sustainability

MDPI

Article

Ethics to Intersect Civic Participation and Formal Guidance

Martin Bohle [1,2,*], Cornelia E. Nauen [3,4] and Eduardo Marone [5]

1 DG Research and Innovation, European Commission, 1149 Brussels, Belgium
2 Ronin Institute for Independent Scholarship, Montclair, NJ 07043, USA
3 Mundus maris-Sciences and Arts for Sustainability asbl, 1040 Brussels, Belgium; ce.nauen@mundusmaris.org
4 Quantitative Aquatics, Inc., Los Baños, Laguna 4033, Philippines
5 FUNPAR/IOI, CEM-UFPR Curitiba, Paraná CEP 80010-200, Brazil; edmarone@gmail.com
* Correspondence: martin.bohle@ronininstitute.org

Received: 18 December 2018; Accepted: 30 January 2019; Published: 1 February 2019

Abstract: Sound governance arrangement in socio-ecological systems (human niche) combines different means of sense-making. The sustainability of human niche-building depends on the governability of the social-ecological systems (SES) forming the niche. Experiences from small-scale marine fisheries and seabed mining illustrate how ethical frameworks, civic participation and formalised guidance combine in the context of a "blue economy". Three lines of inquiries contextualise these experiences driving research questions, such as "what is the function of ethics for governability?" First, complex-adaptive SES are featured to emphasise the sense-making feedback loop in SES. Actors are part of this feedback loop and can use different means of sense-making to guide their actions. Second, the "Voluntary Guidelines for Sustainable Small-Scale Fisheries" and geoethical thinking are featured to highlight the relevance of actor-centric concepts. Third, Kohlberg's model of "stages of moral adequacy" and the United Nations Convention on the Law of the Sea (UNCLOS) are used to show how to strengthen actor-centric virtue-ethics. Combining these lines of inquiry leads to the conclusion that ethical frameworks, civic participation and formalised guidance, when put in a mutual context, support governability and multi-actor/level policy-making. Further research could explore how creativity can strengthen civic participation, a feature only sketched here.

Keywords: sustainable governance; social-ecological systems; ethical frameworks; civic participation; small-scale fisheries; moral adequacy; Law of the Sea; human niche-building

1. Introduction

Governability, civic participation, ethical frameworks and formalised guidance are features of socio-ecological systems (the human niche). This study combines analytical concepts from various lines of scholarly inquiry to illustrate how they are interwoven. The concept "social-ecological systems" (SES) refers to the combination of natural process, technological artefacts and human practices (e.g., techno-commercial operations, culture-based choices). Together, these processes, artefacts and practices set the environments in which people live and are an intrinsic part of [1,2]. The concept "niche building" summarises how people shape technological artefacts, their operational practices as well how these artefacts intersect with natural environments [3,4]. The shaping has a physical form, e.g., design of artefacts, and a mental form, such as ideas about the appropriate use of artefacts. Both may vary with culture and social group. The concept 'governability' refers to circumstances that determine how formal or informal governance may function [5,6].

The notion "blue economy" is a term on the current political agenda to label the development of new economic opportunities in the marine environment [7]. The interpretation of the concept

shows considerable plasticity which does not always align with the Sustainable Development Goals (SDGs) adopted by the UN General Assembly in 2015. The "blue" techno-commercial operations in the marine environment are embedded in global supply-chains and are subject to multi-level regulation/management. These features likely cause that marine "social-ecological systems" exhibit "complex-adaptive" dynamics [8], and therefore require modes of governance that account for the complexity and the inherent unpredictability [9,10]. People (or human agents, stakeholders), institutions (or governments, governance arrangements) and corporations and civil society organisations together co-shape complex-adaptive socio-ecological systems [11–13]. People act (or react) as an intrinsic part of these systems and patterns. Practices on how to design and implement production systems and consumption patterns are the key means to co-shape. When shaping the "human niche", people and institutions are entangled in a process on how to make sense of their activities. As such, they provide an essential feedback loop within the complex-adaptive social-ecological systems ("human niche").

This paper illustrates how ethical frameworks, civic participation and formalised guidance intersect in social-ecological systems (SES) to frame formal and informal governance arrangements. The analytical, conceptual framework on which the paper is founded, complex-adaptive SES, is outlined in Section 2. A simple three-component description of SES is sketched to situate the action of human agents and the underpinning sense-making in one distinct component; the latter includes ethical frameworks, civic participation and formalised guidance. Small-scale fisheries and seabed mining serve as examples (Section 3). They offer a spread of configurations of economic agents, institutions and guidance, although they are focused on the marine environment. The discussion (Section 4) contextualises the examples, drawing on practical experiences and conceptual approaches, and casts a light on the operational role of actor-centric virtue-ethics in complex-adaptive SES. It emerges from the probing that active civic participation is relevant for effective governance. This insight leads to research questions (Section 4) about why creativity is enabling civic participation, and how such enabling could be functional to further the combined use of ethical frameworks and formalised knowledge for improved governability of complex-adaptive SES; features that are sketched in the present paper, only.

2. A Conceptual Framework: Complex-Adaptive Social-Ecological Systems

Social-ecological systems are composite systems of interacting natural and societal processes. The following section describes means of sense-making as an intrinsic part of a given SES. Also, the conceptual description shall show how to situate the feedback loop between the sense-making of an agent and actions in a distinct component of a given SES. It generates understanding that sense-making means are dynamical system features that may evolve as part of system dynamics.

Social-ecological systems may be of a bewildering diversity that easily eclipses commonalities among them. Hence, classifying them facilitates to identify commonalities [1,14].

Complex-adaptive systems (Table 1) challenge the capability of the human agent to make sense of the system behaviour and to act appropriately because often these systems change simultaneously at various scales, coupled with cascading cause–effects relations [1,2,15–17]. Therefore, complex-adaptive SES bind agents in a joint struggle for control [18–21]. Hence, the notion "wickedness" may reflect appropriately the perceptions of human agents operating within a complex-adaptive SES.

For the subject of this paper, a simple, conceptual description of SES is sought, which uses a material-semiotic approach [22]. The description shall highlight how to situate human agency within an SES. A most-simple, two-component description of an SES could be "human systems and practices" and "natural systems and processes". A three-component description of an SES could be "intersection of human and natural systems", "human systems and practices" and "natural systems and processes".

Table 1. Dynamic characteristics of complex-adaptive systems; adapted from Reference [2].

Feature	Description	Effect
Networked causes	Multiple, parallel cause-and-effect pathways	Local and system-wide behavioural patterns
Input/output relation	Not proportionally related	Minor changes in a controlling driver can cause rapid, system-wide behaviour/significant changes in the controlling driver may cause slow and limited system-wide response
Structure	Structural parts are multi-functional	Different structural parts may perform the same function/the same structure can perform various functions
Non-linearity	Amplifying dynamic interactions.	Minor inputs may trigger cascades of significant effects that cause surprise and uncertainty/local interventions may modulate system-wide organisation

A two-component description of an SES is a dichotomy even if components are described as "fuzzy sets" [23]. The component "human systems and practices" could be associated with the "human-built technosphere" [24–26]; for example, the global supply-chain of mineral resource extraction systems. The technosphere would include, for example, the technological artefacts (e.g., machines, chemical processes, logistics) and socio-economic human-dominated institutions (e.g., corporations, regulators, civil society organisations (CSOs)). The second component, "natural systems and processes", would include the abiotic or biotic systems of physical objects, which are perceived as distinct from the "technosphere".

The dichotomy leads to difficult choices; for example, within what component to place aquaculture practices how to treat fish? Would extensive aquaculture relying heavily on the natural productivity of aquatic ecosystems be part of "natural systems and processes" and intensive salmon cage culture be part of the "human systems and practices"? For a three-component description of a SES, the component "intersection of human and natural systems" would include the technical means to grow aquatic organisms and the practices how to treat them.

When using a three-component description of a given SES, the term "intersection" in the notion "intersection of human and natural systems" represents two processes. First, it describes that the "artefacts of the technosphere" and "natural physical objects" interact in the physical sphere (of space and time) according to the laws of nature. Second, it describes the intellectual and affective representation in the human mind of the same artefacts and objects, including how their interactions are perceived. For example, the component "intersection of human and natural systems" would include the physical features of a "mining site" (e.g., manganese nodule at the seabed), "mining equipment" (a technological artefact), the provisions how "to mine at the seabed", the ideas that question the envisaged operations, technology or provisions, as well as the processes to develop common grounds among different societal groups.

When using a three-component description of a given SES, the component "intersections of human and natural systems" includes artefacts, institutions and rules. Likewise, it includes the legal, political and philosophical constructs, which guide (or question) the use of a given artefact. Thus, the social and intellectual forms of the human agency (including means to make sense) belong to the SES component "intersections of human and natural systems" as well as their physical realisations, that is, technological artefacts that interact with natural objects.

Hence, when conceiving an SES as a three-component system, the human agent is situated in a distinguishable component. This component includes the vital feedback loop between the agent's sense-making of the SES and the action to alter the SES. Depending on the dynamics of the feedbacks, the behaviour of the SES may be complex-adaptive, and the agents may perceive it as "wicked". Subsequently, it is essential for the behaviour of a given complex-adaptive SES in response to human actions, how different means to make sense mutually support, for example, governability of the SES and multi-actor/level policy-making.

Effective handling-orientations for agents in complex-adaptive systems target: (i) monitoring mechanisms to capture developments, (ii) intervention forms to steer path-dependent developments, as well as (iii) multi-stakeholder arrangements for participatory governance and a shared culture of

sense-making [14,16,27–36]. In that context of effective handling-orientations, ethical frameworks, civic participation and formalised guidance are operational means for agents to make sense of system behaviour and actions.

3. Marine Complex-Adaptive Social-Ecological Systems

3.1. First Example: Small-Scale Fisheries (SSF)

Compared to industrial fisheries, artisanal, small-scale fisheries (SSF) are much more labour intensive, less capital and energy intensive per ton of fish caught and tend to have a much lower impact on the environment [37]. Small-scale fisheries land between a fourth or a third of the global catch of fish according to global catch reconstructions. Small-scale production is by commercial artisanal, subsistence and recreational fisheries. The artisanal catch accounted for approximately 22 million tons in 2010. It is still gradually growing, while industrial fisheries are declining since the mid-1990s [38]. Small-scale fisheries employ most of the fisheries workforce of approximately 40.3 million people in the primary sector. Selective studies suggest possibly similar numbers in the secondary sectors—processing, marketing and other pre- and post-harvest activities where women tend to play essential roles, but which suffer from very little systematic data recordings [39]. Small-scale fisheries, if supported by appropriate policies, could be a model of sustainability, that is, if they could continue contributing directly to food and livelihood security, poverty reduction and wealth creation and coastal and rural development of many, not only developing, countries [40]. The operation, particularly of long-range industrial fisheries, illustrates the impact of these activities on third country taxes and commercial activities, on distant environments, and on realms of different legal or regulatory jurisdiction. The association with illegal, unregulated and unregistered (IUU) fishing and doubtful, even criminal, practices have become a serious concern in recent years [41–45].

The intersection of industrial fishing and artisanal fisheries shapes a complex-adaptive SES driven by natural, technological, institutional and social dynamics. Contradictory values, different interests and stakeholder relations build complex-adaptive features in the governance structures [46]. To tackle this "wicked game", the Committee of Fisheries of the Food and Agriculture Organization of the United Nations (FAO) adopted in 2014 a rights-based framework, the Voluntary SSF Guidelines [37,47]. Analysing the empirical evidence reveals how to relate formal guidance and ethical frameworks in complex-adaptive SES [48].

First, facilitated by the political choice to make the practical adherence by stakeholders voluntary, the SSF Guidelines could be comprehensive regarding topics covered. They could integrate social, cultural and economic sustainability issues. They address resource access (allocation) as well as use rights matters guided by human rights principles. They allow flexible approaches to accommodate country and region-specific conditions. Hence, the SSF Guidelines are an opportunity to adjust governance towards a coordinated, yet flexible, strategy for any institutional and individual agent to ensure the sustainability of small-scale fishers and their communities; most of all directed to governments to review the prime policy focus on industrial fisheries.

Second, implementing the SSF Guidelines will require policy-relevant intervention and innovation at many levels. Contributions by a range of government departments, of civil society organisations, and academia are needed, together with the empowerment of fishers as participants in decision-making processes. Hence, effective implementation of the SSF Guidelines will package many threads of (top-down and bottom-up) action in a context-specific and actor-dependent manner. It will be a challenging case-by-case approach, whether at local, national, or regional levels [40]; however, driven by a common ethical orientation.

Third, The SSF Guidelines are grounded in a human-rights-based approach to social development and an empowerment process for community organisations (including decision-making power of women). The SSF Guidelines, therefore, favour civic participation. They argue for an adaptive co-management that accounts for traditional knowledge and customary rights, thus encouraging

creative combinations of formal and informal governance arrangements. Likewise, ethically-grounded building blocks of the SSF Guidelines call for protecting the rights of small-scale fishing communities to marine fishery resources and related resources at the shore (and to legislate and enforce accordingly). The SSF Guidelines recognise the criticality of market access, mainly through improved post-harvest handling, logistics and access to credit. Finally, the emphasis is also on supporting diversified livelihoods through access to essential social services like education and health and overarching capacity-building and networking.

A Small-Scale Fisheries Academy

Large-scale analyses through specific lenses that are essential for the sense-making of global trends and understanding the "big picture" can mismatch with realities at local levels where diverse objectives and needs require fine-grained appreciation and trade-offs. For example, "fishing" is linked, e.g., to the social organisation of work and labour issues, investment, environmental conditions, home consumption, local, regional and international markets. External demand can outcompete local demand through higher purchasing power or create new markets for species not previously targeted. Ensuing resource rarefaction then generally leads to further overinvestment and higher exploitation costs. Overinvestment has far-reaching effects not only on fish production and its destination but to social organisation in SSF as observed, for example, in Senegal, where women-led family businesses with no access to affordable credit increasingly lack raw material and thus risk losing their social status too [49]. To thrive, local actors must succeed in tilting their competitive disadvantage against investors external to their communities or even country into innovative market access. This change goes hand in hand with the need to redevelop ways of constructive relations between traditional social regulation and public fisheries policy and administration to make rules enforceable again. One example of an effective collaboration was the Vigilance and Security Committee initiated by the local fishing community in Fass Boye (Senegal) to protect grounds reserved for small-scale fishing against night-time incursions of industrial trawlers. Committee members captured the trawler captains and handed them over for detainment and fining to the coast guard, which did not have sufficient means for maritime monitoring, control and surveillance (MCS) of their own [50]. These forms of mutually beneficial, often tacit, collaboration were severely curtailed in conjunction with sector policy reform supported by a World Bank project. Poor consultation processes and trespassing of newly created institutions into spheres of traditional social regulation led to a general weakening of authority and enforcement of rules [51]. It is against this background and in the light of insistent demands of fishers and women in the artisanal fisheries for better recognition and access to research results, notably in Senegal [52], that the concept of a SSF academy is being developed. It is conceived as a safe space for exchange between different stakeholders and the co-production of knowledge. It illustrates ways on how to handle the related challenges, e.g., by developing collective insights into local ecosystem dynamics incorporating traditional knowledge, local dynamics of social systems, including mutual respect between stakeholders and rebuilding trust [9,36]. The academy responds to the need for implementing the SSF Guidelines with their call on public authorities to enhance cooperation with local communities, to enhance social development and promote a culture open to the world. It also plans to conduct participatory (action) research with fishers and women in post-harvest trades [53].

3.2. Second Example: Seabed Mining

Several societal, technical, economic and environmental features describe the challenges of mining operations at the seabed (Table 2). Mutatis mutandis, these challenges also apply to mature industrial operations at sea, such as shipping, fishing or exploitation of hydrocarbons.

Table 2. Challenges to mining operations at the seabed.

Feature	Description	Comment
Maturity	Mining of minerals at the seabed is not a developed industrial activity, yet.	Currently, investigations are ongoing on "how to mine minerals at the seabed in a viable manner?" These investigations involve research into operational conditions, technological developments, test-deployments and claiming of mining sites.
Frameworks	The legal, regulatory and commercial means to operate a mining site at the seabed are being developed and tested.	These activities may involve international authorities (as the Sea-Bed Authority), national (governmental) regulators, private consortia and civil society.
Environment	The environmental conditions at the seabed, in the water column and at the sea surface pose technological challenges for the operations of the mining equipment.	Access the locations of seabed mining sites will be challenging for the mining operators, regulators or surveillance bodies and third parties. Parts of the sites will be effectively inaccessible for human intervention.
Control	For any interested or concerned party, including the operators of the mining site, it will be difficult to monitor and control the impacts of a given mining operation.	Monitoring, control and surveillance of impacts on third party commercial activities, on distant environments, and of neighbouring realms of different legal or regulatory jurisdiction will be hugely challenging.

In addition to these challenges, the remoteness of the open sea and the philosophical paradigm of the freedom of the seas, initially in the sense of free passage, provide agents with leeway for practices that may be dubious or problematic when applied to free access to resources [54]. Operation at sea for shipping, fishing and exploitation of hydrocarbons are regulated, and adherence is monitored; at least in those parts of the world with strong institutions and high labour standards. Also, much of the knowledge about these operations is shared and publicly available. Compared to these circumstances for mature industrial operations at sea, mining at the seabed is at a conceptual state and triggers controversy [55].

Compared to many terrestrial environments, the marine environments are technologically challenging; winds and waves, or corrosion, come to mind. Although the conditions at the seabed (pressure, temperature) are harsh, the primary technological challenge is to combine remotely controlled mobile operations at the seabed with operation in the water column and at the sea surface [56–60]. Beyond causing heavy corrosion of the equipment, the chemical properties of water facilitate solution and suspension of liquids of different nature. Therefore, tailing-dirt and stirred unconsolidated sediments as well as accidental pollution likely will be transported over long distances and will smother very slowly developing living deep-sea communities.

Possibly, the single most significant challenge to seabed mining derives from the communication and monitoring technologies, which are available for operations at the sea surface, in the water column or at the seabed [61]. Modern satellite-based communication, sensing and tracking technologies ease monitoring of operations at any place on Earth; even at the surface of the open ocean; although the size of the oceans still is a problem. To monitor operations in the water column and at the seabed requires acoustic technologies mounted on moored or floating instruments. They provide much less detailed information and slower communication because of limited bandwidth. Moreover, acoustic technologies are interfering with communication of marine mammals and other marine organisms [62]. This circumstance has significant consequences for the conduct of the mining operations, their surveillance as well as the monitoring of impacts on the environment, on the interests of third parties, and the commons. Hence, operations in the water column and at the seabed are quite "in the dark".

When considering the challenges of mining at the seabed then the intersecting natural and technological systems (and practices) of seabed mining make it likely that the SES is complex-adaptive. Furthermore, seabed mining poses serious risks for the living environment of the deep sea, including understudied genetic resources, of which some have already given rise to patents. The deep sea is a less researched natural environment with unknown biota, and prolonged recovery of natural conditions in millennia or even longer time frames [55,63–65]. These circumstances render the entire technical-environmental system of mining at the seabed complex-adaptive.

Contrasting with its complexity, the knowledge of how to govern "seabed mining" is limited and its codification is nascent at best. In knowledge combined with values and interests lays the foundation for what agents understand (and agree) to be appropriate practices. Limited understanding because of fragmented knowledge, different interests and values are key-drivers of systemic "wicked games" (of agents) in which technical experts tend to underestimate the risks [10].

When one considers the natural, technological, commercial and governmental subsystems of the SES "seabed mining" (and the intersections of the subsystems), then a systemic complex-adaptive behaviour is very likely. Subsequently, the question arises "what are the means to address it?" A viable option seems to be improving initially the governability with the aim to address the behaviour of complex-adaptive systems. Improvements imply, for example, to strengthen the critical engagement and interplay of the different values, interests and knowledge of the various agents in complex-adaptive SES. To that end, terrestrial mining offers some experiences how to consider governability and to improve governance.

Under the circumstances applicable to seabed mining, approaches borrowed from terrestrial mining practices would practice civic participation, refer to formal guidance (mining codes), and consider the lifetime of the mine from exploration through its operation to its closure [66]. Such practices treat the societal contexts of mining by advocating a participatory approach to regulation, governance and operational decision-making [67–75]. Thus, good terrestrial mining practices take governance issues into primary focus. Often, these practices are labelled as a "social license to operate".

Exploring Corporate Social Responsibility

Experiences with responsible marine mining or application of participatory governance to deep sea mining are still to come. Terrestrial case studies may indicate what such experiences may imply. The following insights (quotes) are taken from Boon's [76] (p. 306-322, edited) comparative study of nine exploration projects in Latin America. He researched how relationships of actor groups involved in mineral exploration projects influence both the course of social events and the perceived benefits and harms:

- *"Relationships: Relationships move the world, and it is important to understand [in advance] both the patterns of relationships and their characteristics. For a company, this could mean to begin 'exploration for relationships' in areas of high mineral potential, well before exploration for minerals is to start. For communities and local governments, this would mean acquainting themselves with the companies interested in the area, which could take many forms and may require assistance from higher levels of government. [. . .] Once exploration starts, the parties should regularly characterise their relationship using the indicators to track dynamics and make changes as necessary and possible. [. . .]*
- *Meanings: Meanings given to people and things by both community members and company personnel determine their interpretation of situations and influence their actions. In communities, many of these meanings are implicitly discussed, formed and changed in general assemblies. [. . .] On the company side, this responsibility falls to management. The dialogue between community and company is essential to achieving convergence of meanings: each side needs to learn from the other. [. . .]*
- *Self-analysis: For companies and other actor groups, a self-analysis will provide valuable clues as to its weaknesses in addressing transactional needs, knowledge of the meanings it gives to people and things (especially the community) and of its reference communities. Conducting an early self-analysis of their relationship indicators, meanings and reference communities can be extremely useful preparation for their interaction with new neighbours. This allows them to put their own house in order before engaging with other actors, while at the same time developing familiarity with the tools that they may use for external engagement. This will enhance their ability to meet transactional needs. [. . .]*
- *Transformational approach: Creating a dialogue space that enables meeting transactional needs, developing relationships, and continual adjustment of meanings through interactions are at the core of the proposed model. These processes bring about collaborative processes and facilitate community decision making.*

They also promote acting together rather than just deciding together and provide room for leadership to emerge. [. . .]"

4. Discussion: Contextualising the Examples

As illustrated above, considering complex-adaptive dynamics of SES is vital to understand their governability to improve governance. The wickedness of a complex-adaptive SES is intrinsic because of the conflicting interests, different values, partial knowledge, non-linear system dynamics and multiple positive feedbacks between processes. As the mining and fisheries industries learned, participatory approaches are essential means to maintain governability despite complex-adaptive dynamics.

Experience in other fields shows that dedicated governance capabilities are required to handle appropriately complex-adaptive dynamics [1,8,16,26,74]. Such capabilities include adaptive, deliberative and participatory practices, reflexivity and variety of frames, resilience to uncertainties, responsiveness and capability to observe, revitalisation to block unproductive patterns, rescaling as well as cross-scale interactions. Participatory approaches facilitate that governance capabilities develop [36], although big asymmetries of power or scale of intervention pose significant obstacles to taking advantage of this potential [77–79].

Considering the state of global fish stocks, the current governance systems in place for industrial and SSF do not seem to be in an appropriate shape. The system of regional fisheries management bodies, trade restrictions on endangered species (CITES) and weak enforcement of fisheries legislation in EEZs (including mandated marine protected areas, mainly, but not only, in countries with limited institutional and financial resources) have not been able to halt the massive decline of global fish stocks [80]. Therefore, operational schemes emerge that try to harness modern information technologies, such as satellite tracking of fishing vessels [81]. They open new forms of public mobilisation and spaces for participatory processes to play a role in defending these commons from unstainable practices [78–82]. Hence, frameworks emerge that acknowledge the role of participatory processes in complex-adaptive systems [36].

The governance system in place for regulation and surveillance of mining sites at the seabed, e.g., the International Seabed Authority (ISA) and national regulators for the Exclusive Economic Zone, are unlikely to be able to handle complex-adaptive systems. Their design and the operational and political capabilities did not have these purposes in mind [83–86]. To improve governability of seabed mining, the practices of "social license to operate" may help [87]. However, such practices are not straight forward as shown for the Solwara-1 mining site off Papua New Guinea that is licensed to Nautilus Minerals Ltd. [88].

In the absence of better approaches, robust participatory governance systems for marine complex-adaptive SES could offer the required capacity building for third parties. Furthermore, they could facilitate: the involvement of civil society in different formats, constructive engagement with the insurance industry to discourage high-risk investments, end of damaging subsidies, curtailing market access for fraudulently produced goods, and operational security for legitimate commercial and regulatory parties.

The ongoing UN negotiations about protecting the High Seas are a forum to seek better mutual understanding between diverse interests and sharing of knowledge, including scientifically validated insights [89,90]. Effective marine governance would imply considering the entire life cycle of the global supply-chains for resources. Also, processes leading to a "social license to operate for the blue-economy" need to involve a wide range of stakeholders who would lend their voices to the ethical paradigm that marine resources are part of the common heritage of humankind [85,91]. Strengthening the application of ethical paradigms requires an understanding of their operational role.

4.1. The Operational Role of Ethics

Over the last two hundred years, people have considerably developed their skills and technologies to appropriate resources from marine environments, hence, to use the common heritage of humankind.

Nowadays, human niche building impacts all coastal seas and the world ocean as a whole [92,93]. It is fair to say that

"[T]he largest source of uncertainty rests with human drivers, as not only social dynamics and shifts in the consumer attitudes are difficult to forecast, but the introduction of new, disruptive technologies are intrinsically unpredictable . . . A third source of uncertainty is the prevalence of non-linear systems that can lead to abrupt changes . . . departing from the linear, smooth responses that are amenable to prediction . . . . [92] (p. 6)". The notion of a blue-economy is one more step along a context-depending development path building complex-adaptive marine SES.

As discussed, to handle complex-adaptive SES, including context-dependence, requires governance strategies, which are "adaptive, participatory and transdisciplinary" [1], applying collaborative rationality [94], and provide a governance capability, which Termeer and co-workers [16] frame with the attributes "reflexivity, responsiveness, resilience, revitalisation and rescaling". Besides, Jasanoff [10] postulates the imperative to exercise humility in technological choice and the need for citizen participation. As outlined, such actor-centric strategies are a genuine part of the SSF Guidelines [95]. As a result, they enable agents to address dynamically evolving planning, decision making and action, to navigate unavoidable uncertainties and ambiguous situations [77].

Campbell and co-workers [54] (p. 535) emphasise that "*agents, scale and knowledge (that) are relevant for efforts to govern new and emerging ocean issues*." Elaborating this analysis further, Hughes and co-workers [96] (p. 84–85) state *"By emphasising proximal drivers rather than more distant human ones, we often inadvertently simplify and re-scale a complex social-ecological problem into a subsystem that is entirely biological, which can distract from the underlying causes and ways to address them. A social-ecological approach for sustaining ecosystems is beginning to emerge that explicitly links the resilience of ecosystems to governance structures, economies and society".* In turn, Campbell and co-workers [54] (p. 536) qualify that the *"SSF-Guidelines are . . . attending as much to questions of resource access, human rights and food security as they do to questions of fisheries ecology."* Hence, the SSF Guidelines favour an actor-centric and human-rights-based approach and as such are an *"opportunity to create governance regimes that support environmental sustainability and human well-being"* [54] (p. 536), notwithstanding that their *"implementation . . . is likely to be an ongoing, adaptive and iterative process, as small-scale fisheries are dynamic"* [95] (p.12).

Compared to the practice-oriented SSF Guidelines, geoscientists have deconvoluted an abstract notion, geoethics, to address the context-dependence, uncertainties and ambiguous situations experienced in their professions. Peppoloni and Di Capua [97] (pp. 4,5) define geoethics as: "*Geoethics consists of research and reflection on the values which underpin appropriate behaviours and practices, wherever human activities interact with the Earth system. Geoethics deals with the ethical, social and cultural implications of geosciences education, research and practice, and with the social role and responsibility of geoscientists in conducting their activities*". Geoethics is "actor-centric". This feature distinguishes it clearly from "utilitarian concepts", "ethics of justice" or "conservation for its own sake", as proposed for ocean ethics [98–100]. Geoethics refers to the human actor in general who is operating in any environment, terrestrial or marine [101]. Hence, geoethics applies to the coastal zone and SSF within it. The SSF Guidelines distil from experiences how to govern a complex-adaptive SES through an approach that is grounded in an actor-centric ethic. Geoethics makes an actor-centric ethic its very core concept. This shared focus entangles both approaches.

The human-rights-based approach of the SSF Guidelines has no equivalent in the definition of Geoethics, although human rights were addressed in developing geoethical thinking [102]. Nevertheless, the explicit reference to human rights can be strengthened when applying geoethics to the marine environment based on its actor-centric design.

Considering collective human rights, the 1954 "Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict" (The Hague, 14 May 1954, 3511 U.N.T.S. 216) is the first international treaty that mentions the principle of a "common heritage of mankind". Later the Antarctic Treaty and the United Nations Convention on the Law of the Sea (UNCLOS) applied this concept.

When proposed in 1967 to be applied to the high seas, the industrialised countries rejected the principle of a "common heritage of mankind" in favour of "the freedoms of the high seas", as outlined in the 1958 Geneva Convention on the High Seas [103]. This initial tension between different concepts, although settled mainly in "The 1994 Agreement", still reigns supreme. It is maintained and powered by the increasing technical capability to operate in the high seas in a commercially viable manner [54]. Applied to the high seas, the "common heritage of mankind" principle consists of four elements. It prohibits states from proclaiming sovereignty over any part of the deep sea(bed) and requires that states use it only for peaceful purposes, sharing its management and the benefits of its exploitation.

To recapitulate, individual, collective and institutional agents effectively face choices on how to justify operations at the high seas. They may turn to international law, natural law or folk-ethical considerations, such as the golden rule "not doing to others what you would not have them do to you" [104]. In practice, the associated dilemma may increase depending on the awareness of the consequences of actions [105] and individual consciousness regarding altruistic (or egoistic) standards. Kohlberg's model [106] helps to structure the dilemma and emphasises the function of a human-rights-based approach in governance.

Kohlberg, inspired by Piaget [107], conceived a three-category hierarchy of moral development as a basis for ethical behaviour (Table 3). Kohlberg's concept holds that moral reasoning has six identifiable developmental levels around a central category for which societal conventions tune behaviour. At the pre-conventional levels, the primary social driver is the silent acceptance of the rules imposed by the dominant powers. At the lower conventional level, the primary social drivers are conformity with the governing status quo, maintaining some relationships convenient to both, the ones holding power and those conforming to this power. At the upper conventional level, people act mostly in compliance with law and order. At the lower post-conventional level, a social contract establishes rules and shapes a position. At the upper post-conventional level, the agent acts aligned with ethical principles and not to avoid punishment or to comply with conventions. Although Kohlberg is fixing an ideal-typical scheme to a process [108], the scheme is useful because of the convergence across cultural groups of shared moral values, the development of crucial moral judgement stages and the adoption of related social perspectives [109].

Table 3. Kohlberg's levels and stages of moral adequacy (adapted from Reference [106]).

Level	Stage	Social Driver
Pre-Conventional (direct consequences judge actions)	1	Obedience and punishment Blind egoism
	2	Self-interest orientation Individualism, Instrumental egoism
Conventional (actions are judged by comparing them to society's views and expectations)	3	Interpersonal accord and conformity Others approval, Social relationships
	4	Law and order Blind compliance, Social systems
Post-Conventional (individual's taking precedence over society's principles; inclusion of fundamental human rights such as life, liberty and justice)	5	Social contract orientation Agrees on common regulations
	6	Universal ethical principles Principled self-conscience and mutual respect

Before UNCLOS, governance rules on high seas fitted broadly to pre-conventional levels and the lower conventional level [110]. However, the principle of "the freedoms of the high seas" (for all seafaring people) was progress compared to a time when operations at the high-sea often were at a lower pre-conventional level. The actual exploitation of living and non-living marine resources of the high seas [9,86] provides an example of what happens when agents may operate, at best, at a conventional level. One may wonder what consequence must be faced if seabed mining is framed only at a conventional level.

The mere proposal of UNCLOS in support of more ocean governance does not match an upper conventional level. Implementing UNCLOS as a social contract, governance would meet the criteria of the lower post-conventional level. Nonetheless, when referring to the principles that are enshrined in UNCLOS, individual, collective and institutional agents may operate at an upper post-conventional level.

The principles underpinning UNCLOS call on agents to operate at an upper post-conventional level, that is, for example, sharing authority over the deep seabed, use of the high seas only for peaceful purposes, and participatory management and shared benefits of its exploitation. A governance practice (e.g., for seabed mining and fisheries) that operates at a post-conventional level requires awareness of agents and appropriate boundary conditions, as a necessary although not sufficient condition. As experience shows, the boundary conditions include practising equitable forms of multi-level governance, using scientific knowledge and other reliable sources of knowledge and finding compromises for ethical dilemmas based on universal, agreed principles.

As discussed above, the sound governance of commons resources goes hand in hand with equitable civic participation that accounts for heterogeneity and diversity of social groups, stakeholders and individuals. Under such circumstances, referring to Kohlberg's levels of moral reasoning, a joint operation is complicated if the supporting ethical reasoning does not aspire to the upper post-conventional level (universal ethical principles, principled self-conscience and mutual respect). Just relying on people's conscience or the benevolence of people as a means of governing common resources does not guarantee a satisfactory result. Instead "common instruments" are needed, which are ethically inspired (as the human-rights-based SSF Guidelines) and are grounded in a reasoned understanding of the respective socio-ecological system and its complex-adaptive behaviour.

To reap lasting benefits from nature, such as renewable and non-renewable resources or environmental products and services, it is imperative to know how social-ecological systems shape local conditions. The ambition to act ethically and the reasoned understanding both are necessary for the sound governance of marine resources. In that context scientific knowledge, although not perfect, has an essential function because it organises our rational understanding in the form of testable explanations or predictions. It is recognised here that scientific knowledge at its current level, although indispensable, is insufficient for socially acceptable trade-offs in decision-making [9]. The experiences of practitioners and indigenous communities encode valuable insights into the local system behaviour that capture the emergent specificities of local interactions within larger social-ecological systems including the consequences of "wicked behaviour" of human agents.

Furthermore, although solid scientific and empirical knowledge are necessary for sound governance, even in combination, they are not sufficient. Ethical guidance at any scale of the operational conduct and the decision-making must direct their use. Ethically-based frameworks and enhanced civic participation (from various communities and governance structures) support differentiating between what we have the right to do and what is the right thing to do. They should guide agents and ensure legitimacy and enforceability [46,48]. Both knowledge and ethics are therefore constituents of good governance; or put in a simplified phrase *"science brings society to the next level, while ethics keeps us there"* [111] (p. 44). Given the heterogeneity and diversity that is inherent to marine SES, the upper post-conventional level in Kohlberg's approach should guide ethical, operational practices. This quest can emerge from applying UNCLOS because it is enshrined in it and has the potential for further development [112].

4.2. The Role of Creativity and Future Research

Ethical frameworks and formalised knowledge are embedded in the broader set of cognitive means of people to make sense of their environments, which also relate to cultural context, perceptions and emotions [9]. To that end, creativity to enable civic participation is functional to further the use of ethical frameworks and formalised knowledge.

Civic participation is not an end, but rather an effective means by which to promote human agency, intercultural dialogue, abatement of power asymmetries and societal well-being. Research into how human imagination sets a generative basis on which individuals and societies successfully engage with complexity, envision alternative futures, transform systems and successfully adapt to change helps to shape this means [113]:

"Equitable development efforts [. . .] cannot work in reality unless they are grounded in a culture of shared values, attitudes, and practices. A combination of values, attitudes, skills, and knowledge are needed to empower a more inclusive set of citizens to participate effectively in a creative democracy. Values, including the primacy of human rights, equity, and cultural diversity, are of central importance. Attitudes, including openness, trust, mutuality, civic responsibility, and tolerance for change, are equally important. [. . .] In addition, we must design new organisational structures that enable cross-functional cooperation and creative practices that leverage a community's most abundance source of ideas—its people. [. . .]. Structure enshrines value and shapes behavior. [. . .]. Public policy provides one important mechanism for institutionalising constructive creativity, while creative activities themselves may inform future policies. [. . .].. Where possible, new and more porous structures as well as cross-functional roles can be introduced. Formal roles should be established for practitioners working in the interstitial space across systems to build scaffolding into the future. Embedding artists and designers to lead such processes can be particularly powerful as a means to offer a new way of seeing and organising political processes. [. . .]. By actively generating a robust evidence base, creative practitioners can demonstrate the value of participatory development practices in ways that resonate with municipal agencies as well as other partners for whom data informs decision-making. A commitment to learning and evaluation can also help to ensure that processes are transparent, parties are held accountable, and assets are fully leveraged. [. . .]. As political forces reshape the role of localities, creative practitioners from diverse disciplines are uniquely positioned to directly affect the direction of development in new ways that build community power and position cultural considerations at the heart of governance. In doing so, we can foster creative democracy and embrace change as a natural and necessary resource that enables societal renewal and vibrancy" (Arroyo 2017 [113]*, p. 69–70, edited).*

5. Conclusions

The case studies discussed in this paper focus on complex-adaptive SES (human niche) related to the marine environment. Two examples, small-scale fisheries and seabed mining, were analysed and contextualised using a selected set of analytical concepts. These examples offer a spread of configurations of economic agents, institutions, and guidance that permits some generalisations.

The analytical concept SES refers to the combination of natural process, technological artefacts and human practices. Together, these processes, artefacts and practices set the environments in which people live. People are an intrinsic part of SES, which can be described in a simple manner that situates the human agency in a distinct system component. This systemic approach includes the vital feedback loop between the agent's sense-making and action to alter the SES, which is influenced by ethical frameworks, civic participation and formalised guidance.

The behaviour of a SES may be complex-adaptive, and the agents may perceive this challenging circumstance as "wicked". Using actor-centric virtue-ethics as an analytical concept shows that governability of SES in such "wicked" circumstances depends on combining different means to make sense of it so that they support each other mutually, serving to ascent the Kohlberg scale of moral adequacy.

The insight into how actor-centric virtue-ethics can function may contribute to developing a concept of Blue Growth that is compatible with the SDGs. Furthermore, such insight may guide agents who are involved in operations and decision taking in other complex-adaptive SES. Such systems and the related perceptions of agents to be engaged in "wicked games" are a general feature of Earth system dynamics. Thus, meta-level insights that in the first instance apply in marine settings are likely to apply in other, terrestrial ones, too. We argue firmly that ethical frameworks, civic participation and formalised guidance, which frame actor-centric virtue-ethics, are elements of a meta-order that

mutually support governability and sustainability of human niche-building. We see as further research to study how creativity is enabling civic participation for more effective use of ethical frameworks and formalised knowledge to achieve improved governability of complex-adaptive SES.

Author Contributions: All authors have contributed to the activities: Conceptualization, M.B., C.E.N., and E.M.; Methodology, M.B., C.E.N., and E.M.; Writing-Original Draft Preparation, M.B., C.E.N., and E.M.; Writing-Review & Editing, M.B., C.E.N., and E.M.

Funding: This research received no external funding.

Acknowledgments: This paper develops a contribution of the authors (entitled "Not Out of the Blue: Ethics to Intersect Civic Participation and Formal Guidance") to the Earth System Governance Conference 2018 (5–8 November 2018, Utrecht (The Netherlands)) to the session "Earth System Governance for Blue Growth". The first author thanks his employer for the consent to cooperate with the International Association for Promoting Geoethics (IAPG) and to affiliate with the Ronin Institute. The authors thank Kiley Arroyo and Jan Boon for consenting to reproduce long quotes from their respective work in a selective manner. The authors declare no conflict of interest.

All views expressed herein are entirely of the authors, and do not reflect the position of the European Institutions or bodies and do not, in any way engage any of them.

The authors are grateful for the helpful comments of the reviewers.

Conflicts of Interest: The authors declare no conflict of interest. The funders/employers had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

1. Head, B.W.; Xiang, W.-N. Working with wicked problems in socio-ecological systems: More awareness, greater acceptance, and better adaptation. *Landsc. Urban Plan.* **2016**, *154*, 1–3. [CrossRef]
2. Preiser, R.; Biggs, R.; de Vos, A.; Folke, C. Social-ecological systems as complex adaptive systems: Organizing principles for advancing research methods and approaches. *Ecol. Soc.* **2018**, *23*, 46. [CrossRef]
3. Fuentes, A. The Extended Evolutionary Synthesis, Ethnography, and the Human Niche: Toward an Integrated Anthropology. *Curr. Anthr.* **2016**, *57*, S13–S26. [CrossRef]
4. Ellis, E.C.; Richerson, P.J.; Mesoudi, A.; Svenning, J.-C.; Odling-Smee, J.; Burnside, W.R. Evolving the human niche. *Proc. Natl. Acad. Sci. USA* **2016**, *113*, E4436. [CrossRef] [PubMed]
5. Kooiman, J. Exploring the Concept of Governability. *J. Comp. Policy Anal. Res. Pract.* **2008**, *10*, 171–190. [CrossRef]
6. Bavinck, M.; Chuenpagdee, R.; Jentoft, S.; Kooiman, J. (Eds.) *Governability of Fisheries and Aquaculture*; Springer: Dordrecht, The Netherlands, 2013; Volume 7.
7. Ehlers, P. Blue growth and ocean governance—How to balance the use and the protection of the seas. *WMU J. Marit. Aff.* **2016**, *15*. [CrossRef]
8. Lundström, N.; Raisio, H.; Vartiainen, P.; Lindell, J. Wicked games changing the storyline of urban planning. *Landsc. Urban Plan.* **2016**, *154*, 20–28. [CrossRef]
9. Nauen, C.E. Negotiating a New Deal Between Science and Society: Reflections on the Importance of Cognition and Emotions in International Scientific Cooperation and Possible Implications for Enabling Sustainable Societies. In *Psychological and Political Strategies for Peace Negotiation*; Springer: New York, NY, USA, 2011; pp. 131–156.
10. Jasanoff, S. Technologies of humiliation: Citizen participation in governing science. *Minerva* **2003**, *41*, 223–244. [CrossRef]
11. Van de Poel, I.; Goldberg, D. (Eds.) *Philosophy and Engineering*; Springer: Dordrecht, The Netherlands, 2010; Volume 2.
12. Murphy, C.; Gardoni, P.; Bashir, H.; Harris, C.E.; Masad, E. *Engineering Ethics for a Globalised World*; Murphy, E., Gardoni, C., Bashir, P., Harris, H., Masad, C.E., Eds.; Springer International Publishing: Cham, Switzerland, 2015; Volume 22.
13. Bohle, M. Ideal-Type Narratives for Engineering a Human Niche. *Geosciences* **2017**, *7*, 18. [CrossRef]
14. Alford, J.; Head, B.W. Wicked and less wicked problems: A typology and a contingency framework. *Policy Soc.* **2017**, *36*, 397–413. [CrossRef]
15. Smith, B.D.; Zeder, M.A. The onset of the Anthropocene. *Anthropocene* **2013**, *4*, 8–13. [CrossRef]

16. Termeer, C.J.A.M.; Dewulf, A.; Karlsson-Vinkhuyzen, S.I.; Vink, M.; van Vliet, M. Coping with the wicked problem of climate adaptation across scales: The Five R Governance Capabilities. *Landsc. Urban Plan.* **2016**, *154*, 11–19. [CrossRef]
17. Van der Merwe, S.E.; Biggs, R.; Preiser, R. A framework for conceptualizing and assessing the resilience of essential services. *Ecol. Soc.* **2018**, *23*, 12. [CrossRef]
18. Allenby, B.R.; Sarewitz, D. We have made a world we cannot control. *New Sci.* **2011**, *210*, 28–29. [CrossRef]
19. Galaz, V.; Moberg, F.; Olsson, E.-K.; Paglia, E.; Parker, C. Institutional and Political Leadership Dimensions of Cascading Ecological Crises. *Public Adm.* **2011**, *89*, 361–380. [CrossRef]
20. Folke, C.; Jansson, Å.; Rockström, J.; Olsson, P.; Carpenter, S.R.; Stuart Chapin, F.; Crépin, A.-S.; Daily, G.; Danell, K.; Ebbesson, J.; et al. Reconnecting to the biosphere. *Ambio* **2011**, *40*, 719–738. [CrossRef] [PubMed]
21. Biggs, R.; Schlüter, M.; Biggs, D.; Bohensky, E.L.; BurnSilver, S.; Cundill, G.; Dakos, V.; Daw, T.M.; Evans, L.S.; Kotschy, K.; et al. Toward Principles for Enhancing the Resilience of Ecosystem Services. *Annu. Rev. Environ. Resour.* **2012**, *37*, 421–448. [CrossRef]
22. Wong, C.M.L.; Lockie, S. Sociology, risk and the environment: A material-semiotic approach. *J. Risk Res.* **2018**, *21*, 1077–1092. [CrossRef]
23. Zimmermann, H.-J. Fuzzy set theory. *Wiley Interdiscip. Rev. Comput. Stat.* **2010**, *2*, 317–332. [CrossRef]
24. Haff, P.K. Humans and technology in the Anthropocene: Six rules. *Anthr. Rev.* **2014**, *1*, 126–136. [CrossRef]
25. Edwards, P.N. Knowledge infrastructures for the Anthropocene. *Anthr. Rev.* **2017**, *4*, 34–43. [CrossRef]
26. Rosol, C.; Nelson, S.; Renn, J. Introduction: In the machine room of the Anthropocene. *Anthr. Rev.* **2017**, *4*, 2–8. [CrossRef]
27. Hulme, M. *Why We Disagree about Climate Change: Understanding Controversy, Inaction and Opportunity*; Cambridge University Press: Cambridge, UK, 2009.
28. Tickell, C. Societal responses to the Anthropocene. *Philos. Trans. Ser. A Math. Phys. Eng. Sci.* **2011**, *369*, 926–932. [CrossRef] [PubMed]
29. Hämäläinen, T.J. Governance Solutions for Wicked Problems: Metropolitan Innovation Ecosystems as Frontrunners to Sustainable Well-Being. *Technol. Innov. Manag. Rev.* **2015**, *5*, 31–41. [CrossRef]
30. Monastersky, R. Anthropocene: The human age. *Nature* **2015**, *519*, 144–147. [CrossRef] [PubMed]
31. Seitzinger, S.; Gaffney, O.; Brasseur, G.; Broadgate, W.; Ciais, P.; Claussen, M.; Erisman, J.W.; Kiefer, T.; Lancelot, C.; Monks, P.S.; et al. International Geosphere-Biosphere Programme and Earth system science: Three decades of co-evolution. *Anthropocene* **2015**, *12*, 3–16. [CrossRef]
32. Schimel, D.; Hibbard, K.; Costa, D.; Cox, P.; Van Der Leeuw, S. Analysis, Integration and Modeling of the Earth System (AIMES): Advancing the post-disciplinary understanding of coupled human–environment dynamics in the Anthropocene. *Anthropocene* **2015**, *12*, 99–106. [CrossRef]
33. Tengö, M.; Brondizio, E.S.; Elmqvist, T.; Malmer, P.; Spierenburg, M. Connecting Diverse Knowledge Systems for Enhanced Ecosystem Governance: The Multiple Evidence Base Approach. *AMBIO* **2014**, *43*, 579–591. [CrossRef]
34. Reyers, B.; Nel, J.L.; O'Farrell, P.J.; Sitas, N.; Nel, D.C. Navigating complexity through knowledge coproduction: Mainstreaming ecosystem services into disaster risk reduction. *Proc. Natl. Acad. Sci. USA* **2015**, *112*, 7362–7368. [CrossRef]
35. Kowarsch, M.; Garard, J.; Riousset, P.; Lenzi, D.; Dorsch, M.J.; Knopf, B.; Harrs, J.-A.; Edenhofer, O. Scientific assessments to facilitate deliberative policy learning. *Palgrave Commun.* **2016**, *2*, 16092. [CrossRef]
36. Nauen, C.E.; Hillbrand, U. Underpinning Conflict Prevention by International Cooperation. In *Handbook of International Negotiation*; Springer International Publishing: Cham, Switzerland, 2015; pp. 157–172.
37. Jacquet, J.; Pauly, D. Funding Priorities: Big Barriers to Small-Scale Fisheries. *Conserv. Biol.* **2008**, *22*, 832–835. [CrossRef] [PubMed]
38. Pauly, D.; Zeller, D. Catch reconstructions reveal that global marine fisheries catches are higher than reported and declining. *Nat. Commun.* **2016**, *7*, 10244. [CrossRef] [PubMed]
39. FAO. *World Fisheries and Aquaculture 2018—Meeting the Sustainable Development Goals*; FAO: Rome, Italy, 2018.
40. Jentoft, S.; Chuenpagdee, R.; Barragán-Paladines, M.J.; Franz, N. *The Small-Scale Fisheries Guidelines*; Jentoft, S., Chuenpagdee, R., Barragán-Paladines, M.J., Franz, N., Eds.; Springer International Publishing: Cham, Switzerland, 2017; Volume 14.
41. Agnew, D.J.; Pearce, J.; Pramod, G.; Peatman, T.; Watson, R.; Beddington, J.R.; Pitcher, T.J. Estimating the Worldwide Extent of Illegal Fishing. *PLoS ONE* **2009**, *4*, e4570. [CrossRef] [PubMed]

42. Pramod, G.; Nakamura, K.; Pitcher, T.J.; Delagran, L. Estimates of illegal and unreported fish in seafood imports to the USA. *Mar. Policy* **2014**, *48*, 102–113. [CrossRef]
43. Telesetsky, A. Laundering Fish in the Global Undercurrents: Illegal, Unreported, and Unregulated Fishing and Transnational Organized Crime. *Ecol. Law Q.* **2015**, *41*, 939–997.
44. Pramod, G.; Pitcher, T.J.; Mantha, G. Estimates of illegal and unreported seafood imports to Japan. *Mar. Policy* **2017**, *84*, 42–51. [CrossRef]
45. Ewell, C.; Cullis-Suzuki, S.; Ediger, M.; Hocevar, J.; Miller, D.; Jacquet, J. Potential ecological and social benefits of a moratorium on transshipment on the high seas. *Mar. Policy* **2017**, *81*, 293–300. [CrossRef]
46. Jentoft, S.; Chuenpagdee, R. Fisheries and coastal governance as a wicked problem. *Mar. Policy* **2009**, *33*, 553–560. [CrossRef]
47. FAO. *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication*; FAO: Rome, Italy, 2015; Available online: http://www.fao.org/docrep/field/003/ab825f/AB825F00.htm#TOC (accessed on 15 August 2018).
48. Bohle, M. One Realm: Thinking Geoethically and Guiding Small-Scale Fisheries? *Eur. J. Dev. Res.* **2018**, 1–39. [CrossRef]
49. Sall, A. Interview with Ms Khady Sarr at the Artisanal Port of Hann. 2013. Available online: https://www.mundusmaris.org/index.php/en/projects/beetween/2013-khadysarr-en (accessed on 15 August 2018).
50. Lenselink, N.M. Participation in Artisanal Fisheries Management for Improved Livelihoods in West Africa. A Synthesis of Interviews and Cases from Mauritania, Senegal, Guinea and Ghana. 2002. Available online: http://www.fao.org/docrep/005/y4281e/y4281e02.htm (accessed on 15 August 2018).
51. Belhabib, D.; Sall, A.; Nauen, C.E. Fishing for Accountability and Performance: The Political Ecology of a Fisheries Aid Project in Senegal. *Mar. Policy*, submitted.
52. Sall, A.; Nauen, C.E. *Supporting the Small-Scale Fisheries Guidelines Implementation in Senegal: Alternatives to Top-Down Research*; Springer: Cham, Switzerland, 2017; pp. 609–634.
53. Sall, A.; Nauen, C.E. A Small-scale Fisheries Academy to promote co-production of knowledge in the face of globalised markets. In Proceedings of the Development Research Conference, Gothenburg, Sweden, 22–23 August 2018.
54. Campbell, L.M.; Gray, N.J.; Fairbanks, L.; Silver, J.J.; Gruby, R.L.; Dubik, B.A.; Basurto, X. Global Oceans Governance: New and Emerging Issues. *Annu. Rev. Environ. Resour.* **2016**, *41*, 517–543. [CrossRef]
55. Miller, K.A.; Thompson, K.F.; Johnston, P.; Santillo, D. An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps. *Front. Mar. Sci.* **2018**, *4*. [CrossRef]
56. Shukla, A.; Karki, H. Application of robotics in offshore oil and gas industry—A review Part II. *Robot. Auton. Syst.* **2016**, *75*, 508–524. [CrossRef]
57. Shukla, A.; Karki, H. Application of robotics in onshore oil and gas industry—A review Part I. *Robot. Auton. Syst.* **2016**, *75*, 490–507. [CrossRef]
58. Becker, H.J.; Grupe, B.; Oebius, H.U.; Liu, F. The behaviour of deep-sea sediments under the impact of nodule mining processes. *Deep Sea Res. Part II Top. Stud. Oceanogr.* **2001**, *48*, 3609–3627. [CrossRef]
59. Aleynik, D.; Inall, M.E.; Dale, A.; Vink, A. Impact of remotely generated eddies on plume dispersion at abyssal mining sites in the Pacific. *Sci. Rep.* **2017**, *7*, 16959. [CrossRef] [PubMed]
60. Hauton, C.; Brown, A.; Thatje, S.; Mestre, N.C.; Bebianno, M.J.; Martins, I.; Christiansen, S.; Bettencourt, R.; Canals, M.; Sanchez-Vidal, A.; et al. Identifying Toxic Impacts of Metals Potentially Released during Deep-Sea Mining—A Synthesis of the Challenges to Quantifying Risk. *Front. Mar. Sci.* **2017**, *4*, 1–13. [CrossRef]
61. Teague, J.; Allen, M.J.; Scott, T.B. The potential of low-cost ROV for use in deep-sea mineral, ore prospecting and monitoring. *Ocean Eng.* **2018**, *147*, 333–339. [CrossRef]
62. Richardson, J.W.; Greene, C.R., Jr.; Malme, C.I.; Thomson, D. *Marine Mammals and Noise*; Academic Press Ltd.: London, UK, 1995.
63. Durden, J.M.; Jones, D.O.B.; Murphy, K.; Jaeckel, A.; Van Dover, C.L.; Gjerde, K.; Ortega, A.; Jones, D.O.B. A procedural framework for robust environmental management of deep-sea mining projects using a conceptual model. *Mar. Policy* **2017**, *84*, 193–201. [CrossRef]
64. Durden, J.M.; Lallier, L.E.; Murphy, K.; Jaeckel, A.; Gjerde, K.; Jones, D.O.B. Environmental Impact Assessment process for deep-sea mining in 'the Area'. *Mar. Policy* **2018**, *87*, 194–202. [CrossRef]
65. Van Dover, C.L.; Ardron, J.A.; Escobar, E.; Gianni, M.; Gjerde, K.M.; Jaeckel, A.; Jones, D.O.B.; Levin, L.A.; Niner, H.J.; Pendleton, L.; et al. Biodiversity loss from deep-sea mining. *Nat. Geosci.* **2017**, *10*, 464–465. [CrossRef]

66. Nurmi, P.A. Green Mining—A Holistic Concept for Sustainable and Acceptable Mineral Production. *Ann. Geophys.* **2017**, *60*. [CrossRef]
67. Boutilier, R.G. Frequently asked questions about the social licence to operate. *Impact Assess. Proj. Apprais.* **2014**, *32*, 263–272. [CrossRef]
68. Moffat, K.; Zhang, A. The paths to social licence to operate: An integrative model explaining community acceptance of mining. *Resour. Policy* **2014**, *39*, 61–70. [CrossRef]
69. Parsons, M.; Nalau, J.; Fisher, K. Alternative Perspectives on Sustainability: Indigenous Knowledge and Methodologies. *Chall. Sustain.* **2017**, *5*, 7. [CrossRef]
70. Hall, N.; Lacey, J.; Carr-Cornish, S.; Dowd, A.-M. Social licence to operate: Understanding how a concept has been translated into practice in energy industries. *J. Clean. Prod.* **2015**, *86*, 301–310. [CrossRef]
71. Buhmann, K. Public Regulators and CSR: The 'Social Licence to Operate' in Recent United Nations Instruments on Business and Human Rights and the Juridification of CSR. *J. Bus. Ethics* **2016**, *136*, 699–714. [CrossRef]
72. Falck, W.E. Social licencing in mining—Between ethical dilemmas and economic risk management. *Miner. Econ.* **2016**, *29*, 97–104. [CrossRef]
73. Cullen-Knox, C.; Haward, M.; Jabour, J.; Ogier, E.; Tracey, S.R. The social licence to operate and its role in marine governance: Insights from Australia. *Mar. Policy* **2017**, *79*, 70–77. [CrossRef]
74. Dare, M.; Schirmer, J.; Vanclay, F. Community engagement and social licence to operate. *Impact Assess. Proj. Apprais.* **2014**, *32*, 188–197. [CrossRef]
75. Baines, J.; Edwards, P. The role of relationships in achieving and maintaining a social licence in the New Zealand aquaculture sector. *Aquaculture* **2018**, *485*, 140–146. [CrossRef]
76. Boon, J. Corporate Social Responsibility, Relationships and the Course of Events in Mineral Exploration—An Exploratory Study. Ph.D. Thesis, Carleton University, Ottawa, ON, Canada, 2015.
77. Lundström, N.; Mäenpää, A. Wicked game of smart specialisation: A player's handbook. *Eur. Plan. Stud.* **2017**, *25*, 1357–1374. [CrossRef]
78. Axelrod, R. *The Evolution of Cooperation*; Basic Books: Cambridge, MA, USA, 1984.
79. Berkes, F. From Community-Based Resource Management to Complex Systems: The Scale Issue and Marine Commons. *Ecol. Soc.* **2006**, *11*, art45. [CrossRef]
80. Cullis-Suzuki, S.; Pauly, D. Failing the high seas: A global evaluation of regional fisheries management organisations. *Mar. Policy* **2010**, *34*, 1036–1042. [CrossRef]
81. Kroodsma, D.A.; Mayorga, J.; Hochberg, T.; Miller, N.A.; Boerder, K.; Ferretti, F.; Wilson, A.; Bergman, B.; White, T.; Block, B.; et al. Tracking the global footprint of fisheries. *Science* **2018**, *359*, 904–908. [CrossRef] [PubMed]
82. Smithonian. Tracking Fishing Vessels Reveals Industry's Toll on the Ocean. Available online: https://www.smithsonianmag.com/smart-news/tracking-fishing-vessels-reveals-industrys-toll-ocean-180968250 (accessed on 15 August 2018).
83. Soyer, B.; Leloudas, G.; Miller, D. Tackling IUU Fishing: Developing a Holistic Legal Response. *Transnatl. Envrion. Law* **2018**, *7*, 139–163. [CrossRef]
84. Jaeckel, A. Deep seabed mining and adaptive management: The procedural challenges for the International Seabed Authority. *Mar. Policy* **2016**, *70*, 205–211. [CrossRef]
85. Jaeckel, A.; Ardron, J.A.; Gjerde, K.M. Sharing benefits of the common heritage of mankind? Is the deep seabed mining regime ready? *Mar. Policy* **2016**, *70*, 198–204. [CrossRef]
86. Boon, J. ISBA Draft Exploitation Regulation—IAPG Comments. Available online: https://www.isa.org.jm/files/documents/EN/Regs/2017/Ind/IAPGComments.pdf (accessed on 15 August 2018).
87. Kelly, R.; Pecl, G.T.; Fleming, A. Social licence in the marine sector: A review of understanding and application. *Mar. Policy* **2017**, *81*, 21–28. [CrossRef]
88. Filer, C.; Gabriel, J. How could Nautilus Minerals get a social licence to operate the world's first deep sea mine? *Mar. Policy* **2018**, 1–7. [CrossRef]
89. Sumaila, U.R.; Lam, V.W.Y.; Miller, D.D.; Teh, L.; Watson, R.A.; Zeller, D.; Cheung, W.W.L.; Côté, I.M.; Rogers, A.D.; Roberts, C.; et al. Winners and losers in a world where the high seas is closed to fishing. *Sci. Rep.* **2015**, *5*, 8481. [CrossRef]
90. Heffernan, O. How to save the high seas. *Nature* **2018**, *557*, 153–157. [CrossRef] [PubMed]

91. Van Doorn, E. Environmental aspects of the Mining code: Preserving humankind's common heritage while opening Pardo's box? *Mar. Policy* **2016**, *70*, 192–197. [CrossRef]
92. United Nations Economic and Social Council. Progress towards the Sustainable Development Goals Report of the Secretary General (Vol. E/2016). Available online: https://unstats.un.org/sdgs/files/report/2016/secretary-general-sdg-report-2016--EN.pdf (accessed on 15 August 2018).
93. Duarte, C.M. Global change and the future ocean: A grand challenge for marine sciences. *Front. Mar. Sci.* **2014**, *1*. [CrossRef]
94. Innes, J.E.; Booher, D.E. Collaborative rationality as a strategy for working with wicked problems. *Landsc. Urban Plan.* **2016**, *154*, 8–10. [CrossRef]
95. Jentoft, S. Walking the talk: Implementing the international voluntary guidelines for securing sustainable small-scale fisheries. *Marit. Stud.* **2014**, *13*, 16. [CrossRef]
96. Hughes, D.J.; Shimmield, T.M.; Black, K.D.; Howe, J.A. Ecological impacts of large-scale disposal of mining waste in the deep sea. *Sci. Rep.* **2015**, *5*, 9985. [CrossRef]
97. Peppoloni, S.; Di Capua, G. *Geoethics, the Role and Responsibility of Geoscientists*; Peppoloni, S., Di Capua, G., Eds.; Geological Society, London, Special Publications (Lyell Coll, Vol. 419); Geological Society of London: London, UK, 2015.
98. Auster, P.J.; Fujita, R.; Kellert, S.R.; Avise, J.; Campagna, C.; Cuker, B.; Dayton, P.; Heneman, B.; Kenchington, R.; Stone, G. Developing an Ocean Ethic: Science, Utility, Aesthetics, Self-Interest, and Different Ways of Knowing. *Conserv. Biol.* **2009**, *23*, 233–235. [CrossRef] [PubMed]
99. Jax, K.; Barton, D.N.; Chan, K.M.A.; de Groot, R.; Doyle, U.; Eser, U.; Görg, C.; Gómez-Baggethun, E.; Griewald, Y.; Haber, W.; et al. Ecosystem services and ethics. *Ecol. Econ.* **2013**, *93*, 260–268. [CrossRef]
100. Ott, K. Institutionalizing Strong Sustainability: A Rawlsian Perspective. *Sustainability* **2014**, *6*, 894–912. [CrossRef]
101. Violante, R.A.; Bozzano, G.; Rovere, E.I. The Marine Environment: Hazards, Resources and the Application of Geoethics Principles. *Ann. Geophys.* **2018**, *60*, 1–10. [CrossRef]
102. Peppoloni, S.; Di Capua, G. Geoethics: Ethical, social and cultural implications in geosciences. *Ann. Geophys.* **2017**, *60*, 1–8. [CrossRef]
103. Guntrip, E. The Common Heritage of Mankind: An Adequate Regime for Managing the Deep Seabed? *Melb. J. Int. Law* **2003**, *4*, 376–405.
104. Finnis, J.; Natural Law Theories. Stanford Encyclopedia of Philosophy Archive 2016. Available online: https://plato.stanford.edu/archives/win2016/entries/natural-law-theories (accessed on 15 October 2017).
105. Heinzelmann, N.; Ugazio, G.; Tobler, P.N. Practical Implications of Empirically Studying Moral Decision-Making. *Front. Neurosci.* **2012**, *6*. [CrossRef] [PubMed]
106. Kohlberg, L. *Essays in Moral Development and the Idea of Justice*; Harber & Row: San Francisco, CA, USA, 1981.
107. Murray, F.B.; Hufnagel, P.; Gruber, H.E.; Vonèche, J.; Voneche, J. The Essential Piaget. *Educ. Res.* **1979**, *8*, 20–21. [CrossRef]
108. Carpendale, J.I.M. Kohlberg and Piaget on Stages and Moral Reasoning. *Dev. Rev.* **2000**, *20*, 181–205. [CrossRef]
109. Gibbs, J.C.; Basinger, K.S.; Grime, R.L.; Snarey, J.R. Moral judgment development across cultures: Revisiting Kohlberg's universality claims. *Dev. Rev.* **2007**, *27*, 443–500. [CrossRef]
110. Marone, E.; Marone, L. UNCLOS framework of Ocean Governance: Ethical Dimensions. In *The Future of Ocean Governance and Capacity Development Essays in Honor of Elisabeth Mann Borgese (1918–2002)*; International Ocean Institute: Halifax, NS, Canada, 2018; pp. 34–39.
111. Mayer, P. *Bankbook Bodies: The Billion Dollar Business with Organ Trade—The Development of International Legal Measures and the Effectiveness in Curtailing the Black Market*; Saar BluePrints: Saarbrücken, Germany, 2016.
112. Vidas, D. The Anthropocene and the international law of the sea. *Philos. Trans. R. Soc. A Math. Phys. Eng. Sci.* **2011**, *369*, 909–925. [CrossRef] [PubMed]
113. Arroyo, K.K. Creative Policymaking: Taking the Lessons of Creative Placemaking to Scale. *Artivate J. Arts Innov. Entrep.* **2017**, *6*, 58–72.