



Synthesis

Environmental governance theories: a review and application to coastal systems

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ABSTRACT. This article synthesizes and compares environmental governance theories. For each theory we outline its main tenets, claims, origin, and supporting literature. We then group the theories into focused versus combinatory frameworks for comparison. The analysis resonates with many types of ecosystems; however, to make it more tangible, we focus on coastal systems. First, we characterize coastal governance challenges and then later link salient research questions arising from these challenges to the theories that may be useful in answering them. Our discussion emphasizes the usefulness of having a diverse theoretical toolbox, and we argue that if governance analysts are more broadly informed about the theories available, they may more easily engage in open-minded interdisciplinary collaboration. The eight theories examined are the following: polycentricity, network governance, multilevel governance, collective action, governmentality (power / knowledge), adaptive governance, interactive governance theory (IGT), and evolutionary governance theory (EGT). Polycentricity and network governance both help examine the links or connections in governance processes. Polycentricity emphasizes structural configurations at a broader level, and network governance highlights agency and information flow within and between individuals or organizations. Collective action theory is helpful for examining community level governance, and helps analyze variables hindering or enabling self-organization and shared resource outcomes. In contrast, multilevel governance helps understand governance integration processes between localities, regions, and states across administrative, policy, or legal dimensions. Governmentality is helpful for understanding the role of discourse, power, knowledge, and narratives in governance, such as who creates them and who becomes governed by them with what effect. Adaptive governance helps analyze the links between context, change, and resilience. IGT helps examine the interdependencies between the systems being governed and the governing systems. EGT is helpful for unpacking how coevolutionary processes shape governance and the options for change.

Key Words: *collaborative governance; comanagement; land-sea; marine; natural resource governance; natural resource management; transdisciplinarity; watershed; wetland*

INTRODUCTION

Environmental and natural resource governance scholarship dates back to the 1950s (Davidson and Frickel 2004). Such scholarship has generally aimed to understand how different governance processes or policies influence desired outcomes such as preservation, conservation, livelihoods, and sustainable use or development. However, environmental governance scholarship lacks cohesion and relational orientation. Many concepts (Davidson and Frickel 2004), governance theories (Ansell and Torfing 2016, Cox et al. 2016), and frameworks (Binder et al. 2013, Pulver et al. 2018, Nunan 2019) exist, but in practice their proponents struggle to satisfactorily explain or predict the occurrence of undesirable outcomes.

However, there are also many examples of governance success as analyzed by focused theories, providing some with robust empirical support. More recently, there has been a rise in more combinatory analytical theories and frameworks, reflecting scholarship on social-ecological systems (Cox et al. 2016, Partelow 2018, Colding and Barthel 2019), but also assuming

multiple ways of knowing, combining, and building on foundational theory (Bennett and Satterfield 2018). Much of the combinatory analyses in environmental governance are linked to concepts that bridge scholarship between the social and natural sciences, while adding a complex systems-thinking approach and a normative orientation. This is evident in concepts such as resilience, ecosystem services, social-ecological systems, and sustainability. Although the bridging of theories is usually taken as a positive trend, a critical reflection thereof is rare, leading to uncertainty in both theoretical and practical governance understandings. A synthetic overview and analysis that identifies core claims and abilities of various environmental governance theories, therefore, remains a substantial gap for orienting the diverse contributions of each.

We aim to address this gap with a concise appraisal of the environmental and natural resource governance literature. Our theory selection and analysis rely in part on an expert author consortium, and we aim to provide an audit of where this literature stands and which directions point forward. Although

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Fig. 1. Diverse coastal systems and uses. (A) A large wetland and river on the coast of The Gambia. (B) A coastal beach populated by tourists in Turkey. (C) Large port development for tourism in the Caribbean. (D) Port development for industry and trade in Japan. (E) Wetland pond aquaculture system in an Indonesian mangrove forest with water supplied by tidal flows. (F) Small-scale fishing boats off the coast of Peru. (G) A Senegalese fishing village. (H) Offshore wind energy in the United States. Photos A, B, C, D, H received from <https://unsplash.com/>. Photos E, F, G taken by the authors.



environmental governance is a diverse body of scholarship, the theories reviewed are applicable across sectors and thematic areas. To focus our synthesis empirically, and to provide a coherent set of examples to relationally orient each theory, we concentrate on coastal systems as a representative field with limited integration of governance activities and perspectives across a diversity of stakeholders, sectors, and land-sea interactions, while also being among the most impacted and exploited natural resource systems worldwide (Olsen 2003, Lebel 2012, Van Assche et al. 2020a). The coastal context outlined below provides us with a set of empirical examples with which to compare the analytical capabilities and applicability of each theory. However, the theories summarized are not limited to coastal application. We believe this article can be useful for any environmental governance scholar navigating the literature and seeking a synthetic overview with questions about the analytical usefulness of each theory and the relationships between theories.

Governance of the coast

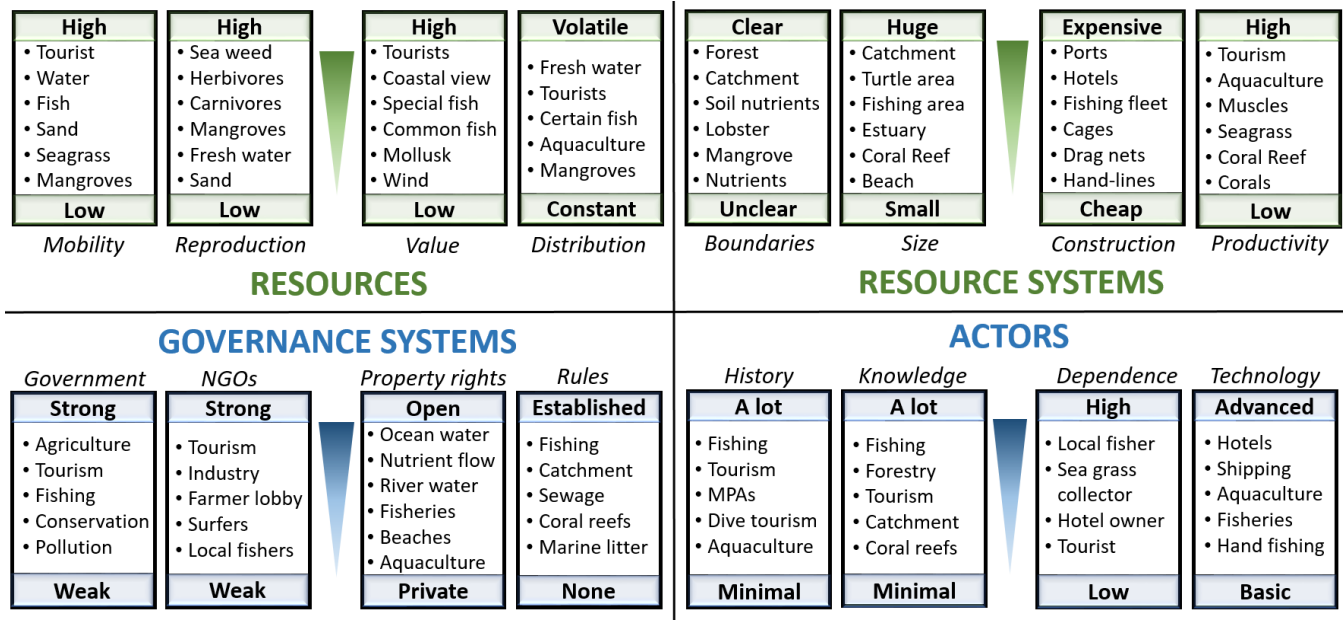
The world's coastal zones represent some of the most diverse and productive ecological and social systems (United Nations 2016, UNESCO-IOC 2017). This raises challenges for analyzing and implementing coastal governance at various societal levels and scales (Glaser and Glaeser 2014). Coasts share characteristics of both land and sea systems; they make up dynamic interfaces combining features of both land- and seascapes (Fig. 1). However, coasts have dynamic and transboundary materiality, as well as high social, economic, and institutional diversity (Lebel 2012, Steinberg 2013, Schlüter et al. 2019). Multiple actors representing diverse interests and sectors engage with the coastal zone (e.g., tourism, shipping, offshore energy, residential development, recreation, conservation, resource extraction), thereby characterizing it as an overlapping and contested multiuse space. However, much of the focus on coastal zones for governing purposes is concentrated on the land-sea interface extending only a few kilometers inland and offshore, if not directly on the shore itself (Pittman and Armitage 2016, Van Assche et al. 2020a). A major

challenge is that land and sea have also been historically regulated separately (Pittman and Armitage 2016, Schlüter et al. 2019), or they have been governed according to terrestrial models, which may be ill-suited to the fluidity and overlapping uses represented in coastal zones (Steinberg 2013).

Coasts now feature as priority research areas in national and global agendas, including economic development espoused by the UN 2030 Agenda (United Nations 2010, Visbeck 2018) and the UN Decade of Ocean Science for Sustainable Development (<https://www.oceandecade.org/>). Sustainable Development Goal (SDG) 14 showcases “Life Below Water” along with recognition that the sea has interdependencies with the achievement and implementation of nearly all other SDGs (Le Blanc et al. 2017, Ntona and Morgera 2018), many of which are interfaced through the coast. The Global Ocean Science Report (UNESCO-IOC 2017) outlines the integral role marine and coastal spaces play in global development, highlighting that over 3 billion people depend on marine and coastal biodiversity for their livelihood, and marine and coastal resources comprise 5% of global Gross Domestic Product (GDP). “Blue growth” agendas advanced by the European Commission and the United Nations Food and Agriculture Organization (FAO), as well as the World Bank (World Bank 2020) complement the ambitions of a “blue economy” or a marine oriented “bioeconomy” (Spalding 2016). These are advancing research, policy, development, and funding discourses worldwide. In fact, more than half of the world's population lives within 60 km of the sea, and three-quarters of all large cities are located there (UNEP 2020).

Coastal governance literature has largely drawn on conventional natural resource governance theories and their application to specific coastal contexts, nations, or regions (Gelcich et al. 2010, Fletcher et al. 2014, Freire-Gibb et al. 2014, Vince 2014), or on specific sectoral fields like fisheries (Jentoft and Chuenpagdee 2009, Bavinck et al. 2013), shipping (Seebens et al. 2013), small-islands (Glaser et al. 2018), offshore energy (Wright 2015), mining

Fig. 2. Characterizing the unique diversity of coastal systems. Modified from Schlüter et al. (2019). Based on the social-ecological systems framework (McGinnis and Ostrom 2014). The figure conceptualizes the unique spectrum of variables on the coast, and the potential challenges for developing institutions to govern them, including coastal resources, resource systems, actors, and governance systems. Although this heuristic conceptualization is reductionistic, and skewed toward the worldview of scholars linked to the social-ecological systems framework, we believe it is nonetheless valuable as a brainstorming exercise to consider the broad spectrum of contexts that environmental governance theories attempt to explain and are applied within.



(Wedding et al. 2015), watersheds (Kroon and Brodie 2009, Álvarez-Romero et al. 2015), or marine conservation (Jentoft et al. 2007, Gruby and Basurto 2014). Additional work has focused on conceptualizing the challenges and complexities of coasts (Olsen 2003, Rochette et al. 2015, Campbell et al. 2016, Schlüter et al. 2019) or reviewing the contextual literature (Pittman and Armitage 2016), without providing a specific governance approach.

On the other hand, there is a large amount of literature focused on policy or management approaches. Topics include marine spatial planning (MSP; Portman et al. 2012, Vince 2014, van Tatenhove 2017), integrated coastal zone management (ICZM; Sekhar 2005, McKenna et al. 2008, Gallagher 2010, Hagan and Ballinger 2010, Portman et al. 2012), and approaches not specific to the coast such as ecosystem-based management, adaptation, and comanagement. We argue that these are not foundational theories, but synthetic applications that have been simplified into policy strategies.

Although policy discourses usually recognize coasts as singular spatially bound places and/or spaces, academic literature now suggests that a more diversified and plural reality exists across locations and for different people (Neumann et al. 2015). Taking coastal governance seriously should include moving beyond the notion of the “coast” as a singularly definable entity (Fig. 2). Instead, coastal areas can in part be understood by the heterogeneity of human connections and interpretations: as hubs of international trade, sites of regional governance and political influence, ecological hotspots, as well as centers for both urban

and rural socioeconomic development. Figure 2 helps highlight the diversity of social-ecological characteristics that may be present in different coastal localities. Although the perspectives presented in Figure 2 only represent a limited view, we believe it is nonetheless useful for portraying the complexity of coastal systems that governance scholarship as evolved is attempting to address, and within which our current analytical tools are currently being applied.

Although much of scholarly literature and coastal governance practice draws on a body of natural resource governance theories, a synthetic overview and analysis that identifies their core claims and abilities for analyzing coastal systems is still lacking. In this article we aim to address this gap by attempting an overview of different theories, their main claims, origin, and core literature. In the discussion we compare focused theories versus more combinatory theoretical frameworks. We argue that each theory is a valuable analytical tool with unique strengths, and that environmental governance analysts should be familiar with how to use the various elements of this toolbox in constructive ways.

METHODS

Identifying theories to include in this study was done in two ways: first, through deliberation among coauthors and participants of the Land-Sea Interactions working group within the European Cooperation for Science and Technology (COST) Ocean Governance Network (<https://www.oceangov.eu/>; SP, ASc, NV, LS, ML, A-KH, MB). Initial working group discussions took place in June 2018 during the Third International Symposium on Ocean Governance for Sustainability in Aveiro, Portugal. The

Table 1. Overview of theoretical literature on natural resource governance.

Theory	Foundational literature	General synthesis literature	Notable coastal empirical literature	Core concepts
Polycentricity	(Polanyi 1951, Ostrom 1972)	(Ostrom 2010, Aligica and Tarko 2012, Carlisle and Gruby 2019)	(Gelcich 2014, Gruby and Basurto 2014, van Leeuwen 2015, Abe et al. 2016, Carlisle and Gruby 2018)	Decentralization Multiple centers of decision making
Network governance	(Whetten and Rogers 1982, Kaufmann et al. 1986, Rhodes 1988)	(Jones et al. 1997, Thatcher 1998, Duit and Galaz 2008, Robins et al. 2011, Klijn and Koppenjan 2012)	(Green et al. 2011, Duval-Diop et al. 2014, Pittman and Armitage 2017, 2019)	Actors and rules Actor connectivity Interdependencies Problem frames Interactions and relationships
Collective action theory	(Olson 1965, Ostrom 1990, 2007, 2009)	(Ostrom 1998, Cox et al. 2010, Poteete et al. 2010, Gyau et al. 2014, Holahan and Lubell 2016)	(Basurto et al. 2013, 2016, Afroz et al. 2016, Partelow et al. 2018a, Chavez Carrillo et al. 2019)	Institutions and institutional change Bounded rationality Commons theory (shared resource) Social-ecological systems
Governmentality/ environmentality	(Foucault 1980, Burchell et al. 1991, Agrawal 2005a, b)	(Burchell et al. 1991, Scott 1998, Darier 1998, Luke 1998, Rose et al. 2006, Malette 2009, Bevir 2010, Fletcher 2010, 2017)	(Hanson 2007, Song 2015, Albert and Vasilache 2018, Satizábal 2018)	Power/knowledge Discourse theory Government as social technology Government at a distance
Multilevel governance theory	(Marks 1993)	(Stephenson 2013)	(Anh et al. 2011, Basurto 2013a, b, Gruby and Basurto 2014, Van Tatenhove 2015, Ringbom and Joas 2018)	Vertical integration Social organization Public administration
Interactive governance theory	(Kooiman 1993, 2003, 2008, Kooiman et al. 2005, 2008)	(Jentoft 2007, Kooiman et al. 2008, Song et al. 2018)	(Bavinck et al. 2005, Kooiman et al. 2005, Chuenpagdee 2011, Defeo and Castilla 2012)	Governability Modes of governance Orders of governance Elements of governance Governing interactions
Adaptive governance	(Gunderson 1999, Dietz et al. 2003, Folke et al. 2005)	(Rijke et al. 2012, Chaffin et al. 2014, Koontz et al. 2015, Chaffin and Gunderson 2016, Cox and Schoon 2019)	(Gunderson and Light 2006, Ashlin 2011, Meek et al. 2011, Österblom and Folke 2013, Tuda et al. 2019)	Adaptation Resilience thinking Panarchy Social-ecological systems
Evolutionary governance theory	(Van Assche et al. 2014, Beunen et al. 2015)	---	(Schlüter et al. 2019, 2020b, Partelow and Nelson 2020, Van Assche et al. 2020a)	Institutional economics Social systems theory Path dependency Evolutionary biology Discourse theory Multilevel governance

discussions focused on: what are the challenges, options, and the role of science in ocean governance? Our group identified one core challenge being that no specific coastal governance theories exist, and that most environmental governance theories have evolved through empirical support on terrestrial systems. Our discussions evolved into a research question: what environmental governance theories have been foundational and influential for coastal scholars? Our goal was to identify and review the core theories, and over the period of the conference we developed an initial list of theories.

Following the conference, confirmation of our initial list of theories was done through a literature search in the academic database SCOPUS using the search string (“natural resource*” AND “governance”), and sorting by “Review” documents. This resulted in 277 documents; each title and abstract was assessed by the lead author for additional theories. A second search string (“natural resource*” AND “governance” AND “theory”) was then used, resulting 325 documents to inform our final list. We acknowledge that this review is not fully exhaustive or inclusive; there are certainly more theories and frameworks with varying degrees of links to natural resource governance scholarship (see Ansell and Torfing 2016, Cox et al. 2016, Nunan 2019). Part of

our inclusion criteria was also diversity, to show a spectrum of theories available with different perspectives and disciplinary origins. Our aim was to provide an accessible summary of some of the core theories that have been foundational in environmental governance scholarship, as well as to highlight more recent developments. To do this, we wanted to ensure that we had an expert in each theory and its application. We brought together additional coauthors, each whom is specialized in one or multiple theories and their application to coastal governance (DA, JP, RG, KC, ASo, KVA).

With our analysis we attempt to highlight the unique value of each theory, but also to compare them in a way that shows the value and unique perspective each takes. In doing so, we provide a qualitative and interpretative synthesis of selected foundational literature, as well as any synthesis literature and notable case studies applying each theory to coastal systems. The order of theories is chronological and based on the year in which a foundational theory emerged. A synthesis is provided (Table 1) referencing the literature as well as the core concepts, variables, or processes integral to each. These were interpretively assessed based on both the foundational and synthesis literature available, each provided by the expert coauthors, and then reviewed by all

authors because many of the authors are familiar with multiple theories presented.

We attempted to undertake this process inductively, and then compare what core concepts were present in each theory. In the end we decided to not have a core set of criteria to analyze each theory because it would be too restrictive, but rather to analyze the strength of each theory separately. The formal comparison was limited to their emergence over time and focused versus combinatory orientation, as we explain below. We also recognize that the “Core concepts” column in Table 1 is not a comprehensive depiction of each theory, but nonetheless provides useful references for basic comparison.

SYNTHESIS OF GOVERNANCE THEORIES AND THEIR APPLICABILITY

Polycentricity

Polycentric governance was introduced by Vincent Ostrom (Ostrom et al. 1961) to describe metropolitan-area governance characterized by multiple, overlapping political units or decision-making centers. These centers in a polycentric system operate with a degree of autonomy but also take one another into account through processes of cooperation, competition, conflict, and conflict resolution that can lead to self-organizing tendencies if general rules provide appropriate incentives and constraints (Ostrom and Ostrom 1991, Aligica and Tarko 2012). Empirical research on polycentricity in metropolitan governance challenged the then prevailing view in the political and economic sciences favoring “monocentric,” i.e., centralized, political order, by revealing the potential for polycentric systems to operate as efficiently as centralized arrangements when they function as a system (Ostrom and Parks 1999). In the field of natural resource systems, polycentric governance emerged in the 1990s through the groundbreaking research of Elinor Ostrom, who found that robust institutions governing common-pool resources tend to be “organized in multiple layers of nested enterprises” (Ostrom 1990:101), a characteristic of polycentric systems. Recognizing that most natural resource systems cross political boundaries, and that few governance systems are purely centralized or decentralized in practice, environmental governance scholars have increasingly turned to the concept of polycentricity (Heikkila et al. 2018). One reason polycentricity is compelling is that its theoretical development has drawn partly from living systems theory. In this regard, polycentric governance systems have been characterized as complex adaptive systems (Andersson and Ostrom 2008) with emergent, self-organizing properties. With their diverse array of decision-making centers with different (and ideally complementary) capacities, polycentric governance systems may be capable of continually evolving and reconfiguring as necessary or desirable (Carlisle and Gruby 2019). Accordingly, scholars have attributed different advantages to polycentricity, mostly within three broad categories: (i) enhanced capacity to adapt to change; (ii) mitigation of risks associated with the failure of any single governance actor or policy because of redundant governance actors and policies; and (iii) the production of institutions that are a good “fit” to ecological and social context (Carlisle and Gruby 2019). An important research frontier is distinguishing among different types of polycentric governance systems and the characteristics associated with their advantages and pathologies in diverse contexts (Carlisle and Gruby 2018, Morrison et al. 2019).

Although the concept of polycentric governance has not been specifically adapted or tailored for coastal systems, a growing number of coastal and marine governance studies have employed the concept, including scholarship on marine protected areas (Gruby and Basurto 2014, Morrison 2017); large marine ecosystems (Abe et al. 2016, Chen and Ganapin 2016); small-scale fisheries (Gelcich 2014, Carlisle and Gruby 2018); marine shipping (van Leeuwen 2015); and climate change, ocean acidification, and marine biodiversity (Galaz et al. 2012) and the role of power (Morrison et al. 2019). The usefulness of the concept in such studies stems, in part, from the scale and complexity of coastal systems, which tend to span multiple jurisdictions, e.g., watersheds, include mobile and transboundary resources, e.g., migratory fish, and encompass many users and decision-making centers with diverse and often competing goals. Understanding and informing governance of such complex systems requires a theoretical framework that embraces complexity and redundancy and enables the analyst to search for order in apparent chaos. Herein lies the overarching power of polycentricity for coastal systems. In a more specific sense, the theory holds utility for both descriptive and diagnostic (problem driven) forms of analysis.

Descriptively, polycentricity helps analysts identify constituent elements of complex coastal governance systems as they exist in practice. Theory directs analysts to ask: who/what/where are the decision-making centers, and what are their roles in governance? Such centers are not only formal bodies; rather, they can be any organization or individual making and enforcing rules with some autonomy, including informal organizations such as resource user groups (McGinnis 2011, Carlisle and Gruby 2019). Rather than focusing solely on rules-in-form and actors with formal authority, polycentricity requires considering rules-in-use, the role of nongovernment/nonstate actors, and their interactions at all levels of political and social organization. The role of power, defined by Morrison and colleagues (2019) as the uneven capacity of actors in a polycentric system to influence goals, processes, and governance outcomes, is another important and underexamined aspect of polycentric governance systems that may explain why certain systems perform better than others, despite structural similarities (Morrison et al. 2019). This helps develop a more complete picture of relevant actors, institutions, interactions, and processes influencing governance.

Although in early stages of development, theoretical work on polycentric governance could be applied diagnostically to identify deficiencies in a coastal governance system. For example, Carlisle and Gruby (2018) devised a theoretical model of a functional polycentric governance system to diagnose governance deficiencies implicated in the decline of a small-scale coastal fishery in Palau. Using the model as the “ideal type,” empirical attributes and enabling conditions were identified as present or absent in the case. Combined with a deeply contextualized historical analysis, they explained limited governance functionality and identified advantageous characteristics for enhancement. As theory improves, this method can inform applied research and institutional design.

Network governance

Network approaches have been examined in the literature since the 1970s (Whetten and Rogers 1982, Kaufmann et al. 1986, Rhodes 1988, Thatcher 1998, Klijn and Koppenjan 2012). Klijn and Koppenjan (2012) suggest three historical research traditions

linked to the development of network governance theory, including policy networks, service delivery and implementation, and managing networks. Additionally, network analysis is often used as a methodological tool to analyze governance networks. As summarized by Thatcher (1998), and synthesized by others (Jones et al. 1997, Duit and Galaz 2008, Robins et al. 2011), core tenets of network governance theory emerged as a counter to the monopolistic view of centralized states as the entities doing all the governing, toward a view of many actors interacting in decentralized and pluralistic ways through coordinated networks (Bodin 2017). These include or may exist as formal or informal structures, or within social hierarchies, and provide alternative means of governing outside of states and markets. Furthermore, network governance theory also reflects ideas of how information is diffused, as well as how social learning and cultural exchange takes place. Much of the empirical analysis has taken place between either state and nonstate actors, actors tasked with implementation or diffusion of information or policies, as well as coordination problems between actor groups or organization (Klijn and Koppenjan 2012). A central tenet of network governance theory is that the characteristics or properties of governance networks will influence the outcomes from governance processes. However, it is not only the quantity of connections that matter, but also the types of connections, the structure of the network, and how important those connections are between the actors involved. Some governance systems have been analyzed as overnetworked or having “governance without government” (Pierre and Peters 2005:40), which some may view as undesirable.

More recently, network governance has focused on environmental management (Newig et al. 2010, Green et al. 2011, Robins et al. 2011, Duval-Diop et al. 2014, Pittman and Armitage 2017, 2019). As Newig et al. (2010) point out, network governance has become useful for its “potential to integrate and make available different sources of knowledge and competences and to foster individual and collective learning” for managing shared natural resources. Furthermore, in the coastal context, Pittman and Armitage (2019) argue that, in theory, improved collaboration via networks in governance increases “flexibility in the face of change and promotes inclusiveness and legitimacy” (p. 62). Ultimately, networks that link actors across scales are primarily a reflection of the social relational features and arrangements that influence governance outcomes (e.g., Bodin and Crona 2009). In this regard, Alexander et al. (2016) identify three useful “waypoints” that can help researchers and practitioners explore networks in a systematic manner, including (1) reflecting on the specific ways in which governance actors are embedded in a broader constellation of stakeholders, rights holders, and decision makers; (2) examining the diverse values and interests of governance actors and the implications for governance outcomes; and (3) reflecting on the specific structure and process dynamics of social relational networks given the implications for decision making.

Collective action theory

Collective action theory was introduced by Olson (1965), and then later popularized by Elinor Ostrom in *Governing the Commons* (Ostrom 1990) as a theory to explain why many communities using natural resources do not always experience overexploitation, i.e., for common-pool resources, or underprovisioning, i.e., for public goods, a so-called tragedy of the commons (Hardin 1968).

Building on *Governing the Commons*, an entire school studying the commons has emerged (Ostrom 1998, 2007, 2009, Cox et al. 2010, Poteete et al. 2010; <https://iasc-commons.org/>). The theory hypothesizes a positive relationship between groups that are able to take effective collective action and the resulting social and environmental outcomes. The theory aims to understand how and why people cooperate through self-organization processes (i.e., a collective action) and what social (e.g., leadership; group size; knowledge; social capital; dependence) and ecological variables (e.g., resource mobility; system size; growth and replacement rates) influence self-organization (Ostrom 2007, 2009).

The variables identified as influencing collective action are generally those compiled in Ostrom’s social-ecological systems framework (Ostrom 2009, McGinnis and Ostrom 2014, Partelow 2018). Ultimately, the theory aims to explain why self-organized collective action can lead to more desired social and ecological outcomes, e.g., sustained provision or use, in some cases, and in others not. Ostrom’s work on the framework has evolved into a commons and collective action take on what is now much broader social-ecological systems discourse. Collective action theory, focusing on community-based solutions in resource governance, is often juxtaposed as a third understanding, or governance perspective on, how to resolve resource appropriation and provision dilemmas through governance, which has historically been viewed as a problem of aligning individual and group interests. It is an alternative to other popularized approaches, such as privatization or top-down state enforcement to solve the same problems. Collective action theory has also been used to understand the self-organization of social movements and activism related to many issues including those related to the environment (Lubell 2002).

Collective action theory is useful for assessing the status of governance by identifying what variables may be enabling or hindering self-organization processes. More than 30 variables have been identified to be critical for collective action to occur (Agrawal 2001). All those factors have been largely discussed in the literature, and Cox et al. (2010) provide a good summary for each variable with other synthesis literature looking at practical applications (Gyau et al. 2014). Relating to coastal systems, collective action theory is most prominently applied to small-scale fishers and the management of inshore resources (Lozano and Heinen 2016, Chavez Carrillo et al. 2019). However, it is also used to understand other collective action problems in the marine realm such as certification (Foley and McCay 2014), freshwater resources (Afroz et al. 2016), aquaculture (Partelow et al. 2018b), protected areas (Gruby and Basurto 2014), and coral reef degradation (Schlüter et al. 2020a).

Governmentality / environmentality

The term governmentality was formulated by Michel Foucault in the late 1970s and early 1980s (Burchell et al. 1991). Governmentality refers to the “conduct of conduct” (Bevir 2010) and “captures the way governments and other actors draw on knowledge to make policies that regulate and create subjectivities” (Bevir 2010:423). Foucault was particularly interested in the practices and technologies employed by modern, liberally organized and territorially defined states for regulating, disciplining, and thus governing social reality. Governmentality suggests an inseparable and iterative relationship between a

governing body and those being governed that is co-shaped by technologies of enforcement in relation to objects of shared interest, such as security or economy. Through the employment of power, knowledge, and discourse, subjectivities are created in which the subjects themselves are indeed willing to be governed. Environmentality combines Foucault's concept of biopower with the concept of governmentality, spotlighting social interaction with the natural world as the object of shared interest. In other words, power, discourse, and knowledge are tools of government that iteratively co-shape the willingness of subjects (the self) to be governed in how they use, think about, and/or interact with the environment. Imaginaries of and discourses surrounding the natural environment, e.g., nature is beautiful; nature is being destroyed; nature is endless, in combination with power/knowledge, e.g., the role knowledge plays in structuring hierarchies between interpersonal relationships and within society, shape one's willingness to act in a governed way toward the environment. These "technologies," e.g., discourse or power/knowledge, shape and are being shaped by the governed, and at the same time governing the subject. Environmentality as a concept has been advanced by scholars, such as Agrawal (2005a) through a comparative analysis of community-based forest management in Northern India, and Scott (1998) focusing on the political economy of Tanzania's agriculture. Further literature has focused on coastal issues (Hanson 2007, Song 2015, Satizábal 2018).

Albert and Vasilache (2018) use governmentality outside the context of modern nation states, instead assessing how a largely uninhabited, oceanic, and formerly ungovernable border zone in the Arctic was made governable. Three processes are regarded as decisive: (1) the framing of the Arctic in international media and policy fora as a regional and governable space (as opposed to international, ungovernable, and wild); (2) the normalization and securitization of the Arctic through systematic multidisciplinary knowledge production on all facets of this particular space, now predictable and ordered; and (3) the unleashing of its economic potential by including it into a highly internationalized liberal political economy.

The case above demonstrates the usefulness of governmentality in studying coastal governance, becoming governable when they (1) move, in public and government attention, from marginal nonplaces to the center of political, economic, and thus governance attention; (2) are ordered, securitized, and normalized through the employment of systematically collected expertise on the coastal zone as a space in itself, not the margin of another space; and (3) as new profit frontiers become part of the political economy (considered worth its own key word in government statistics). This heuristic places focus on power contestations, e.g., who influences those processes, and who is influenced by them, on who are the potential winners and losers, and, in a first instance, privileges the state as governing entity. It nevertheless invites the opposite question about assessing the governmentality of marginal coasts, of little state interest or attention. Who governs there, through the employment of which discourses, knowledge, and securitizing technologies?

Multilevel governance (MLG) theory

While multilevel perspectives go further back (van den Eeden and Hüttner 1982), formal multilevel governance (MLG) theory

emerged from policy debates and the restructuring of the European Union under the Maastricht Treaty in 1992 (Marks 1993), to examine the vertical integration of national and international politics. Stephenson (2013) provides an overview of MLG, its main uses, and applied research. In natural resource scholarship, MLG has expanded the range of levels that are interconnected through governance, often examining the relationship between communities, regions, national and international policies. Because formal natural resource management policies are often formulated at the regional or national level, much of the scholarship drawing on MLG has focused on how higher level policies trickle down to be implemented in practice at the local level. MLG hypothesizes that the better the vertical integration between the multiple levels of governance, the more effective it will be, with the assumption that top-down driven governance can work well if effectively integrated across levels. Thus, MLG emphasizes that there are multiple levels where governance plays out, recognizing that there are often states who oversee natural resource management policy from the top-down, regional, or municipal authorities tasked with implementation, but also local communities who face the reality of policies and who may have self-organizational capacity for governance. MLG aims to provide a theoretical framework that recognizes the vertical integration of the different organizational levels of governance.

MLG is useful for questions of how public administration of environmental policies involve multiple actors at different social organization levels, and how those configurations can be vertically integrated or create challenges from a lack of integration, e.g., communication or implementation. Research questions that seek to understand the views, perceptions, goals, and/or motivations at different policy levels may find MLG useful, as well as examining the difficulties with top-down government strategies or why local governance is mismatched with regional, national, or international policies and goals. The implementation of the FAO Small-Scale Fisheries Guidelines is a useful example of how international frameworks for governance are viewed, interpreted, and implemented (or not) in countries and local fisheries around the world (Jentoft et al. 2017, Sabau 2017, Chavez Carrillo et al. 2019, Song et al. 2019a). Similarly, many national level natural resource management strategies such as Extractive Reserves (RESEX) in Brazil (Santos and Brannstrom 2015, Partelow et al. 2018a), Responsible Fishing Areas in Costa Rica (Lozano and Heinen 2016, Chavez Carrillo et al. 2019), or aquaculture policies in Vietnam (Anh et al. 2011), exhibit heterogeneous implementation processes and outcomes at the local level despite higher level standardization. MLG can assist in analyzing why this occurs, because of vertical integration challenges within administrative, legal, and political processes across levels.

MLG is useful for identifying where governance challenges might be occurring within and/or between social organizational levels. Van Hoof et al. (2012) demonstrate how MLG can be used to unpack the state-centered marine policy approach of the European Union, as attempting to integrate decision and policy making across subnational and national levels. These authors suggest that the regional level should be the focus level for EU policy development, highlighting the need for tailoring marine policies through regionally structured cooperation in the EU (i.e., Baltic Sea vs Mediterranean Sea should involve different subnational actors and approaches), but that many of the decisions are still

made at the member state level, creating challenges for the regionalization of the Commons Fisheries Policy and the Marine Strategy Framework Directive to adapt to the regional context. Challenges with science-policy integration in the EU Commons Fisheries Policy have been similarly explored by Wilson (2009).

Interactive governance theory (IGT)

Kooiman (2016) provides a conceptual overview of interactive governance theory (IGT), along with the associated concept of governability, building on previous work (Kooiman 1993, 2003, 2008)^[1]. Interactive governance is defined as “the aggregate of governing activities carried out by societal actors in response to public needs and visions” (Kooiman 2016:29). It takes place not through single, do-it-alone efforts, but via interactions between multiple actors in different societal realms (state, market, and civil society). Governability provides “a conceptual basis for assessing and improving the interactive governance of natural resource systems” (Kooiman et al. 2008:2). It consists of two dimensions, the capacity for governance, and the quality of governance (Chuenpagdee and Jentoft 2015). The former is instrumental in focus, while the latter adds a normative dimension, asking whether governance lives up to certain standards or principles.

Governability suggests a balance between needs of the specific societal system being governed (SG) and the capacity of the governing system (GS) plus the totality of governing interactions (GI) to deliver those needs. IGT proposes a model to analyze this dynamic in terms of elements, modes, orders, and interactions, assuming that features of any societal system, namely its diversity, complexity, and dynamics, are generally on the increase. Elements include images (mental pictures guiding processes), instruments (available means for governing interactions), and actions (willpower available for governing interactions). Modes of governance include self- (e.g., actors take care of themselves), co- (e.g., societal parties join hands with a common purpose), and hierarchical (e.g., top-down) styles of intervention. Orders are divided into first-order (where people and organizations interact), second-order (institutional arrangements), or meta-order (feeds, binds, and evaluates governance). Interactions are of three types: interferences (open and spontaneous in nature), interplays (semiformalized and “horizontal” in nature), and interventions (“vertical” and formalized in nature).

IGT has been extensively applied in coastal fisheries and aquaculture systems, most notably in the books *Fish for Life* (Kooiman et al. 2005), *Governability of Fisheries and Aquaculture* (Bavinck et al. 2013), *Interactive Governance for Small-Scale Fisheries* (Jentoft and Chuenpagdee 2015) and its practical guide (Bavinck et al. 2005), among others (Defeo and Castilla 2012). Chuenpagdee et al. (2008) broadened the perspective to coastal zones, arguing that coastal zones are normally characterized by high natural and social diversity, complexity, and dynamics. The authors conclude that the governability thereof is normally moderate to very low: “An integrated, holistic, systematic and transparent approach to coastal zone management is difficult to attain” (Chuenpagdee et al. 2008:15), due to different interests and objectives, and difficulties developing a shared way forward. Coasts possess their own constellation of problems and opportunities; there are no panaceas. In line with adaptive governance thinking, “learning” is an important feature of governance in the current age, as is a return to the principles underlying all governance activity.

A unique feature of IGT is first identifying the unique characteristics and challenges of the system to be governed, i.e., the problems and opportunities it presents, and then assessing the social organizational factors of governance. The notion of “fit” is essential: does the governing system and the set of governing interactions correlate with the needs of the system to be governed, or do they obstruct appropriate action? Do actions, instruments, and images of governing match with one another and provide a coherent whole?

While fit and functionality are important, conflict and power are not ignored. Kooiman (2016:45) argues that “there are no interactive governance or issues of governability without attention for power differentials and sources of conflict.” Similarly, Jentoft and Chuenpagdee (2015:739) emphasize that “from a governability perspective, both the restrictive and enabling functions of power must be investigated.” Politics are believed to be a crucial dimension of governance, as it is “basically in political arenas and public spheres where the ‘destinies’ of social fields ... are decided” (Kooiman 2016:45). Here, societal concerns such as ecosystem health, social justice, employment, and food security are translated into governing objectives.

Jentoft and Chuenpagdee (2013) proposed a governability assessment framework. It consists of four steps, first defining a specific problem and its “wickedness” (Rittel and Webber 1974), and then diagnosing the system being governed, the governing system, and the set of interactions. Deliberately holistic in scope, it reduces complexity by pointing out where to look (targets), what to look for (features), and what to look at (measures). The result is a matrix containing all information necessary for a comprehensive governability assessment.

Adaptive governance

Adaptive governance theory emerged in the late 1990s (Gunderson 1999), but was popularized by the book *Panarchy* (Gunderson and Holling 2002), in the context of commons by Dietz et al. (2003), and later in social-ecological systems (Folke et al. 2005). Chaffin et al. (2014) provide a detailed history and overview of adaptive governance scholarship, which has continued into the present (Cvitanovic et al. 2015, Schultz et al. 2015, Chaffin and Gunderson 2016). Adaptive governance has been referred to as a vehicle for putting resilience theory into practice (Garmestani and Benson 2013) with the aim to reduce uncertainty through iterative and continual learning. Theoretically, adaptive governance hypothesizes that the more adaptive a governance system is to social-ecological system functioning and change, the more resilient that governance system is, making it more likely to achieve normative goals, e.g., sustainability.

Adaptive governance is premised on understanding how formal institutions, informal networks, and individuals at multiple scales are linked for resilient collaborative environmental management (Gunderson and Holling 2002). Folke et al. (2005:444) note “that adaptive governance is operationalized through adaptive co-management systems and that the roles of social capital, focusing on networks, leadership, and trust, are emphasized in this context.” In this regard, the literature on adaptive comanagement (Olsson et al. 2004, Armitage et al. 2009) draws attention to the learning (experiential and experimental) and collaboration (vertical and horizontal or networks) required to generate better outcomes in the context of complex social-ecological systems. As

with most broad or combinatory governance theories, however, there is no clearly fixed definition of adaptive governance. All attempts to define or describe it emphasize the interdependencies in changes that occur between social and ecological systems, while also recognizing their complexity. This includes conceptualizing environmental and natural resource systems as linked social-ecological systems (Berkes et al. 2003).

There are many useful features of adaptive governance relevant for coastal change and complexity. These features emphasize the importance of collaboration among diverse actors and interests, as well as institutions that are flexible and nested. The adaptive dimension of governance also draws attention to the importance of the deliberative processes that are required to build understanding based on multiple knowledge systems, encourage trust through repeated interactions, and finally, to encourage social (or collective) learning processes and continuous feedback (Dietz et al. 2003, Folke et al. 2005, Armitage and Plummer 2010). Adaptive governance is particularly oriented toward studying the capacity of a governance system to adapt to new (ecological and social) system conditions, given those changes that may stem from climate change, overfishing, or other issues that make coastal systems dynamic. As such, in coastal systems, adaptive governance has been applied to diverse empirical settings, including disaster management (Adger et al. 2005), marine transboundary governance (Tuda et al. 2019), the response to changes in fisheries or fisheries management (Cinner et al. 2011), and coping in response to climate change (Hughes et al. 2007).

Evolutionary governance theory (EGT)

Evolutionary governance theory (EGT), introduced by van Assche et al. (2014) and Beunen et al. (2015), understands governance as a process of constant evolution. Stability is presented as illusory, as surface features consistently hide underlying change, while radical transitions, as *ab ovo* institutional design, are considered impossible, because transformation requires a starting point. Evolution for EGT is always coevolution, emphasizing configurations of actors and institutions, power and knowledge, and institutional formal and informal rules. Each configuration can only be understood through its previous state, its linkage, and its coevolution with other elements. Following Foucault, the evolution of power relations in governance can only be understood by grasping the coevolution with forms of knowledge, including expert knowledge, but also narratives, concepts, images, and local or traditional knowledge. Similarly, the evolution of institutions (laws, policies, and plans as formal institutions, plus informal institutions) can only be understood through the coevolution with actors (individuals, groups, organizations). The configurations themselves coevolve, bringing every element of governance potentially in contact with every other. Potentially is a key word because the always unique development paths of a governance configuration, a path shaped by strategy, coevolution, and contingency, creates certain elements and couplings between them, not others.

A primary contribution of EGT is the evolutionary perspective, bringing a temporal dimension to the understanding of governance. EGT presents a new conceptual architecture to governance analysis and borrows elements from existing theories: social systems theory, institutional economics, poststructuralism,

evolutionary biology, and of course previous governance theories, cognizant of path dependence, coevolution, and issues of institutional capacity. Prior system states influence future states through a wide variety of mechanisms, ranging from patterns of elements and their interactions to modes of interpretation and transformation. Strategy is not rendered irrelevant yet takes on the character of both narrative and institution (Van Assche et al. 2020b).

Its roots in social systems theory and poststructuralism entail a more socially constructed reality, where sets of knowledge, ideas, and narratives act as a social technology creating power hierarchies and thus governing the reality of how society is organized. Institutions, especially complex ones such as plans, are shaped by knowledge, rely on knowledge for impact, and compete with other types of knowledge for prime position in the definition of problems, solutions, and methods both inside and outside the configurations of governance. One could also understand EGT's main contribution as the mapping of a new middle ground between *laissez faire*, *laissez passer* approaches, and on the other hand beliefs in social engineering: path creation is possible, strategy is possible, comprehensive policies are not a pipe dream, yet what can be achieved will differ per governance path, and hinge on the context it operates in. EGT is not normative, and presents governance as always multilevel, polycentric, and always producing patterns of inclusion and exclusion.

EGT has been applied in different contexts: rural development (e.g., Van Assche and Hornidge 2015), shoreland development (Radomski and Van Assche 2015), natural resource management (Van Assche et al. 2017), coastal governance (Partelow and Nelson 2020, Schlüter et al. 2020b), and others (special issues in *Marine Policy*, *Land Use Policy*, and *Journal of Environmental Policy & Planning*). This step-wise development of EGT placed its understanding of governance in social-ecological systems, becoming more sensitive to the material context of a governance path. In current coastal governance, material dependencies, effects of material environments, create unobserved interdependencies, which require unique forms of observation and dedicated coastal governance arenas (Van Assche et al. 2020a). For EGT, both layering and gaps mark coastal governance.

DISCUSSION

Building a toolbox for governance analysis

Environmental governance theories provide diverse lenses attempting to explain social-ecological realities, whether on the coast or in other systems. Generally, theories are useful if they help us explain what we observe, and there are often multiple if not many useful explanations for observed phenomena. More specifically, we can use each theory to help answer different research questions, but no single theory is or will be sufficiently comprehensive. We believe healthy and constructive scholarship has multiple theories coinciding, supporting, and/or contrasting themselves in a field. Nonetheless, some important questions can be reflected on by governance scholars: how have these theories been useful in establishing current environmental governance thinking, in research, teaching, and practice? Do the starting values motivating the initial theory as well as its current use-value differ between theories? Do we want more or less theory or theoretical framework development? These questions are not

about the degree to which each theory is correct or not in explaining observations; instead, we are interested in how and why they have evolved and shaped intellectual thinking and environmental governance practice.

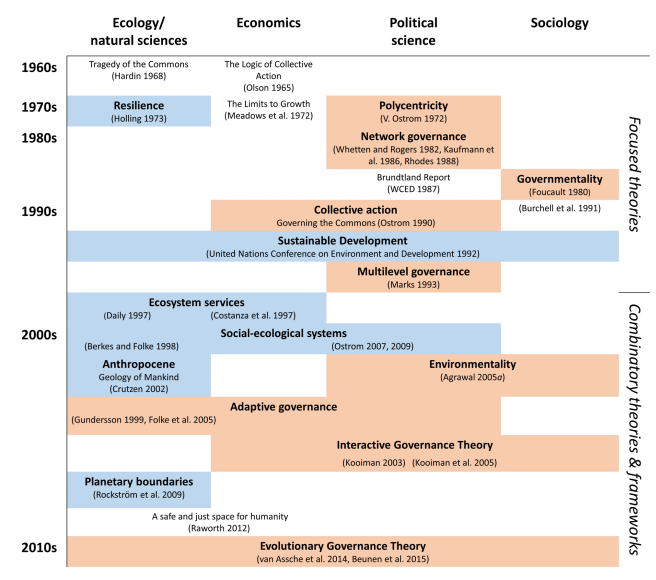
We argue that there is significant value in viewing governance problems from different perspectives, whether conceptual or theoretical. Similarly, theories link to methodological discussions and diversity, i.e., how can we measure particular attributes of a system in different ways? Each theory suggests (perhaps implicitly) a focal unit of analysis. This may relate to a particular focus on certain levels within a scale, e.g., spatial, temporal, and administrative (Cash et al. 2006, Glaser and Glaeser 2014), its epistemological perspective, i.e., positivistic or constructivist, its focus on agency versus system structures, processes versus outcomes, or its disciplinary orientation. Having a diverse theoretical toolbox to examine governance processes and challenges, we argue, is essential to foster a diverse multi and interdisciplinary field needed to build a more complete understanding of environmental governance through multiple ways of knowing. This, we argue, can enable environmental governance to strengthen as a field of scholarship, but also assist individual analysts and practitioners in selecting appropriate theoretical tools or approaches for the research or policy questions at hand to improve governance.

We have recognized through considerable deliberation that it is difficult to formally compare diverse theories based on their claims or constituent components. Nonetheless we have attempted to portray the generic evolution of the theories over time and by field or discipline (Fig. 3). Figure 3 provides a very basic conceptualization of environmental governance thinking since the 1960s based on our simplistic heuristic understanding. We highlight the different schools of thought as well as some key concepts and literature that have been influential. In doing so, we have categorized the theories into two groups for further comparison: (1) focused theories and (2) combinatory theories and frameworks. Although this categorization is somewhat arbitrary, it shows the temporal evolution of environmental governance scholarship, and is a simple way to broadly group them for further comparison below. This highlights a trend toward, we believe, collaborative knowledge production, systems thinking, and interdisciplinarity. For example, an interesting effort is underway to bridge governmentality and IGT via a revamped notion of governability (see Song et al. 2018). It is important to state again that this analysis is not a value judgement of particularly theories, but rather an attempt to assess the field's progression and status of our current toolbox.

We recognize that this analysis is not fully exhaustive or inclusive of all theories, concepts, and influential literature (i.e., Fig. 3). However, we hope to encourage scholars to continue thinking in similar ways about the field's history, status, and trajectory, while encouraging governance analysts to expand their own toolboxes. We also believe it is important for the field, especially for early career scholars and students, to understand this history and diversity so they can make their own interpretations and begin constructively building on the past and exploring new paths forward for environmental governance through constructive encouragement, reflexivity, collaboration, and creativity. Continuing below, we discuss the specific strengths of each theory,

as either focused or combinatory. For example, earlier governance theories often focus on single issues with core theoretical hypotheses, like collective action or polycentric governance. More recent approaches are more combinatory, aiming to better understand the holistic complex picture. We have used the context of coastal systems to do this, providing empirical examples where each theory can be shown as applicable and analytically useful. We divide the theories into those that have a genuine theoretical core (focused hypotheses), as focused theories to be compared, and those that are a combination.

Fig. 3. Simplified heuristic conceptualization of the disciplinary origins of environmental governance theories (orange) and related concepts (blue) since the 1960s. Selected influential literature references are also shown.



Focused theories

Out of the eight theories examined here, some can be characterized as specific in their focus but with more empirical support and literature behind them (Table 2). Polycentricity or network governance, for example, both examine the links or connections in governance processes. However, polycentricity emphasizes structural configurations of the governance system at a broader level, and network governance highlights agency and the flow of information within and between individuals or organizations. Both theories have literature integrating with multilevel perspectives, although formalization of multilevel governance theory followed later historically. Research questions where polycentricity theory is useful might include identifying where decisions are made for governance and by whom, and how the connections between these decision-making centers fit the context or shape outcomes. Network governance would be useful in examining questions related to information or resource flows between actors, and how the structure of actor networks influences governance processes and outcomes. Additionally, network governance is often used to examine patterns of coordination and collaboration within governance systems, which again highlights some similarities with the theory of polycentricity.

Table 2. Focused theories. Their brief analytical strength and when they could be applied to coastal systems and beyond.

Theory	Analytical strength	Applicable questions for coastal systems
Polycentricity	Linkages and decentralization of decision-making processes. Emphasizes structural configurations of the governance system at a broader level.	Where, and by whom, are decisions made influencing the coast? Are connections between decision-making centers fit to the context of coastal land-sea interactions with their diverse actors and uses?
Network governance	Connections in governance processes between involved actors. Highlights connectivity structures with emphasis on agency and the flow of information within and between actors.	How does information flow between many diverse actors and use types? How do coastal and terrestrial structures of actor networks influence communication, governance processes, and outcomes?
Collective action theory	Community-based or local level, but also how broader levels have influence locally, i.e., nested governance via rules. Focus on institutional structures and how those shape actors' behavior.	What variables influence whether local actors using shared coastal resources, i.e., common property, are able to cooperate well or not? Why is cooperation not working among diverse coastal actors, often with divergent use types and interests? Why are coastal resources becoming overexploited and quickly privatized?
Governmentality/ Environmentality	Socially constructed nature of governance. Relational dynamics between state governments, governance institutions, and those being governed.	What is the role of power, narratives, and discourse in marine governance agendas such as Blue Growth, the Blue Economy, and the UN Decade for Ocean Science? How are actions and subjectivities of individuals shaped or coerced into being governed or not, particularly when defining new institutional spaces?
Multilevel governance theory	Governance integration processes across administrative, legal, or institutional levels.	How are higher level policies, e.g., international or national, transplanted, transformed, or implemented, either administratively or in practice, into local marine areas? Particularly policies with terrestrial governance origins, or in shared marine regions such as the EU, South China Sea, the Arctic, or West Africa involving multiple states in contested institutionally new areas.

For example, Morrison (2017) presents a 40-year analysis of Great Barrier Reef governance with polycentricity, revealing “how complex environmental regimes become increasingly structurally dense and eventually reach a point of stabilization” (p. E3013), emphasizing how polycentric structural configurations may be viewed as robust and complex, but that “stable structures can mask exogenous change, which then can generate more endogenous change” (p. E3013). Morrison et al. (2019) further brings a power perspective into polycentricity, proposing a framework to examine the role power plays in governance. Similarly, Van Leeuwen (2015) presents a historical analysis of shipping governance in the European Union, showing how “the emergence of regionally based loci of authority does mean that maritime governance is moving towards a more polycentric system” (p. 30). Van Leeuwen (2015) emphasizes the structural configuration of multiple organizations making interdependently influential decisions.

Whereas network governance also examines structure, numerous empirical analyses have highlighted the analytical strength of network governance as focusing on interactor learning, information sharing, communication strategies, and coordination as important (Newig et al. 2010, Pittman and Armitage 2017, Song et al. 2019b). Pittman and Armitage (2019), examining coastal governance processes in the Lesser Antilles, show that “actors and teams can exert significant steering influences over governance systems” (p. 68) and that “shifts in governance are occurring due to the strategies of autonomous actors” (p. 68). Polycentricity and network governance are complementary in their scope, but each contributes unique analytical richness.

Another distinction between theories is their focus within spatial, administrative, or institutional scales. Collective action theory has historically examined community-based or local level governance. Typical research questions for collective action theory would

therefore focus on what variables and sets of rules influence whether local actors using a shared resource, i.e., common property, will cooperate successfully in governance or not. Ostrom’s *Governing the Commons* (1990), demonstrates the local nature of self-organization processes, and the role that individual and group level variables play in shaping cooperative processes driving environmental commons outcomes. Later work, with the social-ecological systems framework (Ostrom 2009, McGinnis and Ostrom 2014) has shown how both social (e.g., leadership, gear type, local knowledge) and ecological variables (e.g., resource reproduction rates, size), at the local level, influence both social and environmental outcomes. Examples in the field of small scale fisheries would be Partelow et al. (2018a) and Chavez Carrillo et al. (2019).

In contrast, multilevel governance theory helps understand governance integration processes across administrative or legal aspects, as demonstrated in the case of Palau’s marine conservation governance (Gruby and Basurto 2014) and EU (van Tatenhove 2015). Research questions for which multilevel governance theory would be useful might focus on how higher level policies, e.g., international or national, are transformed or implemented, either administratively or in practice, in regional or local areas (e.g., Song et al. 2019a). Similarly, Basurto (2013a) shows how multilevel governance theory is useful for unpacking national, regional, and local institutions for biodiversity conservation in Costa Rica. Findings indicate that multilevel linkages enhancing local autonomy are different from those that enable long-term stability. Basurto (2013b:582) also demonstrated that “configurations of institutional arrangements at different levels between actors or organizations can complement or conflict with each other.” As noted, multilevel governance is helpful in the case of research questions of integration across social structural configurations, while collective action theory is strong in

analyzing local level agent interactions within and between groups.

In general, the Ostroms had a substantial influence on environmental governance scholarship. They advanced collective action theory, polycentricity, and multilevel governance, and others not examined in this article including common property theory, institutional analysis, and social-ecological systems frameworks. There are certainly many other influential academics in the field we are not mentioning, and perhaps our author group is biased toward Ostrom scholarship given some of our backgrounds. Nonetheless, for those studying or researching environmental governance, their work is a part of its foundation.

The different strengths a theory has can also be differentiated according to its epistemological view on governance. Rooted in sociology, governmentality (along with environmentality) examines the socially constructed nature of governance. Song's (2015) analysis of South Korea's coastal governance near the disputed maritime border between North and South Korea shows the "hierarchical translation of power that facilitates government-at-a-distance" (p. 68). Involving coastal fishing fleets, this happens discursively through government-imposed political narratives influencing fisher behavior in a way that helps to secure the coast against North Korea's intrusion, that is, by "using" fishers as civilian scouts who act to observe irregularities in the sea and report to the authority. Governmentality is thus useful for research questions that relate to power, narratives, and the influences between actors involved that make governance (im) possible. Governmentality has been applied extensively to examine the relationship between state governments and those being governed, e.g., individual actions, such as shown by Song (2015). Compared to the other focused theories, it takes a very different analytical and epistemological perspective that focuses on what shifts in the minds of agents to make them willing subjects. For example, governmentality differs from multilevel governance because it focuses on discursive and power relationships rather than legislative or administrative policy practices where multilevel governance is very useful in the European Union (EU) context, including environmental governance within the EU Common Fisheries Policy (Wilson 2009, van Hoof et al. 2012). Governmentality also differs substantially from collective action theory in how it views human behavior. Governmentality assumes that societal discourses are crucial to understand. Collective action theory is linked to bounded rationality, in that individuals tend to make rational choices based on self-interest, but within a context of incomplete information and institutional coercion toward group goals. Discourses are considered in collective action theory, in relation to mental models, but play a minor role (Denzau and North 1994, Ostrom 2007).

Broader combinatory theories and frameworks

In recent literature, more theories are being developed with a broader scope and capacity for analysis, perhaps given the adoption of systems thinking as an integral starting point, which can be seen as a way to integrate and combine the previously focused theories. In general, a divide between the focused and combinatory theories is a useful comparative frame because it reflects on how research has evolved from trying to understand a particular aspect of a system, e.g., how does collective action

emerge, or on which level should an issue be governed, to a broader set of interacting social-ecological conditions, e.g., what are the drivers in this system, and how does it work as a whole. This shift is often, but not always, associated with normatively oriented concepts such as ecosystem services, social-ecological systems, resilience, and sustainability, e.g., sustainable development or the SDGs (Fig. 3).

If the aim is to gain a more comprehensive understanding of multiple factors influencing environmental governance, it quickly becomes clear that singular theoretical perspectives are not as well suited for the broader picture. Thus, what we refer to as a group of combinatory theories, i.e., broader theoretical frameworks, combining or building on multiple theoretical perspectives, can be identified as attempting a comprehensive and often pluralistic understanding. These have often emerged in tangent with, or become coupled with, the normative concepts mentioned above (Fig. 3). We believe using focused and combinatory as a comparative frame is useful, but that the distinction between focused hypotheses and broader analytical frameworks, at least terminologically, has become blurred.

Interactive governance theory (IGT), adaptive governance (AG), and EGT are combinatory theories (Table 3). Research questions within this sphere tend to broadly focus on how human-environment systems function interdependently, including the observable functionality and change processes of their governance over time and space (Cox and Schoon 2019). The term "complexity," although not often clearly defined, is often utilized in these analyses. For example, applications of adaptive governance have helped to identify elements leading to improved coastal outcomes (social and ecological). Schultz et al. (2015) note that governance processes, in their four cases, include the "negotiation and coordination between multiple ecosystem services and multiple interests across multiple levels and were adaptive, were learning-based, and developed with change" (p. 7373), and "will always involve a continuous learning process, nurturing of trust, reflection of procedures and structures, and developing collaboration toward common goals" (p. 7373). However, the most evident take away associated with adaptive governance is the inherent systems perspective. We can see here that broader theories and frameworks can help us understand the many present and interacting parts, but may struggle to identify detailed understandings of certain system features or facilitate comparison across systems, which shows the need for both focused and broader analyses (in methods, concepts, and theories) to work constructively in tangent.

Overall, IGT is the most problem-focused of the combinatory theories we considered, and it provides an analytical framework with fewer references to the fundamental theories described above. For example, Chuenpagdee (2011) provides examples of an IGT analysis in the realm of coastal conservation, arguing that "approaching governance with a holistic lens, like interactive governance and governability analysis, can help address concerns about sustainability," considering a "balance between ecological integrity and socio-economic viability" (p. 207). She also notes that conservation failures and conflict resulting from "resources decline, how some policies result in further devastation, and how scientific research offers argumentative findings instead of consensus," can be "systematically analyzed using [IGT]" (p.

206-207). The broader system perspective is evident in its link to notions of sustainability.

Table 3. Combinatory theories and theoretical frameworks. Their brief analytical strength and when they could be applied to coastal systems and beyond.

Theory	Analytical strength	Applicable questions for coastal systems
Adaptive governance	Iterative, learning-based, inclusive processes of governance. Recognizes links between ecological and social processes across levels and scales.	How can collaborative governance be established to facilitate sustainable relationships between social and environmental change, to make coastal areas resilient to rising seas, warming waters, increased storms, intensive coastal developments, and population density?
Interactive governance theory	Fit between governing system and system being governed. What conditions make a system more or less governable?	How can rapidly emerging and changing coastal governance institutions better fit their fluid and rapidly changing context? What are the unique coastal conditions that make it more or less difficult to govern?
Evolutionary governance theory	Change over time in governance systems, driven by multiple social and material influences. Discerning context-specific options and limits for intervention and strategy.	How is coastal governance evolving and changing? Why? What are all the different pieces influencing coastal governance? What are the current coastal governance strategies and their limitations?

Similarly, EGT combines various theoretical perspectives to encourage reflection on the complex processes of governance change. EGT is “evolutionary” by adding a strong temporal dimension to governance analysis, while taking a broad analytical view. For example, Schlüter et al. (2020a) use EGT to examine the diversity of coral reef governance challenges. The authors conclude “that EGT provides [its own] toolbox of very diverse and broad theories,” and that marine systems “are a new sphere, where knowledge is relatively scarce and uncertainty is high,” emphasizing “the role of discourse” in governance analysis among its other components. Although EGT adds numerous dimensions to environmental governance analysis, coevolution is the central feature. Coevolutions shape what is there and how it can be changed, e.g., toward more sustainable coastal governance. If unobserved, the limits of policy and planning are difficult to understand.

Directions forward and beyond the coast

We do not include all environmental governance theories or theoretical frameworks here. There are many more that have evolved or have been proposed at various stages of development (e.g., see Ansell and Torfing 2016, Cox et al. 2016, Nunan 2019). We encourage further reflection on what fundamental theories and assumptions are guiding environmental research and the analysis of policy practice, using coastal systems as an exemplary sector. We argue that when analysts know the analytical strengths of different theories, it will help create a toolbox of interdisciplinary analytical capacity within the field that its scholars are familiar with and thus able to better communicate about and work together on. However, a common toolbox is only

helpful if we know the basics of how each theory can be used, and if those basics are generally understood and respected as valuable amongst other scholars. This synthesis aims to help facilitate this goal by synthesizing and highlighting the diverse analytical value of eight commonly used theories applied to the coastal realm. The strength and applicability of each theory will depend, as outlined above, on the particular research question and problem context of interest, whether coastal or beyond.

Understanding and using combinatory theoretical frameworks will require analysts with different skill sets, or more likely, multiple analysts from different conceptual, epistemological, and/or methodological backgrounds. A key conclusion of this article is that each theory has its own strength and value, and that by learning about this analytical diversity more comprehensively as a field, we can provide more constructive and cooperative scholarship. We can also observe that developing combinatory or integrated frameworks is a continuing trend, but that focused theories nonetheless remain crucial as building blocks for continued work. Focused and combinatory approaches have reciprocal and mutually beneficial goals. This suggests that there is a need for collaborative research, not only theoretically but in our methods and conceptual work to build theory, as a well-rounded effort mandates more “-arity” to advance environmental governance analysis. The notion of “-arity” includes multidisciplinary (working in tangent with other disciplines), interdisciplinarity (integrated work with other disciplines), and transdisciplinarity (integrated work with nonacademics; Regeer and Bunders 2009). With a toolbox approach, “-arity” is not only necessary to simply understand the analyses of others, but also to broaden our own analytical capacity. Such progress is already evident within the coastal governance literature (Berkes 2015, Markus et al. 2018, Partelow et al. 2018c), and the broader environmental governance literature (Davidson and Frickel 2004, Campbell 2005, Bennett and Roth 2015, Cox et al. 2016, Bennett and Satterfield 2018, Colding and Barthel 2019). This emerging body of scholarship outlines the evolving nature and benefits of “-arity” and pursuing collaborative scholarship in the environmental governance field.

We have used coastal systems as way to provide tangible context to our synthesis and comparison. However, we do believe the theories and lessons learned are applicable beyond coastal systems to other contexts in environmental governance. The foundational and synthesis literature of each theory is by no means limited to coastal analysis, and many governance challenges facing coastal systems occur elsewhere. Although context is increasingly recognized as an essential feature of environmental governance analysis, the nature of theories and theoretical frameworks is to bring out the core variables, principles, and relationships that may be generalizable. From this perspective we encourage reflection on the use and applicability of these theories beyond the coast, e.g., climate change, forestry, water management, grasslands, and urban areas, to consider which theories have been influential in steering governance thinking in those contexts and subfields, and how the evolution of theories and frameworks has led to the tools being used today.

[1] IGT possesses several slightly different strands, with Kooiman representing a more holistic, conceptual perspective characterized as “governance-as-networks” (Hill and Lynn 2015), or “socio-

political governance” (Osborne 2011). Alternative perspectives are presented by Torfing et al. (2012) and Edelenbos and Meerkerk (2016).

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No data or code was used for this paper.

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