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A framework for comparing collaborative management of Australian and New Zealand water resources

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ABSTRACT. Collaborative management of natural resources involves two or more parties working together to govern and/or manage a set of resources within a defined area. Although a number of collaborative management frameworks have been developed for protected area and fisheries management, few exist for freshwater resources that enable their comparative analysis. We present a framework of collaborative management for freshwater resources comprising three elements: scope, governance, and management. Application of the framework to 11 cases from Australia and New Zealand differentiates between primarily consultation/government-based arrangements through to cogovernance arrangements. Our framework differs from others because it highlights the multiscalar and nested nature of collaborative management arrangements that influence effective water resource management. Our analysis highlights the diversity of arrangements that exist for freshwater resource management. Cases involving indigenous groups, a social tradition of waterways management, and those outside the scope of national water resource management reforms generally had higher levels of power sharing and involvement. We argue for greater attention to the effectiveness of and links between governance and management processes to ensure collaborative management remains innovative and appropriate to context. We contribute a framework that contains a continua and three core elements that enables a parsimonious evaluation that could be applied to other resource management contexts and, thus avoids criticism of overly prescriptive, simplistic, and idealistic analysis.

Key Words: *Australia; cogovernance; collaborative management; governance; management; New Zealand; scope; water resources*

INTRODUCTION

It is increasingly recognized that successful environmental management requires a holistic perspective that engages community, industry, and government. In response, many forms of cooperative-, collaborative-, joint-, and comanagement and governance have emerged. For the purposes of this article, we define collaborative management as “a partnership by which two or more relevant social actors collectively negotiate, agree upon, guarantee and implement a fair share of management functions, benefits and responsibilities for a particular territory, area or set of natural resources” (Borrini-Feyerabend et al. 2004:69). Collaborative management is not a new approach, having been applied in fisheries, forestry, and protected area management for around a century (Agrawal 1995, Jentoft and McCay 1995, Borrini-Feyerabend et al. 2004). Despite also being commonly applied in freshwater management, comparative analyses are largely absent from the academic literature (but see Eberhard et al. 2017).

The purpose of this article is to contrast contemporary and innovative collaborative arrangements. We do so through the development of a framework that compares scope, governance, and management along a power-sharing continuum. This framework provides a rapid method for identifying and sharing lessons on the collaborative management of natural resources. We illustrate its application using freshwater management cases from two different countries: a federation of self-governing states in Australia, and, in the case of New Zealand, a Westminster-style government with national, regional, and local tiers. Both governments recognize the rights of indigenous peoples, in Australia through native title and in New Zealand through the Treaty of Waitangi settlement process (Jacobson et al. 2014).

Through framework application, we demonstrate enhanced understanding about the drivers that shape the nature of collaborative management arrangements and provide critical insights that will inform future freshwater management internationally.

Collaboration in governance and management of natural resources has occurred since the 1890s (Jentoft and McCay 1995), and incorporates a suite of terms such as comanagement, cooperative management, and cogovernance of natural resources. Comanagement refers to formalized power sharing arrangements (Armitage et al. 2007); in some contexts, e.g., Australia, comanagement refers principally to relationships between indigenous peoples and the nation state, as per protected area management. In instances where formalized arrangements, either statutory or voluntary, do not exist, are limited in scope, or are unequal between collaborating parties, the term cooperative or collaborative management is used. More recently, the term cogovernance has been used, although this generally refers to formal agreements for sharing of decision-making powers, but not necessarily responsibility for implementing, regulating, or enforcing actions agreed to. Cogovernance provides an attempt to increase deliberation and participation in decision making, and may or may not increase legitimacy of disenfranchised rights, depending on who is engaged in the arrangement (Brinbaum 2016). Thus, we use the term “collaborative management” in reference to a full suite of arrangements, of which comanagement and cogovernance are two. Our use is categorical rather than hierarchical, given that there is no singular definition of each term, and that the appropriateness of any term or set of arrangements is subjective in judgement (see Takeda and Røpke 2010).

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COLLABORATIVE MANAGEMENT APPROACHES

Approaches to collaborative management are diverse because of its emergence from the management of multiple natural resources types, and from multiple socio-political contexts. Community and state can interact in collaborative management in partnership, in joint organizations, or in nested systems (Carlsson and Berkes 2005). Detailed descriptive models have been developed. For example, Plummer and Fitzgibbon (2004) incorporate 18 elements into their framework, linked to context (three rights sets), components (preconditions, characteristics, and outcomes), and linking methods, with multiple feedbacks. Simpler continua, frameworks, and typologies of collaborative management have also been developed that support lesson sharing and improvement of practice. Borrini-Feyerabend (1996), for instance, described collaborative management as a range of approaches along a continuum from full agency control to full stakeholder control, with the latter involving increased contribution, commitment, and accountability of stakeholders facilitated by fully devolved management. Sen and Nielsen (1996) identify a similar continuum of practice for collaborative management of fisheries that varies on the basis of power sharing; it can be instructive or consultative (i.e., communities are consulted and inform government decisions), advisory (where a group has specific input into management decisions but no power), cooperative (where communities and government are partners in decision making), or informative (where responsibilities are delegated to communities).

In the Australian context, Smyth (2001) and Szabo and Smyth (2003) depict three different models of collaborative protected area management. These vary in relation to ownership, management planning, the voluntary/optional nature of arrangements, with whom land management authority resides, costs and security of arrangements. Alternatively, Hill et al. (2012) classify collaborative management between indigenous peoples and government as a position in a three dimensional space generated by consideration of power-sharing, intercultural purpose, and inclusiveness of participation. The common elements in these approaches to conceptualizing comanagement include power sharing, governance (rule setting), management (implementation), and relational context (context). The latter is important, given the criticisms of idealized depictions of comanagement that fail to account for changes in interrelationships between actors over time, the lack of critical reflection on whether power sharing is consensual, and parallel arrangements (Fischer et al. 2014).

Although typologies exist for the collaborative management of fisheries, wildlife, and protected areas management, few similar analytical frameworks exist for freshwater management. Margerum and Robinson (2015), building from Margerum (2008), classify arrangements as action, organization, or policy level, and either as cooperative or coordinated. However, the full range of collaborative approaches evident in other typologies are not covered by Margerum and Robinson's framework, nor are emerging multiscalar collaborative approaches that can include policy, organization, and action based responses, e.g., collaborative management of Te Waihora in New Zealand (Memon and Kirk 2012).

Collaborative management, however, has emerged as an important means of managing both water quality and quantity.

Analyses tend to emphasize whether the resource is managed effectively in accordance with principles for common property resources (Ostrom 1990). Although analysis in relation to common pool resource management principles can be used to assess the effectiveness of arrangements, it does not provide for nuanced analysis of similarities and differences, nor does it aid in generating new understanding about the divergent contextual drivers specifically within water management contexts; framework type analyses may be more useful in this regard.

JURISDICTIONAL CONTEXT

Comparing collaborative management across countries requires an understanding of the jurisdictional context. Ongoing drought in Australia has hastened reforms targeted at greater coordination of water management regimes across jurisdictions. At the state level, these reforms have typically required a statutory response, e.g., the 1989 Water Act (State Government of Victoria 1989) or the 2000 Water Act (State Government of Queensland 2000) and reinforced top-down water planning in which stakeholder input is largely limited to an advisory role. The Australian water management landscape has been shaped by several macro drivers including (1) the Australian Constitution; (2) commitment to market-based mechanisms; (3) severe drought conditions; and (4) regional approaches to natural resource management. Section 100 of the Australian Constitution specifies that responsibility for water management resides with the state and territory governments. When viewed in historical context, water policies and management mechanisms have differed markedly between Australian jurisdictions as state and territory governments pursued their individual priorities (Pigram 2006). Notwithstanding contemporary reforms that have been targeted toward increased coordination between Australian jurisdictions, these legacies continue to shape water management arrangements. Australian water management is also characterized by a commitment to statutory-based water planning and complex market-based arrangements (see the 1994 Council of Australian Governments' water reform framework and the Intergovernmental Agreement on a National Water Initiative 2004).

The context is different for New Zealand where the Resource Management Act 1991 (Government of New Zealand 1991) sets the framework for an integrated approach to planning for sustainable resource management, and appearing to seamlessly link national, regional, and local government planning. It also "enshrined" indigenous interests in planning and environmental management, following significant claims around water and coastal fisheries degradation brought by indigenous Māori tribes under the Treaty of Waitangi (Jacobson et al. 2016a). The relationship enshrined in the RMA was an early signal of collaborative arrangements to come in New Zealand's freshwater management, and of the role Māori were to play in these. This signal has been further driven by the National Policy Statement for Freshwater Management (Ministry for the Environment 2014) which included specific mention of Te Mana o te Wai, the status and importance of water to Māori.

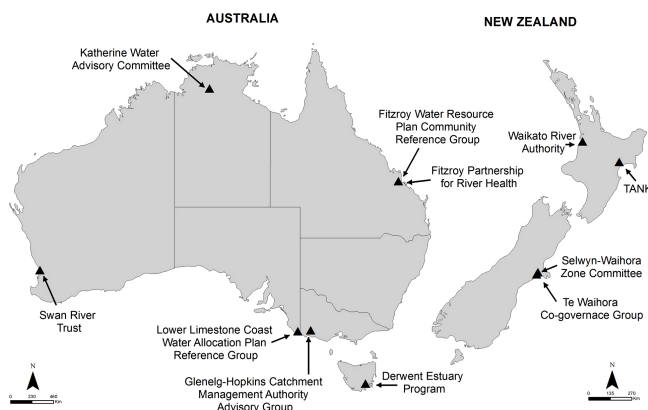
METHODS

There are numerous examples of collaborative water resource management in Australia and New Zealand. To effectively illustrate the use of our analytic framework we selected a range of management examples based on process, design, and geography. The following criteria were used to select cases:

- The collaborative group has an instrumental function, e.g. developing a management plan, with membership reaching beyond government;
- A diversity of current and innovative (collaborative management) arrangements within each country are represented;
- Examples from each country where multiple collaborative arrangements exist within the same catchment;
- Sufficient information was available to enable analysis; and
- Geographic diversity is represented, i.e., across Australian states/territories and including the North and South Islands of New Zealand.

Using these criteria, 11 collaborative freshwater management arrangements were chosen and subjected to document analysis (Fig. 1, Tables 1 and 2). Seven cases were from Australia and four from New Zealand and were believed sufficient to develop and test a framework to inform future development of freshwater collaborative management arrangements and provide insight to deliver on the aims of this paper.

Fig. 1. Location of the 11 collaborative groups.



Our Australian cases exclude (1) examples of community owned water infrastructure, e.g., irrigation schemes; (2) examples from New South Wales where freshwater management occurs at the catchment scale, but community involvement is largely limited to public consultation and does not allow for nongovernment stakeholders to participate in an advisory role; and (3) the Murray-Darling Basin, given that it is a unique arrangement involving the Australian state/territory governments referring their constitutional water management powers to the Australian Commonwealth Government. The latter in particular is an unusual set of arrangements that can only be applied given (i) this is both an environmental matter of national importance, (ii) because the catchment crosses state boundaries and therefore a case could be made beyond the powers subscribed to individual states under federation, and (iii) because there is no comparison in New Zealand.

Almost any natural resource management body could arguably fit these criteria but we have chosen one case study per state given

contextual differences in the way each addresses freshwater management. Based on the exploratory nature of our framework, not all possible cases from across Australia have been included, which is a limitation of the research. Our New Zealand cases exclude regional government planning processes, and two additional major cases: the Guardians of Manapouri, with its focus on water quantity rather than water quality, and the Motueka Integrated Catchment Management process, because of limited scope of analysis and our interest in a diversity of arrangements. We have also excluded the Ngāi Tahu Crown Settlement Act 1998 mandated Joint Management Plan arrangement between Ngāi Tahu and the Department of Conservation for public conservation lands on the lake margin of Te Waihora, given that the current cogovernance arrangements are much broader in physical scope. Thus, the framework we developed could similarly be applied to sharing lessons from programs where state government or equivalent is working with traditional owners under statutory mandates to implement collaborative freshwater management.

Data collection

A two-phase desktop review of water management arrangements was conducted for each case. First, case-specific and other relevant web sites were searched for information applicable to each case, as well as information pertaining to legislation and policy arrangements at national, state/territory (Australia), and regional (New Zealand) scales. All information was recorded in a spreadsheet against the categories outlined in the data analysis section to facilitate cross-case comparisons. Second, a search of the academic literature was conducted using three databases: Scopus, Web of Science, and Google Scholar, for any other analyses related to these cases. The first 100 hits retrieved from the Google Scholar searches were inspected for broad relevance to the project. After scanning all relevant documents from both phases, we created a master file of core references for each case (Appendix 1).

Data analysis

We created a framework matrix to support case analysis. The y-axis represents a continuum of power sharing, based on Borrini-Feyerabend et al. (2004) and Sen and Nielsen (1996), moving from consultation/government-based (top of the continuum) to cogovernance (bottom of the continuum), and an x-axis covering scope, governance, and management. The terms used in this matrix are those typically used in both Australia and New Zealand. We positioned cases along this continuum, based on assessments of their characteristics. Although power sharing provided a useful means to classify cases, relative positioning also required us to consider the scope of participation across the breadth of management activities and the statutory nature of the group. The elements on the x-axis encompass the range of responsibilities and actions, and characteristics and behaviors, encompassed within all known approaches to collaborative water management being undertaken in Australasia (see Jacobson et al. 2014).

Scope

Arrangements vary in purpose, time frame, and the extent to which they address either water quality or water quantity issues (or both). Arrangements also differ in terms of governance, with processes operating at national, state, regional, and local scales. Specifically there are three subelements: purpose, time frame, and

Table 1. Descriptive context of the Australian collaborative groups.

Purpose	Physical scope	Mandate
Derwent Estuary Program, Tasmania (DEP) Develop and implement an environmental strategy for the estuary	The Derwent Estuary between New Norfolk (upstream) and a line between Tinderbox and the Iron Pot (downstream). Note: Although the estuary is a brackish water body, it includes a significant freshwater component.	Derwent Estuary Partnership Agreement
Fitzroy Partnership for River Health, Queensland (FPRH) To monitor and evaluate the health of the river basin	The Fitzroy Basin. Includes shallow groundwater, rivers, off-stream wetlands, and estuaries in the Fitzroy Basin and near-shore coastal and marine environments.	Fitzroy Partnership for River Health Memorandum of Understanding; Fitzroy Partnership for River Health Operating Rules
Fitzroy Basin Community Reference Panel, Queensland (FB) Make recommendations for inclusion in 10-year plan	The Fitzroy Basin. Surface water and some groundwater management areas.	Water Act 2000 (State Government of Queensland 2000)
Glenelg-Hopkins Catchment Management Authority Advisory Group, Victoria (GH) Make recommendations for inclusion in 8-year strategy	The Glenelg Hopkins region covers approximately 26,910 km ² from Ballarat in the east to the border of South Australia in the west. And stretching from the southern coast of Victoria to the townships of Harrow and Ararat in the north.	Water Act 1989 (State Government of Victoria 1989)
Katherine Water Advisory Committee, Northern Territory (KWAC) Make recommendations for inclusion in 10-year plan; different committee reviews plan	The Plan applies to water contained within the unconfined and confined Tindall Limestone Aquifer within the Katherine River Catchment. It does not directly apply to the management of surface water extractions.	Water Act (Government of Northern Territory 1992)
Lower Limestone Coast Water Allocation Plan Reference Group, South Australia (LLC) Water Allocation Plan for the Lower Limestone Coast Prescribed Wells Area 2013	Two distinct underground water systems spanning 1,450,000 hectares in southeast South Australia. Extending from the coast east to the Victorian border and north to Padthaway.	Natural Resource Management Act 2004 (State Government of South Australia 2004)
Swan River Trust, Western Australia (SRT) To manage the health of the Swan Canning River through plan development and reporting	The Swan and Canning rivers flow through the Perth metropolitan area. The catchment accounts for 2090 km ² including the Swan Canning Riverpark, which is 72.1 km ² of public land and adjoining river reserve.	Swan and Canning Rivers Management Act 2006 (State Government of Western Australia 2006)

water values. We attempted to weight the relative emphasis on particular water values, e.g., ecosystem health, recreation, or cultural, to indicate the broader role of freshwater in the delivery of ecosystem benefits and values the groups believed were most important to manage for. We used a three-category scoring system, from one star (low level of emphasis) to three stars (high level of emphasis).

Governance

Collaborative management, as we define it, involves the establishment of a new body or group(s), sometimes with decision-making authority. These groups vary in relation to eight subelements:

- Group membership, representation, and decision-making processes;
- Establishment of subgroups, resulting in nested arrangements;
- Inclusion of indigenous representatives;

- Statutory nature;
- Group mandate;
- Resourcing;
- Ability to adapt governance arrangements; and
- Transparency of governance

Management

Although the focus of collaborative management can be on either or both of governance and management, the inclusion of monitoring and evaluation of both process (e.g., Izurieta et al. 2011) and actions (Hockings et al. 2004) facilitates transparent governance and management and recognizes that both are learning processes (Berkes 2009). We assessed the existence of each in case studies as evidenced through reporting. Thus there are two subelements: monitoring and reporting.

Table 2. Descriptive context of the New Zealand collaborative groups.

Purpose	Physical scope	Mandate
<p>Selwyn Waihora Zone Committee (SWZC)</p> <p>Consultation, assessment, and decision making around the zone implementation program that sets maximum nutrient loadings and minimum flow regimes for the river</p>	<p>Selwyn, Waikirikiri, Waimakariri, Rakaia, Wilberforce, Harper-Avoca, Lake Coleridge, Waianiwaniwa, Hororata, Hawkins rivers and lowlands streams and water that flows into Te Waihora, and are bounded by the Selwyn District Council Government Boundary</p>	<p>Canterbury Water Management Strategy 2009</p>
<p>Te Waihora Governance Group (TWGG)</p> <p>Provide for an enduring, collaborative relationship between the Parties, for the collaborative sharing of functions, duties, and powers to commit to enhance the practice of sustainable management within the catchment</p>	<p>Relationships between Te Rūnanga o Ngāi Tahu, Environment Canterbury and Selwyn District Council to work in partnership to implement their responsibilities (statutory and cultural) within the Catchment including the lake. Excludes the Joint Management Plan arrangement under the Ngāi Tahu Claims Settlement Act 1998 (Government of New Zealand 1998).</p>	<p>Te Waihora Co-Governance Agreement 2014</p>
<p>TANK</p> <p>To enable present and future generations to gain the greatest social, economic, recreational, and cultural benefits from our water resources within an environmentally sustainable framework</p>	<p>Tutaekuri, Ahuriri, Ngaruroro and Karamu rivers and the Heretaunga Plain Aquifer System, including making recommendations on the flow regime, water allocation, surface and ground water quality, involvement of Tangata Whenua in decision making, Mātauranga Māori in monitoring and reporting, security of water supply for water users, and policies affecting freshwater management</p>	<p>Collaborative decision making for the freshwater resources in the greater Heretaunga and Ahuriri region (2014)</p>
<p>Waikato River Authority (WRA)</p> <p>Restore and protect the health and well-being of the river for future generations</p>	<p>The river and activities within its catchment affecting the river and tributaries, lakes, and wetlands commercial and noncommercial fisheries managed under the Fisheries Act 1996 (Government of New Zealand 1996)</p>	<p>Waikato-Tainui Raupatu (Waikato River) Settlement Act 2010 (Government of New Zealand 2010); Ngati Tuwharetoa, Raukawa, and Te Arawa River Iwi Waikato River Act 2010 (Government of New Zealand 2010) Nga Wai o Maniapoto (Waipa River) Act 2012 (Government of New Zealand 2012)</p>

RESULTS

Framework

The 11 cases analyzed fit along a continuum from those that are largely consultation/government-based and to those that demonstrate a range of attributes that are more cogovernance in nature. The analysis in this section is based on a reading of each of the scope, governance, and management elements from left to right in Tables 3, 4, 5, and 6.

Scope

Groups engaged more at the consultation end of the continuum have typically narrower scope, e.g., less emphasis on recreation and cultural values, than the much more inclusive groups at the cogovernance end of the continuum (Table 3). The relative weighting of emphasis between the management of water quality and quantity differs overall between Australia and New Zealand. In Australia there is typically either equal consideration given to both or more emphasis on quantity; conversely in New Zealand the emphasis is more around quality. The four New Zealand cases are also more encompassing of integrated natural resource management (including freshwater) than most Australian cases. In all New Zealand cases, there is an almost equal consideration of three to four values, with recreation the least considered, particularly in those that emphasize indigenous partnerships,

whereas in Australia, economic and ecosystem health values are emphasized.

Groups tend to provide recommendations to the applicable state (Australian cases) or regional council (New Zealand cases) about the content of the statutory plan (typically covering a 5–10 year time frame). Exceptions were those groups typically focused on cogovernance, i.e., Fitzroy Partnership for River Health (FPRH), Derwent Estuary Program (DEP), and Waikato River Authority (WRA).

It was sometimes difficult to determine the “life” of the group. Cases at the bottom of the continuum have a more enduring status, beyond the life of recommendations made and plan completion. Conversely, those toward the top appeared to mostly only survive for the plan recommendation stage, and not for plan implementation and review. Thus, the clustering of Australian cases toward the top of the continuum shows the shorter, more determinate life of these groups.

Governance

Moving from consultation/government-based to cogovernance in Tables 4 and 5, the most obvious distinction is a shift away from a planning advisory function, and toward a role that involves either more of a quality assurance, e.g., the Fitzroy Basin Report Card (Fitzroy Partnership for River Health [date unknown]) or a

Table 3. Categorization of collaborative groups along the consultation/government-based to cogovernance continuum: Scope.

Consultation/Government	Purpose	Time frame	Scope Subelements						
			Quantity	Quality	Ecosystem health	Water Values			Economic development
						Recreation	Cultural	Cultural	
FB (Aus.)	To make recommendations for 10-year plan	Short term: plan development phase	***	***	**	**	*	***	
LLC (Aus.)	To identify issues, options to address them and to make recommendations for the plan	Short term: plan development phase	***	***	*	*	*	***	
KWAC (Aus.)	To make recommendations for 10-year plan; different committee reviews plan	Short term: plan development phase	***	***	**	**	**	***	
TANK (NZ)	To make recommendations for 10-year plan	Short term: plan development phase	***	**	***	***	***	***	
GH (Aus.)	To make provide advice for 8-year strategy	Medium term: strategy development phase	***	***	**	**	**	*	
FPRH (Aus.)	To monitor and evaluate the health of the river basin	In perpetuity	-	***	***	-	-	-	
DEP (Aus.)	To develop and implement an environmental strategy for the estuary	Five years	-	***	***	*	*	***	
S-WZC (NZ)	To prepare a programme for the integrated management of freshwater resources and to oversee plan implementation and review	In perpetuity	**	***	**	*	***	***	
SRT (Aus.)	To manage the health of the river through plan development and reporting	In perpetuity	***	***	***	*	*	***	
TWGG (NZ)	To develop a partnership between Ngāi Tahu,† and the regional and district governments for management and governance of the lake and its tributaries	In perpetuity	**	***	***	-	***	**	
WRA (NZ)	To manage the health and wellbeing of the river through restoration strategy development, resource and consent monitoring, and fisheries	In perpetuity	-	***	***	-	***	**	

NOTES:

FB = Fitzroy Basin Community Reference Panel; LLC = Lower Limestone Coast Water Allocation Plan; KWAC = Katherine Water Advisory Committee; TANK = TANK; GH = Glenelg-Hopkins Catchment Management Authority Advisory Group; FPRH = Fitzroy Partnership for River Health; DEP = Derwent Estuary Program; S-WZC = Selwyn Waihora Zone Committee; SRT = Swan River Trust; TWGG = Te Waihora Governance Group; WRA = Waikato River Authority

† Ngāi Tahu is a specific Iwi (tribal group) that includes Te Waihora and tributaries within its tribal area.

One * = low level of emphasis; Three *** = high level of emphasis

Table 4. Categorization of collaborative groups along the consultation/government-based to cogovernance continuum: Governance subelements (1-4).

		Governance Subelements (1-4)			
		Group membership	Establishment of subgroups	Indigenous representation	Statutory/nonstatutory
Consultation/Government-based	FB (Aus.)	State government appointed.	Not specified	Not specified	Statutory
	LLC (Aus.)	NRM [†] Board responsible for plan preparation. Appoints water allocation plan Reference Group.	Reference Group comprises representatives from forestry, and agricultural industries and the SA [†] Farmers' Federation and the Conservation Council of South Australia.	One member of the NRM Board must represent the interests of Aboriginal people.	Statutory
	KWAC (Aus.)	Advisory Committee established under Territory legislation; 13 members.	Technical Expert Group. Other technical advisors as required.	Committee includes two indigenous representatives.	Statutory
	TANK (NZ)	Committee appointed by Hawkes Bay Regional Council. 30 representatives; broad based.	Not specified	Ten indigenous representatives decided by the Tangata Whenua. [‡]	Statutory
	GH (Aus.)	CMA [†] responsible for strategy preparation. Appoints advisory group with community (5) and agency or industry representatives (5), plus indigenous community nominee (1).	Not specified	One indigenous community nominee on advisory group.	Statutory
	FPRH (Aus.)	Voluntary membership (includes industry, universities, state, and local governments). Partnership hosted by nonstatutory NRM group.	Management committee (nominees from partners); science advisory panel; technical network.	None, but partnership open to all interested parties.	Nonstatutory MOU [†]
	DEP (Aus.)	State and local governments, industry, universities.	Steering Committee; Technical Working Group; advisory issues-based groups as required.	None	Nonstatutory MOU [†]
	S-WZC (NZ)	Committee includes representatives from Tangata Whenua [‡] (5), Te Rūnanga o Ngāi Tahu [‡] (1), district council (1), regional council (1), community (6).	Subsidiary nonspecified focus groups that inform the committee.	Yes, as members of the committee	Statutory terms of reference
	SRT (Aus.)	Board comprises state government appointees (6), one appointed by minister (but nominated by WA LGA [†] Association), and CEO of appropriate state government department.	River Protection Advisory Committee includes relevant agency representatives. Other subgroups formed as required.	No indigenous representatives on Board	Statutory trust
	TWGG (NZ)	Governance group includes representatives from regional government (4), district government (1) and Tangata Whenua [‡] (5).	Joint committee (regional government [2]; Te Rūnanga of Ngāi Tahu [‡] [2]) oversees ecological and cultural restoration program.	50% Indigenous representation	Nonstatutory MOU [†]
Cogovernance	WRA (NZ)	Authority includes representatives from Iwi [‡] (5), regional council nominees (2), and three others (nominated on advice from national government).	Includes Waikato River Clean-up Trust, which manages a competitive restoration fund.	50% Indigenous representation	Statutory

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[†] CMA = catchment management authority, LGA = local government area, MOU = memorandum of understanding, NRM = natural resource management, SA = South Australia, WA = Western Australia

[‡] The term 'tangata whenua' refers to Māori people from a particular area/place; Iwi refers to tribal group; and Ngāi Tahu is a specific Iwi that includes Te Waihora and tributaries within its tribal area.

Table 5. Categorization of collaborative groups along the consultation/government-based to cogovernance continuum: Governance subelements (5-8).

		Governance Subelements (5-8)			
		Group mandate	Resourcing	Process allows for adaptation	Transparency of governance
Consultation/Government-based	FB (Aus.)	Community reference panel provides advice/recommendations to Minister.	State government	No, but plan expires after 10 years unless the Minister postpones the expiry. The Minister can also amend or replace plans at any time (subject to the provisions of the Water Act 2000).	Consultation report available outlining how submissions were considered. No minutes available online for community reference panel.
	LLC (Aus.)	Ministerial sign-off required.	State government	No, but plan reviewed within 10 years of adoption	More than 40 meetings held with stakeholders. Written submission process. Not available online.
	KWAC (Aus.)	Ministerial sign-off required.	Territory government	No, but five-yearly review of water allocation plan. New advisory committee appointed for plan review.	Advisory Committee minutes available online. Community and stakeholder meetings, written submission process.
	TANK (NZ)	Provides recommendations to Council, which generally accepts them providing they are consistent with legislation/policy.	Regional government	Evidence of changes to group management especially for Tangata Whenua [‡] ; changes to terms of reference have occurred.	Minutes online (but not up-to-date) and published reports.
	GH (Aus.)	Advisory Group provides advice to the CMA [†] board and senior management.	State government	Three-yearly Advisory Group review. Adaptive management cycle incorporated into the Waterway Strategy.	Advisory Group is responsible for conveying information about the CMA [†] and its activities to the community. No records available online.
	FPRH (Aus.)	Resides with partners.	Self-funded	MOU [†] may be reviewed /modified subject to written mutual consent of all parties.	No public meetings. Annual report cards available online.
	DEP (Aus.)	Partnership reviewed every five years.	State government and partners	No, but biennial review of implementation; five-year management plan revision.	Strategies and plans available online, no meeting minutes.
	S-WZC (NZ)	Only makes recommendations but seldom ignored.	Regional and district councils	Roll-over process for membership is defined; committee numbers can be changed.	Agenda and minutes of all meetings are available online.
Cogovernance	SRT (Aus.)	Ministerial sign-off required.	State government funds two-thirds, participants fund one-third	Unclear, but plan reviewed every five years.	Minutes not available online. Consulted 500+ community members, 21 LGAs [†] , & 15 state organizations.
	TWGG (NZ)	Final, requires majority government and Tangata Whenua [‡] agreement.	Equal resourcing between parties	Not specified, but the process has been adapted between interim and final arrangements.	Not specified
	WRA (NZ)	Jointly decide binding recommendations for the strategy and other functions.	Presumed from national government as part of Treaty of Waitangi settlement	Statutory	Annual report (available online) includes financial and related matters.

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[†] CMA = catchment management authority, LGA = local government area, MOU = memorandum of understanding, NRM = natural resource management, SA = South Australia, WA = Western Australia

[‡] The term 'tangata whenua' refers to Māori people from a particular area/place; Iwi refers to tribal group; and Ngāi Tahu is a specific Iwi that includes Te Waihora and tributaries within its tribal area.

more holistic role. For example, Swan River Trust's (SRT) role includes management plan development, implementation, and review oversight, WRA's includes administration of a competitive natural resource management fund, e.g., \$6m in the 2015 round (Waikato River Authority 2015), and the capacity to manage river fisheries (commercial and customary) that fall under the Fisheries Act 1996 (Government of New Zealand 1996).

In all of the cases, governance group arrangements are normally specified through either memorandum of understanding or terms of reference, through the formation of a specific trust or equivalent, or sometimes specified through law, e.g. settlements such as WRA; we refer to these collectively as "agreements." However, the type of agreement does not appear to vary in relation to the extent of power sharing. Group sizes vary from seven to an unlimited size, with no apparent variation along the continuum. In one Australian case (FPRH), membership occurs in three classes based upon level of resourcing provided to the partnership (Fitzroy Partnership for River Health 2013). Cases falling toward the cogovernance end of the continuum were more likely to have a nongovernment appointment process, for example, through indigenous groups determining their own appointments (WRA), through cash contribution (e.g., FPRH), or through elective processes (e.g., DEP), but not in all cases; in the SRT, an example of a community-based collaboration, appointments are still made by government.

Subgroups typically exist in arrangements located toward the cogovernance end of the continuum, which provide for delegation of particular governance functions. In some cases the specific nature of these is outlined in agreements, while in other cases the capacity to do so is merely mentioned. In general, these groups report to the main collaborative group rather than having authority in their own right. In the case of Te Waihora Governance Group (TWGG), an example of cogovernance, an additional "joint officials group" exists to support the implementation of a range of functional decisions made by the group; thus the arrangement is unique in specifying and overseeing a series of collaborative practices which, through their nature, should support partnered management.

In some cases, once again particularly toward the cogovernance end of the continuum, decision-making methods are specified; in other cases they are not. For example, the WRA agreement identifies that members must reach decisions pursuing consensus decision making (Government of New Zealand 2010; Schedule 6.9); although it provides detailed conflict management mechanisms, it fails to specify exactly what "consensus" decision making involves. In contrast, the TWGG arrangement defines consensus decision making as a majority of each of the party types: indigenous and government (combined local and regional).

Funding for arrangements also shifts from government toward greater partner cofinancing (or derived from settlement) as they move toward cogovernance. All nonstatutory arrangements provide for adaptation of governance arrangements, usually on a five year time frame; this has already occurred in the TWGG and DEP. In some cases, particularly in New Zealand, the workings of these groups are transparent to outside parties, e.g., minutes are publically available, but in other cases they do not appear to be so or at least are not easily accessible.

Indigenous engagement in groups, as opposed to a scope that includes indigenous interests, varies significantly. For Australian cases, Glenelg-Hopkins Catchment Management Authority Advisory Group (GH) and Fitzroy Basin Community Reference Panel (FB) are the only groups with Aboriginal membership, although nothing precludes Aboriginal peoples' membership in other groups. The inclusion of Tangata Whenua (indigenous peoples from a particular area) in all New Zealand arrangements described here can be viewed as an assertion of values and responsibilities upheld through recognition of the Treaty of Waitangi (for additional detail see Jacobson et al. 2014 and the discussion).

New Zealand arrangements toward the cogovernance end of the continuum are based on government-indigenous partnerships. In the case of TWGG, this represents a layering of arrangements building from a joint-management arrangement of the riparian lake margin as specified in treaty settlements, toward engagement in the Zone Implementations Programme, which effectively attempts to manage the quality of water entering the lake, and further through the nonstatutory cogovernance arrangement and associated Whakaora Te Waihora Cultural and Ecological Restoration Program (covering core tributaries and the lake), which together recognizes the interests of Tangata Whenua as a government partner, and enables them to fulfil cultural responsibilities and provides for cultural values, e.g., food resources. A similar scope is provided for through the WRA.

Management

The main pattern observable along the continuum is inherently due to the broadening responsibilities beyond management plan development to include monitoring and reporting (Table 6). Arguably though, planning inherently involves a degree of evaluation. Country differences were more apparent. All Australian groups have specific monitoring and reporting responsibilities, either through self-assigned responsibilities (FPRH and DEP), or as required by state or other external parties, e.g., Lower Limestone Coast Water Allocation Plan Reference Group (LLC). These responsibilities are generally around outcome monitoring and reporting. Typical reporting is annual but for some it is quarterly (DEP), and others biennial (SRT). Both DEP and FPRH utilize healthy waterways report cards. A report card system is being implemented for the WRA (John Quinn, National Institute of Water and Atmospheric Research, Hamilton, 4 September 2015, *personal communication*), and another has been implemented for Te Waihora Lake Ellesmere and was reported at the biennial living lake symposia (Lomax et al. 2015). In New Zealand, monitoring is typically less prescriptive, with no specified requirements for Selwyn Waihora Zone Committee (SWZC), TWGG, or TANK. The WRA reports annually. Collaborative arrangement monitoring (see Izurieta et al. 2011) is only explicit for the SRT.

DISCUSSION

We discuss insights from this assessment through reflecting on the following: (1) Lessons for management of waterways in Australia and New Zealand; (2) Framework application; and (3) Relevance to international audiences.

Lessons for Australia and New Zealand

Although our assessment focused on collaboration, this can be further disaggregated into decision making (i.e., governing),

Table 6. Categorization of collaborative groups along the consultation/government-based to cogovernance continuum: Management.

		Management Subelements	
		Monitoring	Reporting
Consultation/Government-based	FB (Aus.)	Monitoring of outcomes included in plan, but no monitoring of process. Group is not involved in monitoring.	No role.
	LLC (Aus.)	Monitoring (required under legislation) of ecological/hydrogeological performance, evaluation of effectiveness/efficiency of environmental water provisions.	Annual water use reports submitted to the South Australian Government Department of Environment, Water and Natural Resources.
	KWAC (Aus.)	Monitoring program based upon performance indicators of river health, use, quality, cultural purposes, water trading activity.	River health monitoring reported annually. All other performance indicators reported once, either prior to five year review or between five and ten year reviews.
	TANK (NZ)	No role.	No role.
	GH (Aus.)	Strategy includes a monitoring, evaluation and reporting framework consistent with state wide processes on long-term resource condition, management outcomes, management outputs.	Annual reporting on activities and outputs, monitoring, evaluation, and reporting plan reviewed annually, eight-yearly report on resource condition, end of strategy review includes reporting on outcome targets.
	FPRH (Aus.)	Integrated waterway health monitoring program at the catchment scale.	Monitoring of programs.
	DEP (Aus.)	Annual report cards, agricultural water use summaries, and drinking water summaries are created.	Quarterly e-bulletins, annual report cards, five-yearly State of the Derwent Estuary report.
	S-WZC (NZ)	Provides advice on and overview of monitoring.	Provides advice on and overview of reporting.
	SRT (Aus.)	Monitoring of collaborative management, social wellbeing, and river/ecosystem health.	Reports biennially to the Western Australian Minister for Environment against targets; annual reports are a statutory requirement.
	Cogovernance	TWGG (NZ)	Not applicable, as no management functions, although Whakaora Te Waihora plan does include monitoring.
WRA (NZ)		Management plan monitoring, cash grant outcome monitoring.	A publically available and comprehensive annual report.

NOTES:

FB = Fitzroy Basin Community Reference Panel; LLC = Lower Limestone Coast Water Allocation Plan; KWAC = Katherine Water Advisory Committee; TANK = TANK; GH = Glenelg-Hopkins Catchment Management Authority Advisory Group; FPRH = Fitzroy Partnership for River Health; DEP = Derwent Estuary Program; S-WZC = Selwyn Waihora Zone Committee; SRT = Swan River Trust; TWGG = Te Waihora Governance Group; WRA = Waikato River Authority

† Ngāi Tahu is a specific Iwi (tribal group) that includes Te Waihora and tributaries within its tribal area;

implementation, and regulation (i.e., management). Our framework assessed collaboration with regard to both of these. Nkhata and Breen (2010) distinguish between governance and management cycles, positing that a governance learning cycle involves articulation and sharing of values, the development of policies and agreements, the enactment of those policies and agreements, and their monitoring and evaluation. The management learning cycle involves objective setting and planning, action taking, and monitoring and evaluation. Coupling of the two depends on effective information flows, addressing and resolving (if possible) competing interests, and lesson sharing. Collaborative management arrangements have an inherent role to play in linking the two learning cycles. Thus,

although arrangements of limited scope might serve governance learning purposes, they are unlikely to support effective management learning, particularly where monitoring and evaluation of process and/or outcome are missing. In examples where a succession of arrangements has occurred and/or polycentric arrangements exist, e.g. Te Waihora and Fitzroy Basin, there is a need for ongoing and collaborative monitoring and evaluation of outcomes and processes to ensure activities link and align.

Our analysis identifies lessons for water managers in both countries but with potential application also elsewhere. New Zealand policy makers could strengthen their collaborative

approaches by including more emphasis on monitoring and evaluation of the group's progress and management outcomes, despite the fact that the WRA is very strong on this element. Such requirements appear absent from the three other New Zealand cases examined. Equally, Australia could think more about broadening the mandate/scope of collaborative approaches so that a more integrated approach to water resource management, including land use, is undertaken. Another opportunity that could be taken in Australia is to more fully embed the collaborative processes to include plan implementation, monitoring, and reporting. Finally, more consideration could be given to taking a more inclusive approach to group membership where appropriate, i.e., by including more community representatives, such as from environmental and recreational interests. These responses highlight jurisdictional biases evident in the practice of collaborative freshwater management, in terms of the actual things people collaborate on, and the capacity of collaborators to learn from the outcomes of their decisions.

Perceptions of water scarcity are arguably a key economic driver of the development of these collaborative processes, in both countries. Ongoing drought in Australia has hastened reforms targeted at greater coordination of water management regimes across jurisdictions. State, federal, and intergovernmental reforms were hastened by the Millennium Drought that was experienced throughout much of Australia from the mid-1990s to approximately 2010 and likely played a greater role in hastening government-led water reform (Smith 2015) resulting in a high number of top-down water planning processes, e.g., Katherine Water Advisory Committee (KWAC) and FB. Droughts along the eastern side of the South Island and in the Hawkes Bay (TANK) of New Zealand have been one of several drivers leading regional government to invest in and promote collaborative approaches through regional strategies, e.g., the Canterbury Water Management Strategy within which the SWZC sits.

In parts of both countries, e.g., the Waikato River (Waikato Regional Council) and Tasmania (DEP), water quality and other environmental drivers are more important. For example, the impacts of Tasmania's forest legacy (Jacobson et al. 2014), and ongoing concerns about nutrient loading affecting water quality in Lake Taupo and the Waikato River system (WRA), and in the Canterbury Plains (TWGG) tend to override water quantity concerns. To some extent, these drivers have been complemented by national fora such as the New Zealand government initiated Land and Water Forum (a multistakeholder initiative advising government on policy initiatives) and the National Policy Statement for Freshwater Management (Ministry for the Environment 2014). Australia's regional approach to natural resource management, also implemented through intergovernmental agreement (Head and Ryan 2004, Curtis et al. 2014), renders regional organizations an appropriate scale for water management (e.g. GH, LLC, KWAC, SRT).

Social drivers also significantly impact collaborative management. Australia has a long tradition of community engagement in community based natural resource management, most likely because of a lack of regional government, which led to the statutory formation and substantive business development of previously catchment based "care" groups (Curtis et al. 2014). It is unsurprising that community engagement exists in cases like SRT and DEP where there has been strong historic engagement,

but where funding has waxed and waned. Indigenous cultural considerations are a key driver of the clustering of New Zealand cases toward the cogovernance end of the continuum.

New Zealand's National Policy Statement for Freshwater Management (Ministry for the Environment 2014) directs councils to "involve iwi [tribes] and hāpu [subtribes] in the management of fresh water and freshwater ecosystems in the region" (Ministry for the Environment 2014:18). Water is a tāonga (treasure) for Māori in New Zealand and the mauri (life force) of water is an important driver of ongoing Māori grievance. Tangata Whenua commonly identify issues around freshwater management including the mixing of waterways (both water courses and the release of human waste into streams, rivers, and lakes), the health of food resources, and the mauri of water (Memon and Kirk 2012). For example, the Waikato-Tainui Iwi Management Plan "Whakatapuranga 2050" (a nonstatutory planning document) identifies that "waterways are living embodiments of our tribal identity" (Te Kauhanganui o Waikato Incorporated 2013:4) and likewise the Maahanui Iwi Management Plan (Jolly and Ngā Papatipu Rūnanga Working Group 2013:75) covering TWGG and SWZC areas identifies that "water is a significant cultural resource that connects Ngāi Tahu to the landscape and the culture and traditions of the Tūpuna [ancestors]," noting that current water governance and management has failed, and that a change is needed in the way in which water is valued. Because Treaty of Waitangi claims are progressively being negotiated, there is an increasing range of outcomes with implications for specific catchments. The WRA is a specific outcome of three such settlements and reflects then an ongoing commitment to cogovernance by the national government and Iwi, in a similar way to which the TWGG sets up a process for such arrangements for Tangata Whenua from Ngāi Tahu. This driver helps explain the development in New Zealand of specific and strong collaborative arrangements at the cogovernance end of the continuum.

Unlike Māori in New Zealand, it is difficult to make generalizations about the importance of water to Australian Aboriginal peoples given the cultural diversity that exists. A second issue is the limited extent (geographical and temporal) of formally recognized native title, and even when native title exists, Durette (2008) argues that the legislative provisions are difficult to uphold given the lack of common law recognition for spiritual relationships with country (including water). Although there is low Aboriginal engagement in collaborative groups we reviewed, provisions do exist within the National Water Initiative for indigenous and cultural values for water, under the auspices of environment and other public benefits.

Water plans and planning can (1) incorporate indigenous social, spiritual, and customary aims and strategies for achieving them; (2) take account of the possible existence of native title rights to water in the catchment or aquifer area; (3) potentially allocate water to native title holders (albeit this right appears secondary to commercial values); and (4) account for any water allocated to native title holders for "traditional cultural purposes" (Jackson 2007:63). These processes have however been criticized as struggling to adequately account for Aboriginal interests and rights (Ayre and Mackenzie 2013). Along with multiple examples detailed by Jackson (2007), other instances include Guditi Miring (whose native title and land rights have been settled) who are

engaged in three other cooperative development, management, and planning processes operating at the landscape scale in the GH catchment area (see Appendix 1); in South Australia (but not specifically the LLC) significant recent work has been done exploring cultural values associated with water (Nurse-Bray and the Arabana Aboriginal Corporation 2015), and in the land area above the Tindall Limestone Aquifer (KWAC), the Jaowyn people are actively engaged in management of natural resources including National Parks (Nitmuluk) for spiritual and cultural purposes. Thus, water may be a tacit part of other engagement opportunities that exist for traditional owners to express their rights and responsibilities for its management. However, the commitment to do so is weaker than in New Zealand, where treaty settlement, formal agreements outside of treaty settlement, and the Resource Management Act 1991 (Government of New Zealand 1991) provisions provide significantly stronger opportunities, including for fully devolved management (see Jacobson et al. 2016a).

Despite legal recognition of indigenous rights, e.g., through the UN Declaration on the Rights of Indigenous Peoples, both countries have been slow to operationalize recognition, as have Canada and the USA (see for example Lightfoot 2008). Perhaps unsurprisingly then, the comparative analysis reported here indicates variable inclusion of indigenous interests. It is clear that with the increasing emphasis on cogovernance and management opportunities, will come an expectation of achieving high levels of emphasis for recognition of cultural values and associated explicit inclusion of indigenous representation in governance. Such a pattern has emerged in New Zealand but not so clearly in Australia.

Framework application

The framework was constructed as a way of classifying a selection of existing collaborative approaches to water resource management across Australia and New Zealand. Eleven groups (seven in Australia) were examined and were fitted to the continuum from government (consultation/government-based) to devolved power sharing (cogovernance). Five of the groups could be described as primarily consultative in nature because they were tasked with advising on or making recommendations about the content of a particular planning document and thus typically had a shorter time frame and narrower scope, i.e., groups were at best engaged for shorter periods of time, albeit not for less important activities. The remaining six groups can be considered as arrangements more closely aligned with cogovernance, with three of the four New Zealand groups in these categories. Notable in this grouping is the greater scope, higher level of specified involvement of indigenous peoples, clarity of monitoring and reporting (especially in Australia), and ongoing involvement with more than just planning. Our cogovernance category is novel in terms of the power sharing continuum derived from Sen and Nielsen (1996) and Borrini-Feyerabend et al. (2004), in that it does not necessarily imply direct involvement in actual management implementation, but operates at a relationship and strategic direction setting level, with government and tribal organizations responsible for management implementation.

Our framework extended Borrini-Feyerabend et al. (2004), given that comanagement varies in relation to other factors as well, such as participation scope, formality, and focus on governance and

or management. Our framework differs from Hill et al. (2012), because some of the arrangements do not include intercultural purpose, and because we do not consider scope, governance, and management variations as continua. That being said, our indigenous-government partnerships would also not easily align with their typology. First, the Waikato River Authority is specifically a partnership with different components that arguably have different intercultural purposes, such as fisheries management under the Fisheries Act 1996 (Government of New Zealand 1996) as opposed to recommendation and endorsement of a management plan. The intercultural purpose of TWGG is clear though not easily placed along this continuum; it is a partnership agreement that sets out to share power but not in a way that denigrates the existing legislated responsibilities or interests. It includes a set of collaboration processes in relation to various functions of the members (rather than participation), and it defines a new intercultural purpose of good faith and no surprises, while not excluding further treaty or nontreaty-related arrangements. Our framework elements also differ to Szabo and Smyth's (2003) elements that are more prescriptive about resource ownership and property rights, as well as capacity development within an indigenous-government partnership context.

Many of our framework elements correspond with those in Plummer and Fitzgibbons's (2004) comanagement framework. For example, we have considered resource- and rights-based contextual drivers, in a more distinguished social, political, economic, and environmental context. Our scope, governance, and management elements are also similar to that of preconditions, characteristics, and outcomes. However, our analysis identifies that not all of these are relevant, appropriate, or necessary as a means of developing a freshwater management framework, and would, particularly if component subcategories are included, result in a very prescriptive framework that overdifferentiates between examples and inhibits learning across them.

In comparison to Margerum and Robinson (2015), our analysis reveals arrangements are more nuanced, and recognizes that one arrangement can cover actions, organization and policy levels, and be cooperative and collaborative depending on which level is being considered (particularly for layered arrangements). Existing typologies or frameworks of collaborative management therefore do not fit neatly to the freshwater context revealed here.

This comparison of frameworks is itself interesting, highlighting that framework design depends on the following: (1) the elements perceived to be important to a given context, e.g., to indigenous-government collaboration; and (2) the intended use of the framework, e.g., detailed description or comparative analysis. In our case, no clear patterns in management subelements emerge across the continuum. For scope subelements, cogovernance arrangements appear more enduring, but do not necessarily include consideration of a broad range of values associated with freshwater. For governance subelements, decision-making mandate, indigenous engagement, and multisourced resourcing were associated with cogovernance, but not whether the process was statutory, transparent, or able to be adapted. We thus concur with Fischer et al. (2014) that a more nuanced understanding of comanagement that recognizes the historicity and evolving nature of arrangements is necessary.

Relevance to international audiences

Our results are also relevant elsewhere. For example, if we were to develop an “ideal type” for cogovernance, core ingredients would include flexible but long-term arrangements, focused on a specific array of values deemed important to partners, with equitable resourcing. These are highlighted in arrangements for the management of Auyuittuq National Park, Canada, but not the binding nature of agreed decisions (see Jacobson et al. 2016b). This ideal type also allows for parallel systems of governance, coming together on issues of common interest; as argued for by Fischer et al. (2014) in studies of comanagement of conservation areas in Ethiopia, care needs to be taken in such cases to avoid management by cooption. Our Te Waihora Governance Group (TWGG) and Waikato River Authority (WRA) arrangements appear to have achieved both of these, through multilayered rather than evolutionary arrangements (TWGG), and clarity provided through statutory negotiation (WRA). These arrangements also address conflict tensions observed in South Africa because of lack of agreement on material benefits from comanagement and settlement of land claims (Thondhlana et al. 2016). Conflict has also been evident in the Haida Gwaii settlement (Canada), where there is tacit agreement to disagree on the nature of power-sharing under comanagement despite a collaborative planning process (Takeda and Røpke 2010). Although we applaud efforts for equity in stakeholder representation in comanagement, we must also remember the importance of social network structure (having the right people, in the right place, at the right time) to comanagement success (Crona and Bodin 2006); this is perhaps why there was no discernible pattern in group membership breadth along our continuum.

Finally, our results build on Eberhard et al. (2017), who examined water policy governance networks in six cases in Australia, France and the United States based on governmentality theory. Their work did not examine values nor the changing nature of Indigenous 'power' in new and emerging arrangements, neither within the context of governance or of management. Our proposed framework sits within the context of effective environmental management and provides a mechanism for policy makers to rapidly consider the substantive nature and choices of design in collaborative management arrangements. This contribution is testable and able to be adapted to context.

CONCLUSION

Overall, our research makes several important contributions. Theoretically, it has developed a draft framework that has proved beneficial in identifying commonalities but also important differences both within and between countries. These differences offer important insights to managers and policy makers and, in particular, are linked to (1) strengthening monitoring and reporting in the New Zealand context; and (2) more open and inclusive governance processes and broader scope to identify integrated solutions to water resource management issues, e.g., the exercise of indigenous rights and expectations, in the Australian context. These likely apply to other international jurisdictions, e.g., Canada and the United States, where there are similar jurisdictional arrangements.

Our analysis has indicated that the scope, governance arrangements, and management functions of collaborative water

management in Australia and New Zealand are intrinsically linked to national scale drivers. A shift toward greater partnership status of arrangements (more common in New Zealand than Australia) provides a more deliberative process, but not necessarily one that is more democratic or representative of all community interests in equal measure.

Three main areas for future research can be identified. A broadening of cases including from other jurisdictions would further test the framework's application. More in-depth, on-the-ground analysis, would strengthen and potentially modify the cross-cutting elements. Finally, disciplinary-focused evaluation of specific elements would further refine them.

Our framework identifies a provisional continuum from less to more inclusive responses to various drivers of freshwater management. Although we have focused on collaborative arrangements, we are aware that the design principles of Ostrom (1990) could refine the elements within the framework. The significance of our analyses is that we are able to demonstrate a means of comparison that captures the multilevel and polycentric nature of collaborative arrangements evident in Australian and New Zealand freshwater management.

Responses to this article can be read online at:

<http://www.ecologyandsociety.org/issues/responses.php/9582>

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