solutions into actor-specific best practice recommendations (on the right side), Fig. 1 provides a strategic starting point for the main actors in CB-GSPs, which is based on the currently available collective knowledge of scientists in ocean conflict projects. While elements of Fig. 1 will continue to be subject to debate and review, the committed (best practice level engagement of each project stakeholder group is clearly essential.

The complexity, and the synergies and complementarities evident in the web of connections between individual challenges and the multiple solutions and actor-specific best practices that can contribute to resolving them is shown in Fig. 1. This figure thus supports individual-project stakeholders in adapting their own approaches to better address major challenges.

We conclude by discussing two key recommendations for improving the inclusiveness and reach of case research in CB-GSPs: 1) Effective networking and 2) recognizing the diversity of types of coastal and marine social-ecological systems. These are included in the "Solutions" column of Fig. 1 but merit further discussion here.

Effective networking

The characteristics of their associated social networks potentials, and of the actors and connections they consist of, affect the impact of CB-GSPs. Like other CB-GSPs, the NOCRISES project has researchers from different disciplines and backgrounds, including social scientists, environmental researchers, educators, and marine biologists, from diverse research institutions and at different career stages, who are part of a diverse and growing set of interconnected social networks. The analysis of such social and social-ecological networks (Schröter and Glaser 2020; Glaser and Schröter 2020) has key potential for case-based global ocean conflict and sustainability research. For the social-ecological systems surrounding ocean fisheries, Estévez et al. (2020) see a transition towards collaborative governance and note that collaboration requires stakeholder capacity for designing and implementing legitimate and scientifically robust management plans in collective action arenas with scope for participatory decision-making.

The complexity, dynamic nature, and need for long-term horizons which are characteristic of transdisciplinary case-based sustainability research are well supported by active social networks. Networks are dynamic and adaptive, and crucially, they can operate beyond the duration of a project. Established research networks, or networks established in the wake of concluding projects (such as the TBTI; see Table 1), follow up on different (spin-off) issues related to their "mother" projects.

Networking may involve local/regional/national and global researchers and other stakeholders potentially adding societal impact across system levels and scales (Gerhardinger et al. 2018). An example is the international *fishgovfood* network, initiated with EU funding during the 2002 MARE Conference. It resulted in the book "*Fish for Life: Interactive Governance for Fisheries*" (Kooiman et al. 2008) which applied governance theory as a research framework to the global fisheries setting. Subsequent theoretical developments in interactive governance theory were based on various international case studies and are reflected in a series of books and articles published by the MARE Center[12]. These works address global fisheries governance issues in the context of a wide range of case studies in the framework of interactive governance theory and have produced key policy outputs such as the Guidelines for sustaining small-scale fisheries[13][13] clearly showing how cross-case work can support global sustainability objectives.

Recognizing types of coastal and marine social-ecological systems

In view of the growing consensus that research needs to enable answers for the planet as a whole, case study work needs to assess the meaning, significance, and relative importance of a case in a global context. This requires a framework of reference within which each case can be situated.

Diverse social-ecological system typologies have been proposed. Evolving from early research which diagnoses "messy SES" (Alessa et al. 2009), such work increasingly responds to the complex character of SESs with qualitative, quantitative, and mixed approaches (for reviews, see Oberleder et al. 2019; Sietz et al. 2019). While more work has been done on land-based SES, typologies for coastal and marine social-ecological systems exist. Early coastal and marine system typologies focus on the natural system features of coasts (Buddemeier et al. 2008) and oceans (Hobday et al. 2014), and more recently, interdisciplinary coastal and marine social-ecological system (CM-SES) typologies have been initiated (Glaser and Glaeser, 2023a, b; Glaeser, 2023).

With the I-ADApT decision support tool[14] (Bundy et al. 2016; Guillotreau et al. 2018), an explicitly case-based approach was designed to assess diverse marine and coastal governance responses to social-ecological change and to derive a multidimensional typology of CM-SES and their responses to change. Addressing the need for a sufficient number of case studies to allow for conclusions

[12] https://marecentre.nl/publications/annual-report/mare-publication-series/

[13] http://www.fao.org/3/i8347en/I8347EN.pdf

[14] I-ADApT (Assessment based on Description and responses and Appraisal for a Typology) see https://imber.info/science/regional-programs-working-groups/human-dimensions-working-group-hdwg/imber-adapt/

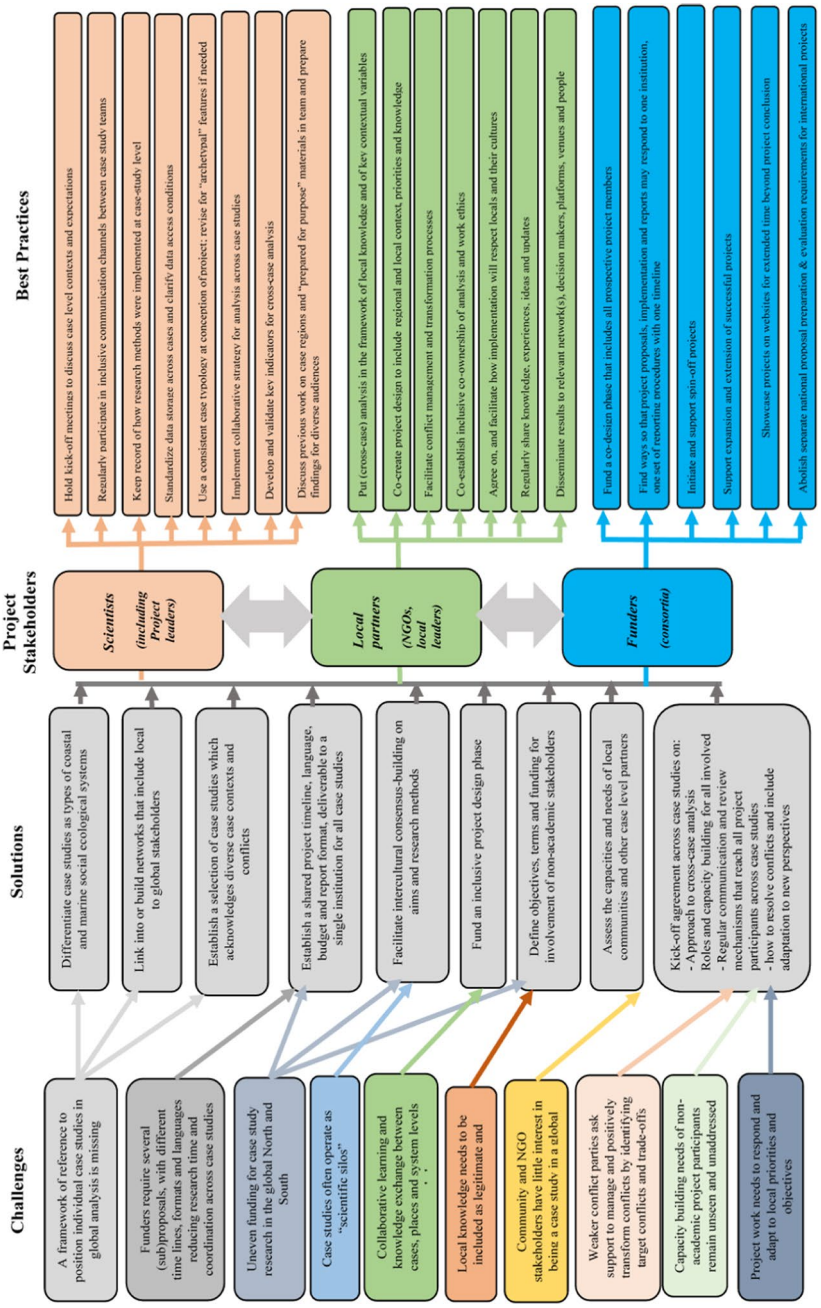

Fig. 1 Challenges, key elements for their solution, and stakeholder-specific best practice for facilitating cross-case analysis in ocean CB-GSPs

from the I-ADApt typology, the V2V project (see Table 1 and Appendix), a recent CB-GSP with an 8-year time horizon (which is unusually long in contemporary practice), is currently implementing 12 case studies in Africa and Asia[15].

In a pioneering attempt at constructing the components of a multi-level global "typology of typologies" for coastal and marine social-ecological systems, Glaeser (2023b) contrasts knowledge-based and curiosity-driven typologies and identifies several focal variables for CM-SES typologies. To overcome the limitations of single-case analyses, Bodin et al. (2019) suggest a typology of causal relationships connected with social-ecological networks. Since typologies are heuristic tools, the quest for a single valid typology is likely to be misguided—as is the quest for a single valid SES definition (Glaser et al. 2012). Current SES typologies need to be further developed and collated to provide what global projects, including those on ocean conflicts, need: consistent global frameworks in which in-depth case studies can be situated. Such framing would support the generation of generic and/or transferable knowledge and the assessment of the meaning and significance of cases. Any case typology (e.g. I-ADApT or the typology suggested by Glaeser, 2023a) needs a sufficient number of implemented case studies as well as continuous adaptation and development. The growing number of case-based global sustainability research projects needs to connect and collaborate at and across multiple levels. Ocean conflict research is well placed to engage here and would benefit from increasing its global relevance.

Outlook

The CB-GSP we identify here as a new category of global project is predominant in ocean conflict research and it has arisen in parallel to an also increasing focus on quantitative" big data" analysis in ocean science (Liu et al. 2016; Guidi et al. 2020). Synergies between these complementary approaches will need to be explored.

"Viable pathways to sustainability" in ocean conflict research (as is the title of this special issue) will need explicit management of the challenges we identify here to increase the global relevance and impact of case-based research, and we hope to have provided an important element of this evolving process.

This paper provides new insights on how to conduct cross-case analysis more effectively in terms of understanding the global significance of ocean conflict cases. Global (ocean) sustainability projects (CB-GSPs) that include multiple actors linked by complex relations and rules are a prominent feature in marine social science research. We will need to move beyond general statements that are merely illustrated by single cases to effective multi-case research. A major challenge for cross-case research is showing what a case study actually signifies in relation to a wider, global issue, such as the growing incidence of ocean conflicts we have focused on here.

Although tensions will remain between unique, complex systems (the cases) and the fundamental "levelling" features of global analyses, when conclusions are based on multiple cases, global analysis requires case-level work within broader analytical frameworks. Such frameworks or typologies are needed to enable effective global analysis based on multiple cases. They should identify and retain the key features of individual cases which are needed to inform effective, context-specific solutions, but also situate the meaning of a case study in a wider frame. The combination of case typologies and actor-specific best practices that we suggest here addresses the challenges of working at and beyond the case level for scientists, other partners in transdisciplinary research, and the funders of such international research.

Our "best practice" suggestions for those engaged in planning, implementing and facilitating globally relevant but regionally rooted and societally impactful (right part of Fig. 1) should facilitate pathways for ocean conflict research projects of the CB-GSP type to expand their impact beyond the individual, locally grounded, inclusive, and actionable case research so as to address wider ocean conflict and sustainability issues. This requires a collaborative further development of best practices by scientists, funders and project partners.

[15] These are struggling with the contextualization of the "one fits all" aspects of the IADApt tool, as revealed in our Key Informant interview with the PI (IvP) in February 2022.

Appendix

Table A Cross-case analysis in selected CB-GSPs

Project name	1. How central was the project aim to analyze across case studies to generate globally relevant results? Very central/ Fairly central/ Secondary/ Unimportant	2. What was the project approach to analyzing across case studies?	3. What were the strengths of the adopted approach?	4. Pitfalls/challenges of the adopted approach?
NOCRISES (Negotiating ocean conflicts among rivals for sustainable and equitable solutions)	Very Central - The project started out with a set of generic globally relevant questions and objectives and then searched for case studies to generate information on these	A shared research agenda on the basis of a "state of the art" literature review and based on an agreed menu of methods to be applied at the case study level (process tracing, governance mapping, cultural consensus analysis, and creative arts). The aim is to apply a core set of methods across case studies	Effective collaborative learning and team-building on methods for the study of (ocean) conflicts; identifying similar conflicts in different regions of the earth (e.g., small-scale fishers vs a multiplicity of other ocean users and uses)	The selection of case study regions could not but follow a number of practical criteria, so the representativeness of cases is in doubt; a concentration on methods has in the ongoing first half of the project perhaps reduced focus on results; fieldwork and in-person meetings were hampered by COVID
OCEANSPACT (Ocean sustainability pathways for achieving conflict transformation)	Fairly Central - Not a full comparative approach since cases in global North and South are so different: in the North, people trust and feel they can influence the system, here science "observes; in the South, fewer options for communities to influence blue growth and more activist scholars and contextual learning; comparative work may be overambitious	An "analytical generalization approach" develops guidance on (predefined) analytical areas (like drivers & root causes of conflicts; power dynamics); based on reflections and analytical frame; work packages have core conflict analysis themes in conflict analysis themes (drivers, power dynamics of conflicts); aiming for a conceptual theory to show that conflict can have negative or positive outcomes; mainly qualitative, participatory and action-oriented data collection	It allows learning across cases in light of contextual differences, networking, and capacity building among researchers to generate pluralistic/flexible understanding to prevent being too dogmatic; generate understanding of contextual differences	Cross-case analyses can become superficial; differences between researcher teams in how the analysis is performed hard to handle & lead to ambiguity; different perceptions of the role of research and science (e.g., action orientation or not); misconception of what action can/ should be; not necessarily action that results in outcome in 3 years, can be more long-term and progress over time on a pathway; this creates friction in project; soft follow up makes it hard to get project run in COVID times; fragmentation, turning into scientific silos that take their own direction; organizational problem: needs to be flexible with implementation but also core organization and communication needed to deliver shared results

Table A (continued)

Project name	1. How central was the project aim to analyze across case studies to generate globally relevant results? Very central/ Fairly central/ Secondary/ Unimportant	2. What was the project approach to analyzing across case studies?	3. What were the strengths of the adopted approach?	4. Pitfalls/challenges of the adopted approach?
GULLS (Global understanding and learning for local solutions)	Very Central - We selected several cases of "hotspots of change" (fast-warming marine areas and areas experiencing social tensions as a result) because these areas are in urgent need of adaptation and resilience building. Our goals were to pinpoint resulting problems and identify how each location manages change and identify what commonly works well in order to make some global recommendations	To ensure comparison, case studies used consistent tools; conducted group meetings to discuss methods and results; each case study was carried out by a cross-nation team to work on impacts, social aspects, and models (for each project component: communication and education, ocean and climate modelling, sensitivity of species important to fisheries, social and economic vulnerability, governance & systems modelling); the work aimed to understand the perspective and background of each country/case team; using a participatory approach	Strong coordination and consensus building between participants increased the confidence in country teams; students/postdocs working in several case studies were empowered to build network and leadership; Particularly the social and economic vulnerability component had good representation from all hotspots and brought together compatible data sets and methods. The participatory development of this component enhanced the skills of all team members; Similarly, existing methods were applied in different hotspots (e.g., ocean and climate modelling and species sensitivity) but here capacity building for method co-development by teams with diverse experience from across the case studies was less.	Different start dates due to funding schedules; for some sites specific requirements had to be adapted to accommodate the needs of non-academic participants; cultural and language issues; different capacities of national teams to cover all components-e.g., systems modelling component not well covered; funding for a final face-to-face workshop was missing; GULLS was mainly a set of discrete and largely independent subprojects (i.e.; components) rather than an integrated project but some commonalities were identified. More exchange between components and an overall synthesis and integration was needed to make project outcomes more than the sum of the components.
ONE OCEAN HUB	Unimportant - We have case studies but we do not work on comparing cases; equitable partnerships in the different countries to work for the development of those countries through "in context learning" is our focus; global reach of project work is also central	Multiple institutions collaborate in a "living laboratory" in which (in-country) case studies are used; there are in-country directors and some researchers from participating country teams are part of an international working group which may develop ocean governance interventions	It is a collaborative and applied research for development impact which we can and do measure through interviews; an international impact working group exists	UK budget cuts reduced funding
MULTIFRAME (Assessment Framework for successful development of viable ocean multi-use systems)	Fairly Central - The project aims to adapt an originally European concept to other contexts across the globe focussing on synergies between ocean uses rather than just multi-use	We are a "one issue project," the same questions are applied to all cases but each case study has its own combination of ocean multi-use. We identify shared cross-case issues	We frame some common issues in different geographical contexts and identify new multi-use combinations and issues	Working as an interdisciplinary team with only one social scientist makes for the imbalance between applied and critical science so finding common ground to work together is difficult; funding is not equal between North and South partners, hard to build good relations to new partners through videoconferencing

Table A (continued)

Project name	1. How central was the project aim to analyze across case studies to generate globally relevant results? Very central/ Fairly central/ Secondary/ Unimportant	2. What was the project approach to analyzing across case studies?	3. What were the strengths of the adopted approach?	4. Pitfalls/challenges of the adopted approach?
DELTAS (Catalyzing action towards sustainability of deltaic systems)	Fairly Central - Not the whole project aimed to be globally relevant. Some activities were only for one of our three large river deltas (Amazon, Ganges/Brahmaputra, and Mekong). Some partners worked on a global scale. Some WPs were cross-cutting on delta-related knowledge. One activity looked at all deltas globally.	A nested approach with 9 partners in a large consortium: Some indicators of vulnerability and exposure were assessed globally, and then we looked at where our 3 "case deltas" appear in the overall risk landscape. The socio-ecological risk was assessed for all three deltas in a modular, indicator-based approach with some cross-cutting indicators for all three deltas to compare delta challenges and patterns. We also had project members working only on one delta (e.g., Eduardo Brondizio's ethnology team on Amazon Belém water challenges)	Scientifically, it allowed and enforced "inter-delta learning:" everyone learnt something new; most scientists had experience in one delta, it increased mutual understanding, and allowed the transfer of solutions; our indicator-based methodologies were more suited to global work.	You lose local specificity when working across cases (i.e., here deltas). If you want global relevance, you will be less informative for local planning; for the qualitative (soft social) science; a larger budget would have been needed for all three deltas to be empirically researched. We used desk-based indicators; their validation on the ground was challenging; locally appropriate fine-tuning of indicators was needed. A follow-up to make outcomes usable in the local context would have been good. For the global discourse (i.e., to tell a story about the three case deltas) our indicators were useful, less so for local debate and implementation
Vulnerability to viability (V2V)	Very Central - Cross-case analysis is our starting point and guides us	IADApt is the central method which guides us. But we will have another, more comprehensive assessment approach as a precursor to the IADApt case study and implement this to develop a final template to be applied to all 12 case studies	The final V2V research template will be comprehensive and inclusive. Each case study can also apply the issue-based IDApt template multiple times	How does the project continue to contribute after it is over? You need enough common ground to build "lasting" knowledge. Cross-cultural templates are a challenge and take time; to look at a project as a process is not encouraged in academia; how do case study participants benefit?; capacity building in case study work is a challenge

Interviews were conducted online by one of the co-authors; interviewees/project respondents were leading members of their respective CB-GSPs

Table B Summary of interviewees' ideas for future case-based global sustainability projects (CB-GSPs)

- A realistic timeline and budget and the right sort of partners from communities, government, and NGO sectors are needed. "All this is decided in the design stage of the project."
- Opportunities for global comparison need to be designed for and coordinated; fieldwork needs to be planned, funded, and implemented; delays or changes need to be communicated and the overall design needs to have contingency plans
- The scientist does not only want to be a small piece in the big matrix, thus the coordinator needs to have an overall "herding function" and explain the need to cover the different cases (i.e., deltas). That is not easy for a coordinator.
- If you want a global view, the number of partners increases, and budget limits come to bear more strongly. The framework needs to be developed first and then targeted partners need to be invited to fulfil specified tasks. Planning at the beginning is key.
- Need to check that those who are allocated tasks have the capacity to fulfil them; match the distribution of tasks to the distribution of funding; ensure that the project coordinator has a scientific vision for the project. This is not necessarily given when a private company coordinates.
- Time and capacity are needed
- For big projects: (1) think of additional clustering into case types to introduce extra options for comparison (e.g., between cases in the global North; it is easier to learn from similar cases, different dimensions of comparison of case studies; (2) longer projects, more funding for empirical work and ambitious project management are needed; now case selection is driven by countries` eligibility for funding; funding for external collaborators is needed (researchers and others); need to be able to collaborate on a more equal basis with community collaborators (e.g., small scale fishers); (3) better to identify case types first and then collaborators; mediation via an organization might be good but that limits free competition for projects; a boundary organization that helps to pre-organize case studies might work; (4) if transdisciplinary research is the aim, funding for non-academic partners is needed; do not fund projects that have no ambition/experience in working with local people. Different core ambitions/sets of research; natural science cross-case comparisons seem easier than studies that contain social complexities.
- A set of core methods needs to be combined with flexibility to complement and adapt them to context.
- Simultaneous start of funding for all case studies/research teams and one set of reporting requirements within one project timeline is needed (rather than each national funder following their separate, and at times mutually inconsistent procedures); this is important for a global multi-case project to generate synergies through cross-case team collaboration
- Project design: When working with indigenous communities, project design is challenging because trust and co-creation are key but not all "tools" fit with all cultures. This needs to be discussed early, during project framing; we need longer projects to allow for early redesign and starting problems (5 rather than 4 years).
- Funding: The time frame including start and end dates for all funding agencies should be coordinated, and the degree of support should match the (planning and reporting) effort required from project scientists. The central funding (by a single partner country or by a central one-stop agency) would help project cohesion and dynamics.
- Organization: Project teams that have experience with collaborative work, and are trusted locally are likely to be more successful. Frequent meetings (at least monthly) of all participants and in-person kick-off meetings are important; distributed leadership is good (e.g., co-chairs, topic leads, national coordinators…); where time zones and distance make interaction hard, a post- COVID communication strategy needs to be designed (e.g. go beyond emails and phone calls with Miro board, interactive tools, shared documents, online meetings).

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Declarations

Conflict of interest The authors declare no competing interests.

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