



Polycentricity in practice: Marine governance transitions in Southeast Asia

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ABSTRACT

Environmental governance systems are expanding in size and complexity as they become more integrated and ecosystem-based. In doing so, governance transitions often involve more actors and knowingly or unknowingly alter the autonomy of actors to make decisions, and thereby the ability of the governance system to self-organise. In other words, these governance systems are becoming increasingly polycentric, moving towards an institutional structure that is reported to confer a number of benefits to social-ecological systems. This article adds to a growing body of evidence on polycentric environmental governance in practice. It adds nuance to the normative and apolitical portrayals of governance transitions in general, and transitions towards more polycentric forms of governance in particular. We analyse the relations amongst actors and historical development of four large-scale marine governance systems in Southeast Asia to understand how context, particularly power, shapes the emergence and evolution of polycentric marine governance in practice. Our data indicate that transitions towards increased polycentricity do increase diversity and autonomy of decision-making centres, which can enable more innovation or flexibility to respond to changing circumstances. However, these innovations do not always underpin sustainability and equity. Coordination mechanisms are critical for channelling the power dynamics that emerge among diverse actors towards sustainability. Yet, in these emergent, ad hoc polycentric governance arrangements such mechanisms remained nascent, ineffective, or inactive. The transaction costs involved in coordinating a semi-autonomous polycentric system are seemingly difficult to overcome in low- to middle-income contexts and need investment in resources and accountability mechanisms.

1. Introduction

Polycentric governance systems are characterised by decision-making centres that have some autonomy to act independently whilst interacting with and being influenced by other decision-making centres through processes of connectivity, including cooperation, competition, conflict, and conflict resolution (Carlisle and Gruby, 2018; Ostrom et al., 1961). Semi-autonomy, diversity and connectivity of these systems is

theorised to make environmental governance more adaptive to change, better able to fit the complexity of social-ecological systems and problems, and able to mitigate against the risk of systemic governance failure (Table 1). In reality, polycentric governance systems often emerge unplanned rather than as a result of careful design to achieve these benefits (Polanyi, 1964). Worldwide, purposeful transitions to ecosystem-based, integrated, landscape and environmental planning approaches create overlapping jurisdictions and semi-autonomous decision makers

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Table 1
Benefits and disbenefits of polycentric governance.

Benefits	Critiques and Disbenefits
Better adapt to change because semiautonomous decision-making centres have freedom to innovate and experiment with different ideas and institutions.	Transaction costs incurred through coordination of diverse actors, inefficiencies, and costs of redundancy and experimentation.
Complexity and diversity of institutions, actors and their knowledge better ‘fits’ complex multi-scale dynamics of environmental problems.	Inconsistencies and untested assumptions about diffusion between decision-making centres.
Mitigates the risk of failure because overlapping and redundant institutions and actors enable pursuit of goals even if a single institution or actor fails.	Freeriding by governance actors who perceive others will do work and/or can subvert blame for inaction.
Lessons about successes and failures can be diffused across decision-making centres to improve adaptability and performance.	Difficulties enforcing overarching rules in absence of organised hierarchy and in resource-limited contexts.

Sources: [Andersson and Ostrom \(2008\)](#), [Ostrom \(2010\)](#), [Biggs et al. \(2012\)](#), [Galaz et al. \(2012\)](#), [Bixler \(2014\)](#), [Morrison \(2017\)](#), [Carlisle and Gruby \(2018\)](#) and [Jordan et al. \(2018\)](#)

([Berkes, 2006](#); [Blomquist, 2009](#)). Polycentricity can thus emerge ‘accidentally’, meaning the degree of autonomy and connectivity are not strategically planned to achieve the idealised benefits of polycentric governance, even where the governance transition itself, more broadly speaking, is intentional and expected to deliver benefits for sustainability.

To date, most research has focused on defining governance as either polycentric or not, analysing the structural elements and how they facilitate cooperation, and identifying the advantages of polycentric regimes compared to other types of governance ([Thiel and Moser, 2018](#)). By contrast, we take the view that there can be various degrees of polycentricity on a spectrum, and governance systems can move towards higher or lower levels of polycentricity intentionally or unintentionally (see also [Baltutis and Moore, 2019](#); [Carlisle and Gruby, 2018](#); [Heikkilä et al., 2018](#)). Yet little research has explored how various degrees of polycentric governance emerge and evolve in different contexts, and how this affects the functioning of the governance system. Previous research suggests that the historical and contemporary institutional, socio-economic and environmental context influences the processes and outcomes of governance transitions and, thus, what degree of polycentricity emerges and whether proposed benefits are realised ([Pahl-Wostl and Knieper, 2014](#)). In particular, various types of power relation are ignored or portrayed as an external force in existing polycentric governance literature ([Morrison et al., 2019](#)), yet power imbalances amongst actors and decision-making centres are intrinsic to, and influence the emergence, structure, evolution, performance and outcomes of any governance system ([Tormos-Aponte and García-López, 2018](#)). There is a need to understand how power is mobilised in governance to affect management and effectiveness, and how it is mediated through mechanisms that facilitate connectivity (including coordination and conflict resolution) between decision-making centres in more or less polycentric systems ([Morrison, 2017](#)).

This article contributes to the development of a more nuanced theory of polycentricity that recognises the diversity of polycentric systems and the varied pathways by which they emerge and develop. Specifically, it analyses how different types of power by design (formal authority to make rules, allocate resources and set administrative structures), pragmatic power (informal capacities, e.g. reputation, control of information, trusting relations), and framing power (the capacity to define problems, construct issues and set norms) ([Morrison et al., 2019](#)) are dispersed and mobilised across actors to shape the emergence of various degrees of autonomy and connectivity amongst decision-making

centres. To this end, it presents a meta-analysis of case studies undertaken on deliberate governance transitions in four large-scale marine parks and biosphere reserves in Southeast Asia. The two case-studies of Vietnam and Malaysia reflect transitions from traditionally centralised modes of governance. The two from Indonesia and Philippines show transitions from more decentralised modes of governance. The large spatial size of the parks and reserves means they cover multiple jurisdictions, and working towards their objectives requires cooperation amongst multiple decision-making centres. The benefits of polycentric governance have been discussed for marine protected areas ([Ban et al., 2011](#); [Morrison, 2017](#)) and Large Marine Ecosystems ([Abe et al., 2016](#); [Vousden, 2016](#)), and the disadvantages of polycentricity for governing the seas has been identified recently ([Table 1](#)). This article looks in-depth at the processes by which different degrees of polycentricity emerge and what the implications are for marine governance outcomes in tropical, Global South contexts.

In this article, we first describe the four case studies and the novel methodological approaches used to capture governance dynamics and power relations amongst actors. Second, we present results to show how intended marine governance transitions in these cases resemble ‘accidental’ transitions towards increased polycentricity through changes in autonomy and connectivity of decision-making centres. We then show how differences among the cases are shaped by distributions of different types of power, which is contested, dynamic, and influenced by institutional legacies. We go on to evaluate the structural and practical ways that power is mediated through co-operation in practice. Finally, we discuss the implications of these governance transitions and their increased polycentricity in practice for the outcomes, equity and sustainability of the marine parks and reserves. The research provides critical insights that advance conceptual underpinnings of polycentric governance and policy insights on how potential benefits can be leveraged, challenges addressed, and disbenefits avoided or mitigated.

2. Methodology

2.1. Case studies

The article presents analysis of data collected on three UNESCO Man and Biosphere reserves (referred to as biosphere reserves in this article) and a large-scale marine park. These were the four case studies of GCRF¹ Blue Communities, an international research capacity development programme on marine planning in Southeast Asia, from which this article is an output ([Fig. 1](#)). The reserves/parks are all comparatively large (> 8000 km²) except for Cu Lao Cham-Hoi An (CLC), and geographically span multiple administrative boundaries to require coordination amongst several decision-making centres at multiple levels. They also all contain globally important biodiversity and significant human populations with high dependence on marine ecosystem services. [Table 2](#) summarises the key characteristics of the case studies.

2.2. Methods

To understand polycentric governance systems beyond structural elements defined by formal institutions and actors, which often only have partial influence in reality, methods are needed that reveal informal rules-in-use and interactions amongst decision-making centres, and the degree of autonomy in reality ([Carlisle and Gruby, 2018](#)). There have also been calls for more actor-centred approaches to understand the mechanisms that generate outcomes in polycentric systems ([Heikkilä et al., 2018](#)), and understand the power dynamics, which are often masked in polycentric systems because of their complexity.

The research was carried out by Southeast Asian and UK researchers participating in GCRF Blue Communities. Each in-country case-study

¹ Global Challenges Research Fund



Fig. 1. Map of case study marine reserves and parks. Source: blue-communities.org

Table 2
Characteristics of case study marine reserves and parks.

	CLC biosphere reserve, Vietnam	Palawan biosphere reserve Philippines	TBKS biosphere reserve Indonesia	TMP MPA Sabah, Malaysia
Size (km²)	331	14,650	10,504	8,988
Ecosystems	Coral reef, seagrass bed, intertidal zone, mangrove, estuary, forest	Coral reef, seagrass, mangrove, beach forest	Clusters of small islands, seagrass, mangrove, coral reef	Marine ecosystems, including seagrass beds and coral reef (mangrove outside park boundary)
Population	83,792	1.2 million	137,071	85,000
Religions	Buddhism	Roman Catholicism, Protestantism, Islam, Animism	Predominantly Islam. Other religions include Catholicism, Hinduism and Buddhism	Islam, Christianity, Buddhism, Hinduism, Animism
Ethnicities	Vietnamese	Cuyunon (43 %), Tagalog (21 %), Hiligaynon/Ilonggo (13 %), Palaw'an (8 %), Other (15 %)	Selayar, Bugis, Bajo, Makassar and Flores	Bajau, Suluk, Bajau Ubian, Dusun Bonggi, Balabak, Chinese, Malay, Rungus, Sungai, Benadan, Kagayan, Samah, Kadazan Dusun
% overall poor individuals	0 %	11.2 % poverty incidence	12.5 %	41–54 % (incidence of absolute poverty*)
% no formal education	No data	7	n.d	11
% primary		45	50	28
% secondary		31	20	45
Key coastal marine livelihoods	Tourism and small-scale and commercial fishing	Small-scale and commercial fisheries, aquaculture (seaweed farming), live reef fishing, lobster fry fishery, tourism and pearl farming	Small-scale fisheries and agriculture	Small-scale and commercial fishing, tourism, aquaculture

Notes: *Incidence of poverty in Malaysia is defined as the percentage of households with a gross monthly household income that is less than the predetermined Poverty Line Income.

Sources: Ambrosius, 2010, DOSM (2018), Indonesia MAB Committee (2014), PSA (2015, 2018, 2021), Sabah Parks and WWF-Malaysia (unpublished), Statistics Indonesia (2018) and The People Committee of Quang Nam Province and Vietnam National Commission for UNESCO (2008)

team received training in Participatory Marine Governance Analysis (PMGA), a methods toolkit compiled for the governance research of the programme. Please refer to Fortnam et al. (2022) for a detailed description of the PMGA methodology used in this study. The PMGA process essentially involves desk-based institutional analysis, and a combination of innovation histories and Net-Map methods.

The innovation histories method, developed by Douthwaite and Ashby (2005), is a technique for recording and learning from the development and adoption of past innovations. We adapted the method (similarly to Fortnam, 2020) to record the history of the evolution of the

four case-study marine parks and reserves. The method involved: (1) workshops with stakeholders that participate in marine governance in each of the cases; and (2) semi-structured interviews with stakeholders past and present (Table 3). The participants were purposefully selected by in-country teams of researchers because they had knowledge of, were active in, or were affected by the governance of the marine park/reserves from the local to national level, including local and national government agency and NGO staff, and private-sector and community representatives. Participants cocreated timelines by identifying key events such as critical decisions made; important meetings, actions, and

Table 3
Data collected in the four case studies.

Case	Workshop governance level (location)	Total workshop participants	Key informant interviewees (n)
Cu Lao Cham-Hoi An (CLC) biosphere reserve, Vietnam	City (Hoi An City)	4	8
	Local (Tan Hiep commune)	6	
Palawan marine protected area (MPA), Palawan, Philippines ^a	National and Province (Puerto Princesa City)	16 (divided into two groups)	8
	Municipal (Municipality of Aborlan)	19 (divided into two groups)	
	Municipal (Municipality of TayTay)	10	
	Village	15	
Taka Bonerate Kepulauan Selayar biosphere reserve (TBKS) ^a	National (Jakarta)	13 (divided into two groups)	5
	Province and regency (Selayar)	10 (divided into two groups)	
	Local (Selayar)	8	
Tun Mustapha Park (TMP) ^b	N/A	N/A	39

^a For further details of case study view: [Praptiwi et al. \(2021\)](#) and [Madarcos et al. \(2022\)](#).

^b Because of political, cultural and operational sensitivities, methods were implemented at interviews rather than at workshops.

activities; changes in relationships between, and influence of, actors; lessons learned; problems and challenges; and unexpected events, such as a typhoon event (adapted from Abernethy et al., 2014). Participants then identified and discussed the most important events on the timeline. During semi-structured interviews, events identified at the workshop were discussed in depth by the same participants, allowing them to voice perspectives that they may have felt uncomfortable providing in a public forum. Interviews (Table 3) were also held with stakeholders involved in earlier phases of the history (e.g., retired personnel) and those unable to attend the workshop. Overall reflective questions were also asked about the timeline to investigate emerging themes.

To analyse the complex relationships among governance actors in each park/reserve and power dynamics, we adopted Net-Map, a participatory social network mapping tool that “helps people understand, visualise, discuss, and improve situations in which many actors influence outcomes” (Schiffer, 2007:3). The Net-Map toolbox provides a process for mapping power relationships and understanding the differential influence of actors on a policy domain (Schiffer and Hauck, 2010). Put simply, the same participants of the innovation history at the same or proceeding workshops and interviews recorded all the stakeholders of the respective marine park or reserve on actor cards, drew lines between the actor cards on flipchart paper to represent relationships amongst actors, and created ‘influence towers’ (stacked chips) to represent their perception of the relative influence of each actor. Discussion and reflection were facilitated throughout the process. By capturing the perceived influence of actors within a social network, we revealed power relations and how they affected the ability of actors to enable, shape, and inhibit polycentric governance of the parks/reserves.

Each case study research team adapted the methods for their context, while ensuring data were comparable across case studies. For example, for Tun Mustapha Park, the methods were implemented solely through interviews rather than holding workshops because of perceived sensitivities regarding the discussion of power and past management challenges. Data were collected between October 2018 and July 2019.

The process of data analysis was guided by the PMGA manual (Fortnam et al., 2022), which was informed by the recommended analysis for the respective methods. Immediately after each workshop,

analysis forms (templates provided in the PMGA manual) were completed by facilitators to write up and structure notes and the reflections of the team, and photographs taken of workshop outputs (e.g. innovation history timeline and the drawn Net-Map). Interviews and workshops were digitally recorded and transcribed. The innovation history was written up as a chronological narrative in a (learning) report drawing upon data from innovation history analysis forms and transcripts, and a collated timeline of events compiled (either on paper, in a spreadsheet, or in timeline software) based on the individual timelines drawn at each workshop or interview. The Net-Map and innovation history transcripts and analysis forms were also coded; this involved words and phrases used by the participants being coded (‘in vivo’) and then converted into broader themes through an iterative process of reading and rereading transcripts and refining codes (Strauss, 1987). While the process of coding was consistent, the medium through which coding was undertaken varied across teams, according to the skillsets of the analysis team and availability of qualitative data analysis software (see S1). The influence towers were converted into influence scores according to the number of chips in the tower normalised by the total number of chips. These scores were recorded in analysis forms, along with the qualitative justifications for the scores given by participants. Mean averages (S1) and standard deviations were then calculated to assign an overall influence score for each actor in each case study and ascertain the degree of variability amongst perceptions, respectively. A cross-case workshop was then held for each case research team to present (in written and spoken form) the themes that emerged from their analysis; these themes were then clustered (using post-it notes and room walls) into broad cross-cutting themes, which informed the selection of themes, quotes and paraphrases used in the meta-analysis contained in this article.

3. Results

The Net-Maps and desk reviews for each case characterised the governance structures of the marine reserves and parks, while the innovation histories analysed how these structures had emerged over time, as summarised in [Supplementary Information 2 \(S2\)](#).

3.1. ‘Accidental’ emergence of polycentric governance

Net-Map and innovation history data show that the marine governance systems we studied are evolving over time to become more complex, interconnected, and self-organising (Fig. 2). Our data show the inclusion of new actors across scales, new connections between actors, and changing levels of autonomy and influence of some actors within governance networks. All four marine parks and reserves cover multiple jurisdictions, involving decision-making centres with (often overlapping) authority and autonomy to make decisions, create rules, and implement management. The decision-making centres (nodes in Fig. 2) have spatially defined jurisdictions (e.g. municipal or provincial and national in Philippines and Indonesia) and/or sectoral jurisdictions (e.g. state conservation, fisheries and forestry agencies in Sabah, Malaysia) with spatial implications (e.g. forestry department responsible for coastal-zone mangroves). Other actors in the governance networks (e.g. scientists and some NGOs) do not have decision-making authority but are connected with and influence (to varying degrees) decision-making centres. The emergent governance of the marine biosphere reserves and park also have new mechanisms to connect decision-making centres. For instance, through multi-stakeholder collaborative platforms (e.g. Palawan Council Sustainable Development (PCSD) in Palawan, Philippines, and TMP Steering Committee in Sabah, Malaysia).

Each governance system is transitioning towards increased but variable degrees of polycentricity. Fig. 3 depicts categories of polycentric system according to the variable degree of autonomy and connectivity of decision-making centres. In our analysis, highly polycentric systems have decision-making centres that are highly autonomous and

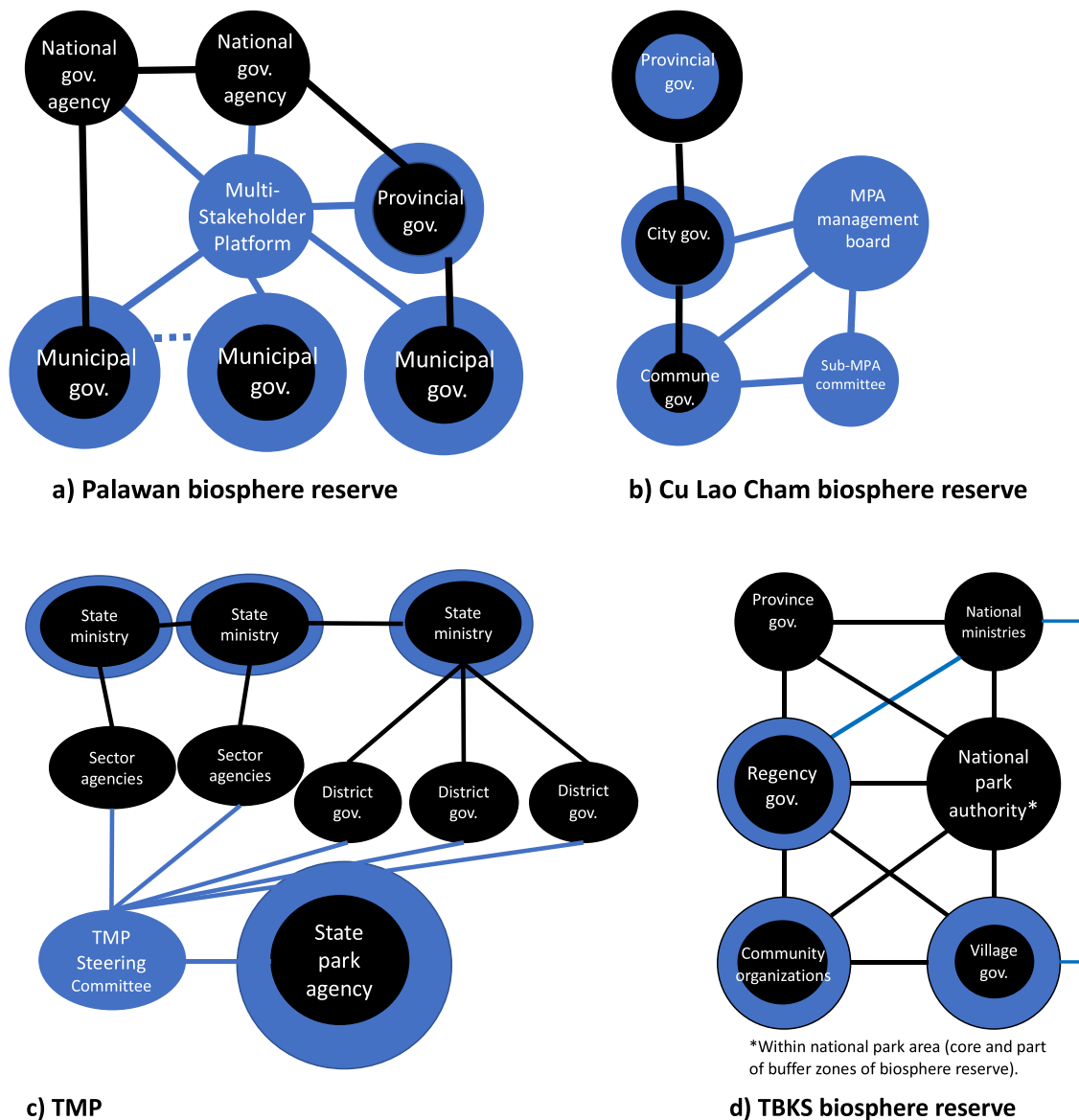


Fig. 2. Polycentric structures and influence of decision-making centres. Figure shows the additional actors and lines of coordination (blue) that have increased the degree of polycentricity in each case. The size of the nodes are qualitative indications of the influence of the actor type (average Net-Map influence score for each actor), including their current influence (blue) compared to past influence (black) (interpreted from innovation history data). Changes in influence were not always directly related to the biosphere reserve or park establishment.²¹ Acronyms and abbreviations: Government (gov.); marine protected area (MPA); Tun Mustapha Park (TMP). For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.

connected (e.g. sharing of learning and information). In contrast, governance systems with low polycentricity have decision-making centres with limited but some autonomy and loose connections. Directed polycentric systems are highly connected through hierarchical structures that constrain, to a degree, the autonomy of decision-making centres, while fragmented polycentric systems have highly autonomous decision-making centres with limited connections. To position each of the four case studies on the axes in Fig. 3, we interpreted qualitative Net-Map data on the relationships between, and influence of, actors in the governance network and innovation history data to qualitatively indicate the trajectory of change of each case study (shown as a grey trail in Fig. 3). The Fig. illustrates the variable degree of polycentricity of the governance systems, and their variable trajectory of change. It does not suggest that there is an end point in an ideal polycentric system, but rather a spectrum of high and low, fragmented and directed forms of polycentricity in relation to each other. Autonomy (of local government) is greatest in Palawan biosphere reserve (Philippines), variable over

time in TBKS biosphere reserve (Indonesia), and weak but potentially emerging in TMP (Malaysia) and CLC biosphere reserve (Vietnam). Because these governance systems are emergent, they are marked by the legacies of the structures, institutions, politics, and other social processes from which they evolved in each context, and will continue to adapt and evolve in the future. The trajectories of change of the governance systems demonstrate that polycentric systems in practice are not static, but in flux.

The innovation histories showed how the structures of polycentricity emerged ‘accidentally’ through processes of both national and marine-specific governance transition. In the Philippines and Indonesia, national decentralisation processes devolved power from the centre to regional and local bodies, while polycentric marine governance arrangements specific to the biosphere reserve/park emerged from traditionally hierarchical governance in TMP and CLC. Polycentricity itself is not a stated objective of these governance transitions. The motivation for these transitions was to achieve more large-scale integrated,

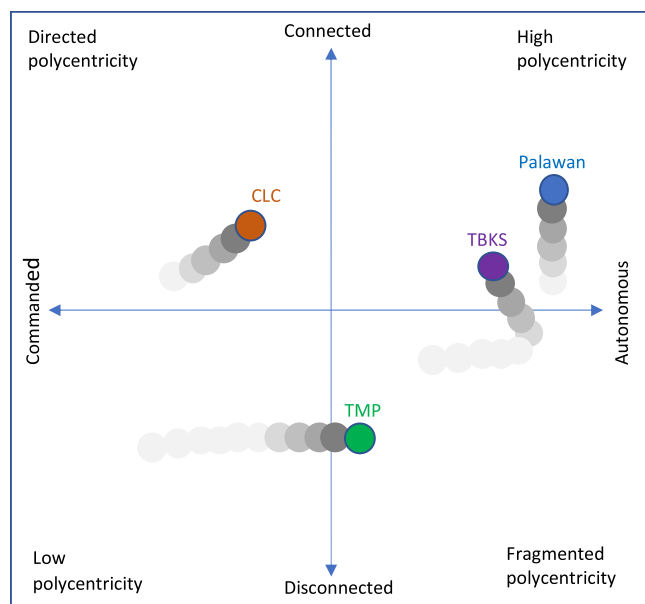


Fig. 3. Degrees of polycentric marine governance: Depicts the position of each case-study biosphere reserve or park on axes of connectedness and autonomy, and the trajectory of change followed by each case governance system (in grey) as qualitatively interpreted from Net-Map and Innovation history data. The four categories of polycentric system (high, low, fragmented, and directed) are explained in body text above.

ecosystem-based management to reconcile biodiversity conservation and economic and social development. Nevertheless, understanding these systems as polycentric, and as diverse and dynamic expressions of polycentricity, is important for explaining how these systems function (and can be improved) in practice. To further illustrate how the trajectories of change are different and matter for understanding governance outcomes in practice, we focus next on the power relations that characterise the four different polycentric marine governance systems that have emerged in our case studies.

3.2. Types of power influencing autonomy of decision-making centres

The emergent polycentric governance systems distribute power unevenly across decision-making centres and actors. Power can be seen in the degree of autonomy of these centres across the levels, which varies markedly amongst the cases (e.g., Fig. 3). There are, however, many forms that power can take. We follow Morrison et al. (2019) to consider power by design, pragmatic power, and framing power (defined in introduction) (Table 4).

Power by design, the distribution of formal decision-making authority across levels and actors, was determined by national constitutions and legal frameworks. Our data find that legally decentralised governance in Indonesia and the Philippines afford local decision-making centres more autonomy for decision making and actions compared to those in Malaysia and Vietnam. At municipal and village-level workshops in Palawan, participants scored municipal government actors as the most influential. Palawan respondents highlighted "the [municipal government] is the one that actually make things happen at the local level" because decentralisation has given the municipal governments significant autonomy to command government staff and village officials, and regulate and enforce marine resource user activities.

² For TBKS, processes of decentralisation and the establishment of the Village Law (2014) increased influence of regency and village governments. Their influence was not increased by the creation of the biosphere reserve.

In contrast, regulatory and management authority is at the provincial and city level, respectively, in Hoi An - Cu Lao Cham biosphere reserve (Vietnam) and at the state level for TMP, Malaysia. Local actors have very little autonomy to make significant decisions in these cases. State and provincial fisheries agencies in TMP and Cu Lao Cham biosphere reserve, for example, issue licenses and develop fisheries regulations that influence fishing effort and practices, and undertake patrols to enforce rules, within the reserves/parks. Malaysia is traditionally a top-down hierarchical governance system, from which the polycentric and, in principle, more collaborative arrangements of TMP are emerging. As such, top-down decision making is accepted in society, as illustrated by a quote from an interviewee: "all local knowledge was not well documented, creating a mentality that local people need to be managed because they don't know what's best for them". This is confirmed by a socio-economic survey of communities in TMP in 2006–2007 which found that respondents expect a degree of hierarchical command (Sabah Parks and WWF-Malaysia, 2010).

In addition to power by design, pragmatic power was exercised in all cases by decision-making centres and supporting actors. First, individuals possessed informal capacities to act autonomously owing to their social position. Municipal mayors in Palawan, for example, were said to informally prioritise which national laws and policies they implement through budget and human resource allocations according to their political priorities, which varied across political cycles. Second, resource users can make decisions and act semi-autonomously given weak enforcement. Local fishers were scored as being one of the most influential actors by some village-level participants in Palawan and CLC because of their autonomy around compliance/non-compliance with rules and their willingness (or not) to participate in collaborative management activities. Third, decision-making centres and supporting actors were pragmatically influential because of their position in social networks. For example, CLC Management Board was considered the most influential actor in CLC biosphere reserve because it was the most connected, sharing information and advice across levels, from city and provincial policy to supporting the local management of a sub-MPA by local fishing communities. Fourth, decision-making centres and supporting actors can use the information and resources they control – their pragmatic power – to influence those decision-making centres that have power by design. For example, by gathering and sharing published, policy-relevant evidence to inform the drafting of laws, or being a focal point for national and international investment in marine management at local levels. Lobbying from the private sector can also result in changes to park/reserve institutions. In Palawan, lobbying from mining companies and the commercial fisheries sector resulted in changes to, and a weakening of, collaborative institutions and the rules governing core marine zones. Finally, NGOs and donor agencies can influence core decision-making centres through their investment of resources, trustworthy relations developed with communities over time, and respected technical advice.

The pragmatic power of international NGOs and donors is underpinned further by so-called framing power. Innovation history discussions pointed to the influence of new management concepts and approaches introduced by NGOs. In particular, they promoted larger-scale marine planning frameworks that implicitly required the transition to more integrated, complex and thus polycentric governance systems. Beyond the role of scientists (Table 4), framing power was not referred to further in the data. This may be because framing power is often invisible and not explicit in the relationships between actors revealed by Net-Map; norms, discourse and worldviews may be accepted as given by participants and better exposed using other methods, such as discourse analysis.

The autonomy and power of different actors within these diverse systems is highly contested. For example, in the Palawan case, the perceived influence of the PCSD varied considerably amongst participants at each level (0.06 STDEV.P): provincial and national agencies pointed out its power to make decisions affecting the entire biosphere

Table 4
Example of power in practice in the case study marine parks and reserves.

Case study	Power by design	Pragmatic power	Framing power
CLC biosphere reserve	Regulatory authority held by Quang Nam provincial government; local actors have limited autonomy to make decisions.	Agency of fishers for compliance/non-compliance with rules; CLC management board most connected actor, sharing information and advice across levels, from city and provincial policy to supporting the community-based management.	In all cases, NGOs and donors through the projects they fund and implement in each reserve/park introduce new management concepts and approaches, such as marine protected areas, seascape management, and livelihood programmes.
Palawan biosphere reserve	Decentralised authority to municipal governments to manage coastal waters out to 15 km and control resources (policies, finance, staff, and enforcement).	Municipal mayors and politicians had informal autonomy to make decisions, e.g. through budget and human resource allocations; agency of fishers for compliance/non-compliance with rules; the PCSD provides a focal point for national and international investment in marine management; private-sector lobbying from mining companies changed the authority of the PCSD, and lobbying from the fisheries sector resulted in the prohibition of some activities in core zones being lifted.	Global science underpins these concepts, while local science informs how projects are designed and the management of the reserves/parks adapted.
TBKS biosphere reserve	The authority to issue regulations and implement management measures resides within several governmental actors nested in different levels of governance. These include national level ministries, the National Park Authority, and the provincial, regional and village governments, each with its own designated jurisdiction.	Village governments and influential individuals (local champions) have entrenched networks of goodwill amongst the people living in their locality of the reserve. The National Park Authority wields considerable power within the core zone of the biosphere reserve through their ownership and implementation of programmes and projects that fulfil functions that are usually under the authority of other government actors.	
TMP MPA	Regulatory and management authority held by Sabah State government and respective sectoral ministries.	District offices and village leaders occupy key positions in social networks influencing and mediating relations between village and higher level and external actors; information and proposals from Sabah Parks influences state government laws affecting TMP; WWF were one of three most influential actors due to their long-term partnership with Sabah Parks in the gazettement of the park, in that they provide a large proportion of park funding, and directly implement activities with stakeholders.	

reserve, while municipal actors considered it less influential because it has no jurisdiction and insufficient resources to influence management of coastal waters, and some village participants did not even recognise it as an actor because it is unknown to them.

Power, connectedness and autonomy were also found to shift over time during transitions to different degrees of polycentricity. The governance transitions, captured in the innovation histories, and mapped according to autonomy and connectedness in Fig. 2, resulted in the diffusion of power mainly from the centre out to various lower-level decision-making centres. The distribution of power continued to shift within these polycentric systems through dynamic relations between actors, some of which led to further structural changes. In Indonesia, for example, participants had differing perspectives on where authority lies in practice due to the difficulties implementing the decentralisation agenda that began in the late 1990s, but which has had successive cycles of authority shifting from national to local to provincial level, creating inconsistencies. Fig. 2 shows how these wider governance changes in Indonesia caused a shift in the trajectory of the polycentric governance of the TBKS biosphere reserve from increasing to decreasing autonomy of decision-making centres. Maintaining political will for marine parks and reserves across election cycles was a particular challenge. In Palawan biosphere reserve, new municipal mayors and their administrations introduced new agendas and priorities, anxious to make a demonstrable contribution to local development during their term in order to be re-elected. Given their power, resourcing and political commitment to marine management can therefore be highly vulnerable to political change. In TBKS biosphere reserve, regular changes in political leadership, in addition to the short lifespan and discontinuation of programmes and policies, fostered uncertainties about whether existing policies and programmes would be continued under new government leadership. The framing and pragmatic power of international NGOs and donors on decision-making centres was also recognised as transitional

because, when projects end, state and local stakeholders assume responsibility for management. NGOs with a long-term presence tended to have higher influence scores than those temporarily involved. For example, WWF has an eight-year MoU with Sabah Parks to support TMP establishment, and has worked in Palawan since 2000.

In sum, we found that power and autonomy were variously expressed in the emergent polycentric governance case studies. These distributions of power amongst reserve and park governance actors were shaped by the institutional legacies and national governance. Power by design expressed in laws and policies authorises autonomous decision-making, and pragmatic and framing power enables other actors to influence decision-making centres. Power in the polycentric systems was contested and dynamic. Next, we outline the key co-ordination mechanisms at work in our case-study systems. These are important mechanisms for mediating contested and dynamic power relations, connecting the diverse and overlapping actors within a polycentricity system, and thereby enabling them to deliver the purported advantages of innovation, redundancy and adaptation, and better governance outcomes.

3.3. Mediation of power through co-ordination mechanisms

The Net-Maps revealed mechanisms and institutions that facilitated horizontal and vertical cooperation within the case studies (Table 5). The UNESCO Man and Biosphere Reserve programme itself was not discussed as providing a coordinative mechanism for management of the biosphere reserve case studies. Instead, multi-stakeholder collaborative forums or steering groups have been established to bring together multiple state and non-state and/or sectoral stakeholders in order to coordinate policies and activities across organisations and jurisdictions. These mechanisms often facilitate both horizontal and vertical connectivity amongst decision-making centres and supporting actors. For example, an information hub in Palawan called Palawan Knowledge

Table 5

Summary of co-ordinating mechanisms across the four polycentric governance systems, and overview of co-ordination constraints.

Co-ordination mechanism	Cases	Issues
Multi-stakeholder collaborative institutions, including steering groups and councils	PCSD; TMP Steering group; TBKS Steering group	<ul style="list-style-type: none"> • Inactivity • Lack of formal authority to hold members to account for agreed decisions • Transaction costs • Unmeaningful participation of less powerful members • Membership exclusivity • Unresolved divergent goals and priorities of members
Bridging organisations	CLC Management Board NGO and donor programmes	<ul style="list-style-type: none"> • Lack of formal authority • Not a forum for cooperation and conflict resolution • Temporary bridging arrangements
Consultations	TMP, Palawan	<ul style="list-style-type: none"> • Perceived lack of consultation • Perceived lack of voice and influence in consultations • Lack of community engagement in consultations

Platform facilitates horizontal and vertical negotiation, collaboration and knowledge sharing amongst stakeholders, including the national and local government, academes, and NGOs. Bridging organisations, such as the CLC management board, informally facilitate stakeholder cooperation by organising meetings, leading programmes, and sharing information; a role that is also facilitated temporarily through donor, NGO, and governmental programmes that resource meetings and collaborative activities. Lastly, consultation processes provide for community and stakeholder input to decision making. For example, Sabah Parks has conducted an extensive consultation process with communities about TMP MPA and has a community officer to liaise and obtain feedback from communities within TMP.

The Net-Maps, however, identified issues with these co-ordination mechanisms (Table 2). Some were inactive or met infrequently, which diminished their perceived influence. In Fig. 1, the relatively small size of the node for the TMP Steering Committee reflects the perceived limited influence (relative to its mandated coordinative role in park management) because it rarely convenes (having met only once to date, instead of 2–4 times annually as stipulated in the TMP management plan), and its six thematic working groups were not operational. Other cooperative institutions that are active lacked authority to ensure decisions made by parties were implemented or followed by lower-level actors. Vertical cooperation between government departments and communities can also be considered cursory or not meaningful. In Palawan, local stakeholders reported that they were not consulted or not consulted early enough during the ECAN zoning process, and in TMP, they perceived that, despite an extensive consultation process for the park, their concerns were not reflected in final decisions:

The programs are using one-way approach. Where the agencies come and talk about current situation and the communities just hear the information. No feedback is given and sometimes the communities did not even come." (Government representative, TMP)

In TBKS biosphere reserve, the reliance of various actors on informal mediation of power through community organisations and local champions with strong social capital in communities was also perceived to be problematic in the long term. The withdrawal of support from these individuals when programmes end, or when they retire from

participation as a governance actor, can make the informal mechanism of power mediation fragile.

These barriers to cooperation were attributed to several factors. First, resource constraints restrict the regularity and depth of cooperation amongst decision-making centres. Second, the data show that decision-making centres often have their own agendas and goals, making the parks and reserves highly politicised and meaning that co-ordination mechanisms are often political rather than neutral arenas. In multi-stakeholder collaborative institutions, there are political tussles between decision-making centres over whose aims should be prioritised and whose territories should be maintained. Even within these mediation mechanisms, the power relations amongst members influence whose goals dominate. In Palawan, for example, the agenda and annual plans of the PCSD are a product of the many and varied interests of national government agencies and other PCSD members. Territorialism by government agencies and intra-ministerial power relations was said to hamper cooperation in TBKS biosphere reserve, Indonesia and TMP MPA, Malaysia (Box 1). Third, institutional legacies can also hamper trust in coordinative mechanisms. For example, because other marine parks managed by Sabah Parks exclude resource users, fishers do not perceive TMP MPA (also managed by Sabah Parks) to be a multiple use and collaboratively managed protected area that will permit fishing activity, undermining reassurances that TMP MPA has development as well as conservation aims. Lastly, decision-making centres can have divergent protocols, practices or systems that lead to a mismatch of timeframes and strategies, which can create misunderstandings amongst stakeholders: *"there will be a lot of agencies that come to us and each of them have different agenda and method to do what we see as same objective. This sometimes confuse the communities and other target groups"* (Community education representative, TMP).

Co-ordination mechanisms are particularly important in polycentric systems that are emerging ad hoc in order to mediate the power dynamics that play out among decision-making centres and supporting actors. Our data show that in our four cases of 'accidental' polycentricity, coordination mechanisms have been established but they remain relatively nascent, weak, or inactive. Next, we explore what these weak coordination mechanisms mean for polycentricity in practice and the implications for the outcomes of environmental governance.

3.4. Implications of governance transitions that reflect increased and variable degrees of polycentricity

Our data suggest that the emergence of various degrees of polycentricity catalysed by the establishment of large marine parks and reserves did confer some of the benefits of polycentricity proposed in the literature but had consequences for the sustainability outcomes of the parks and reserves. Semi-autonomy enabled some decision-making centres to innovate and implement a more progressive sustainable development agenda: progressive municipalities in Palawan could decide to implement marine zoning and fisheries law enforcement without requiring higher-level approval; Sabah Parks with support from WWF facilitated the establishment of community-based organisations in TMP; and Cu Lao Cham MPA management board worked with the local commune and island communities to establish a sub-MPA to empower and provide greater autonomy to community actors in an otherwise hierarchical governance context. However, more often than not, autonomy did not progress sustainable development but rather enabled decision-making centres to advance their own agendas determined by local or sectoral politics and power. For example, municipal mayors in Palawan can use their influence to be selective in the enforcement of MPA and fisheries rules to appease their political supporters, which was said to undermine trust and legitimacy in marine regulations. This means provincial guidelines are not always adopted by municipal governments, marine zoning is weakly implemented by municipalities, and non-compliance is not consistently sanctioned. Similarly, in TBKS biosphere reserve, while the national government provides an

Box 1

Decision centre territorialism in TMP MPA, Malaysia.

During the establishment of TMP, there were political negotiations and conflict over the boundaries of the park as government departments sought to retain control over their respective jurisdictions. Mangrove forest reserves and terrestrial areas were excluded from the park to appease the forestry department and district governments, which did not want to relinquish control to the park's management authority, Sabah Parks. TMP therefore has resulted in centralised decision-making centres retaining their power, but there are weak horizontal connections between these centres. Today, the departmentalised and territorial approach to resource management creates a barrier to the adoption of the collaborative approach outlined in the TMP management plan. For example, the Department of Fisheries was said to consider that TMP will reduce fish harvests and affect fisheries, livelihoods, and maritime economic development aims, and many of the actors perceive Sabah Parks to be focused solely on conservation, to the detriment of development. In this context, the interests of the most powerful sectors take precedence, undermining the vision and aims of ecosystem-based and multi-use management of TMP that requires cooperation across jurisdictions to manage multiple sectors and multiple jurisdictions:

there's a hierarchy of ministries, which means that the Ministry of Tourism will always win over Sabah Parks [the statutory conservation body]. [...it's the same for fisheries], Whatever [Department of] Fisheries wants, everybody else has to kowtow. (NGO country director)

The co-ordination and conflict resolution mechanisms in place in TMP have seemingly been unable to fully overcome and effectively mediate the tensions that result from power by design in this polycentric system.

overarching policy framework, pragmatic power leans towards the provincial and regency levels who decide whether to implement national laws. For example, the national Ministry of Environment introduced regulations to control plastic pollution, but its implementation was said to depend on political will, values, and interests at the provincial level. In these cases, lack of accountability to or command from higher-level institutions resulted in cases of parochialism at the expense of achieving higher-level objectives. In contrast, actors leading the implementation of TMP and Cu Lao Cham (Box 2) could be overruled or lack authority to resist higher-level initiatives that had aims that conflicted with park/reserve objectives. The upshot of hierarchy in TMP is that decisions can be made by the state government (e.g. licensing new oil and gas installations) that contravene the conservation objectives of TMP. Thus, the polycentric structures enabled variable flexibility and innovation, but the sustainability objectives of the biosphere reserve or MPA were not always prioritised in decision making.

In our cases, institutional redundancy, resulting from the devolution of powers to multiple decision-making centres with overlapping mandates, increased transaction costs of management, and created barriers to and inefficiencies in sharing information between centres. In TMP, the process of acquiring information was time-consuming, and information would only be shared when there were instructions from higher levels. In some cases, overlapping jurisdictions created confusion over roles and responsibilities, and a lack of recognised leadership. In TMP for example, an NGO team said: "...we see some illegal activities in the sea; however, we do not know who to contact about the issues". In response, some interviewees highlighted the importance of a collective vision and more effective co-operation among decision-making centres:

It would benefit to all parties involved if we could work together not just as coordinator but cooperatively to achieve [the] same mission and vision. (government representative, TMP)

Finally, while increased polycentricity widened participation of

stakeholders, having multiple decision-making centres does not mean the voices of peripheral actors are necessarily enveloped in the governance of biosphere reserves/parks. Indeed, moving to larger-scale management may disenfranchise local actors and resource users themselves from decision making. In Palawan and TMP, village-level and fisher representatives complained of weak consultation processes and information sharing or even a lack of awareness of the marine parks/reserves and their rules. Without a sense of being recognised in decisions made, there is non-compliance with biosphere/park rules. In Palawan, "a lot of people really complained because they were forced to follow without knowing". Resource users are then more willing to non-comply with and resist the implementation of marine zoning. The potential for conflicts due to the alienation of local communities in decision making can manifest in local unrest, as was the case in TBKS biosphere reserve: some instances of marine zoning favoured the tourism sector development at the neglect of local livelihoods, which resulted in violent confrontations between local fishers and private MPA owners (Praptiwi et al., 2021).

4. Discussion

The study illustrates how, within deliberate governance transitions towards large-scale MPAs and biosphere reserves, polycentricity emerges with variable degrees of autonomy for, and connectivity amongst, decision-making centres operating at different levels (national to local). The institutional legacies from which the emergent structures evolved influenced how different types of power are expressed by and among actors. Power by design reflected in laws and policies authorises autonomous decision-making, while pragmatic and framing power enables actors to influence decision-making centres. Various mechanisms exist in the marine parks and reserves to mediate connections and power dynamics amongst decision-making centres vertically and horizontally, but these are challenged by resource constraints, a lack of accountability mechanisms, and the politics and power relations amongst participants.

Box 2

Large-scale tourist development permitted in Cu Lao Cham MPA.

A large-scale luxury tourist resort development on Cu Lao Cham islands was given a licence by the provincial government, but the CLC board and Tan Hiep commune complained about its potential ecological impacts on coral reef and seagrass beds. Eventually it was agreed that the resort would be downsized to one-tenth of its original size. This demonstrated that the local actors are able to influence the higher level through resistance, but the tourism sector representative claimed, "we got a license from high level, we don't care".

The study found that increased polycentricity within the environmental governance case-studies in practice was not necessarily congruent with increased sustainability, since greater autonomy sometimes enabled parochialism and the progression of self- and constituency-serving interests at the expense of higher-level sustainability goals. Moreover, peripheral decision-making centres and actors were sometimes marginalised in the case-study polycentric arrangements and devolution to multiple decision-making centres created inefficiencies in information exchange and learning rather than effective redundancy and resilience in the system.

The meta-analysis of the cases demonstrates how increased polycentricity can result in divergence of goals in practice rather than the robust pursuit of common goals (Ostrom, 2010). In the decentralised cases (especially Palawan), local governments may pursue their own political agendas, despite having signed up to higher-level goals; whereas state agencies in the more hierarchical cases (especially TMP) may ultimately seek to further their sectoral interests, even when they are part of collaborative arrangements. Whose goals became dominant was determined by power asymmetries and politics within and amongst decision-making centres and supporting actors. Rather than decision-making centres being equal in polycentric governance (Biggs et al., 2012, Morrison et al., 2017), the distribution of design and pragmatic power in the four reserves/parks determined the capacity of centres to make autonomous decisions. Beyond their own autonomy, powerful actors were shown to co-opt co-ordination mechanisms to serve narrow interests, a problem that has been found to pervade cross-scale multi-stakeholder collaborative institutions worldwide (Adger et al., 2005). Other studies of inter-agency politics (Clarke and McCool, 1996), and the politics of World Heritage governance (Morrison et al., 2020) have shown that relations between decision-making centres do not always involve compliance or negotiation; they can also involve appropriation, rhetorical adoption, or passive resistance. In this cauldron of power and politics, both high and low levels of polycentricity can lead to the pursuit of the goals of the powerful rather than common goals of sustainability – thus, cooperation, competition, conflict, and conflict resolution do not take place on a level playing field. Adaptations to polycentric arrangements can reflect changing political leadership and their constituencies' associated interests, which may not align with previously established environmental or social goals (Fortnam, 2019). More highly polycentric systems may be robust through processes of self-organisation (Lebel et al., 2006), but self-organising tendencies (Ostrom et al., 1961) may not be congruent with sustainability even where polycentricity emerges (intentionally or unintentionally) within deliberate governance transitions to improve environmental outcomes.

Such power and politics were determined by past and ongoing transitions both wider than, and specific to, marine governance – increased polycentricity does not emerge in an institutional vacuum. In the decentralisation case of Palawan, semi-autonomy enabled pursuit of parochialism. TMP, on the other hand, is implemented within the 'shadow of hierarchy' where local autonomy is limited and the agendas of politicians and the differential power of sector agencies and ministries can overrule collaborative decisions and goals. Baltatus and Moore (2019) similarly found for water governance that with authority remaining vested in the state, some values and interests remain subordinate in polycentric arrangements. All the cases point to how governance transitions with emerging polycentricity, while increasing the range of actors involved does not necessarily mean the state relinquishes authority. Indeed, in Palawan, where there is a history of community-based governance, the shift in polycentric arrangements with decisions made at higher levels may be inadvertently reducing community involvement. Similarly, Gruby and Basurto (2014) found that shifting the scale of marine management to a larger, ecosystem scale engendered perceptions of lost autonomy at a local level. At the same time, other studies have shown that hierarchical governance structures can successfully support the effective functioning of polycentric water governance systems (Pahl-Wostl and Knieper, 2014). Our study highlights the

importance of further developing our understanding of the little-investigated relationship between polycentricity and background modes of governance (Pahl-Wostl and Knieper, 2014).

While power and politics are critical (yet often ignored) in all polycentric environmental governance arrangements irrespective of levels of economic development, they may be particularly acute in low-income contexts where precolonial and postcolonial legacies of extreme inequality and often weak corrupt states persist (Christie et al., 2009; Hedman, 2006). Increasing polycentricity may reinforce rather than challenge these inequities and entrenched power relations by increasing the autonomy of existing decision-making centres and creating connections through which powerful centres can influence less powerful centres. Thus, without attention to processes of inclusion and exclusion in polycentric arrangements, there is a risk that polycentricity, of any degree, can reproduce rather than challenge marginalisation (Baltatus and Moore, 2019). Furthermore, the study shows that in the context of low- to middle-income countries, the transaction costs of financing and maintaining coordinating mechanisms and carrying out responsibilities in polycentric systems may be prohibitive. There is an assumption that transaction costs are higher in more highly polycentric systems, but this is not necessarily the case. Our study shows that the costs can be prohibitive in systems with different degrees of polycentricity. Yet without robust co-ordination mechanisms, unequal power distributions and overlapping responsibilities may lead to uncoordinated and conflicting policies and actions that reduce effectiveness and efficiency of achieving goals.

Taken together, the findings highlight the tensions between the various characteristics of polycentric governance: semi-autonomy, co-ordination, and the presence of organisations at multiple levels with divergent agendas and portfolios of responsibilities. More autonomy can make coordination harder, diverse and overlapping functions can increase opportunities for innovation and redundancy but can also increase transaction costs and reduce efficiencies, and multi-level governance and diverse constituencies can increase participation and account for a broader range of interests but can favour the voice and interests of some actors at the expense of others, and generate conflict. As the study shows, polycentric structures can be pushed and pulled towards more or less fragmented/coordinated and autonomous/hierarchical structures (and these reflect just two of many criteria by which a polycentric system can be defined). Polycentricity therefore does not represent a harmonious, ideal governance structure towards which a system should necessarily be steered; polycentric systems in reality change and adapt over time in response to the tensions and adjustments made by individual actors and institutions that increase or decrease autonomy, coordination, diversity, redundancy and other polycentric characteristics. What makes polycentric systems adaptable also causes them to be in flux.

Moving forward, autonomy and freedom to innovate needs to be balanced with accountability mechanisms to ensure compliance with shared rules, pursuit of common goals, and to avoid polycentric structures being co-opted opportunistically for aims incongruent with sustainability and equity. Thus, adherence to principles of good governance is essential for polycentricity to function effectively and generate more equitable outcomes by holding decision-making centres to account for underperformance and corruption. Social outcomes will also likely continue to be inequitable without diffusion of power to more peripheral decision-making centres, including community institutions and those representing marginalised groups. Similar to the findings from the Palawan, TBKS and TMP cases, Lieberman (2011) for disease governance, Wyborn (2015) for terrestrial conservation, and Morrison (2017) for marine governance found that problems of accountability can become apparent when authority is dispersed, there are multiple actors responsible for the same or similar tasks, or there are a lack of resources for enforcement. Attention to coordination mechanisms will be crucial to move systems away from fragmented polycentricity that produces uncoordinated and contradictory actions (Lieberman, 2011; Marshall,

2015; Pahl-Wostl and Knieper, 2014). This requires enduring bonds of trust (Galaz et al., 2012), financially sustainable transaction costs, and attention to wide and representative participation and the power dynamics amongst decision-making centres and supporting actors (Morison et al., 2019).

Problems of coordination, power imbalances, and accountability are, of course, not an issue of polycentricity per se – they are also issues pervading hierarchical, decentralised and other forms of governance. The wider point is, therefore, that governance structures and processes should be analysed as they are in practice rather than as idealised forms. There are no governance panaceas, but by studying governance arrangements and their outcomes in practice, including emerging polycentric systems, we may be able to strengthen, steer or address the aspects which appear to influence the capacity of governance transitions towards more integrated and ecosystem-based approaches to deliver their intended benefits for sustainability.

5. Conclusion

We do not intend in this article to attack the fundamental premises of polycentric governance, but to draw attention to the challenges and practicalities of its emergence in practice given that it is already a dominant form of governance worldwide. The article provides empirical evidence to support claims of the need to make power and politics central to conceptualisations of polycentric governance. It also points to the importance in practice of understanding and improving how coordination mechanisms mediate power dynamics and influence outcomes. We suggest understanding governance transitions as accidental moves towards various degrees of polycentricity. As a reviewer rightly highlighted, we should stop treating polycentricity as a prescription and treat it instead as a governance reality. This viewpoint represents a shift of scholarly attention away from idealising polycentric (and other) structures and their benefits towards investigating how purported benefits can be achieved in practice in diverse contexts with different types and degrees of coordination, decision-making autonomy, redundancy, and other governance characteristics.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.envsci.2022.08.010](https://doi.org/10.1016/j.envsci.2022.08.010).

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