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Pristine Waters of Tasmania? An Analysis of Water Quality Governance Using a Polycentric Environmental Governance Framework

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ABSTRACT

Tasmania, an island state in Australia, is renowned for its unspoiled natural environment. However, ongoing pollution in Tasmania's rivers, estuaries, and coastal regions, driven mainly by primary industries, raises significant concerns. This pollution will likely worsen without more effective mitigation measures. In this study, we apply a polycentric environmental governance framework to critically examine Tasmania's water quality challenges. The limited regulatory actions taken to address water pollution reflect an asymmetric power dynamic between major industry players and state-level governance bodies, potentially obstructing state-based regulatory reforms. Instead of relying upon state-level interventions, we argue that a national-level policy initiative could strengthen water quality governance in Tasmania and other Australian states and territories. Our findings also emphasize that the value of a polycentric governance framework lies in its capacity to uncover hidden obstacles and to address multi-scalar challenges, offering valuable policy insights at broader levels.

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Introduction

Water quality challenges span regions and jurisdictions, presenting complex environmental governance issues (Wuijts, Driessen, and Van Rijswijk 2018; OECD 2011). In Australia, microbial hazards, sediment and dissolved oxygen changes from primary sector sources are common stressors (DAFF 2002). For example, agriculture can potentially introduce nitrogen and phosphorus stressors, whilst aquaculture is often associated with water turbidity from fecal deposits and antibiotics from fish feed. Forestry may also contribute to water turbidity from land clearance.

Tasmania is known for its pristine environments under the Brand Tasmania initiative (National Parks and Wilderness 2022; Tasmania Parks & Wildlife Service 2023). "Brand Tasmania", created under the Brand Tasmania Act 2018, is a government effort aiming

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to the state's image and reputation. Surprisingly, Tasmania exhibits some of Australia's poorest water quality, with significant issues stemming from forestry, agriculture, and aquaculture (Proemse et al. 2022). While drinking water quality across Australia's major urban areas surpasses 90% compliance, Tasmania only achieves 76% (Hasan 2019; Coleman 2017). Unsatisfactory water quality was reported in the River Derwent, Hobart's primary drinking water source (Proemse et al. 2022); further concerns have arisen from the Tamar Estuary due to high pollutant levels (Argent 2017). The Huon Estuary in the south, a center for salmonid aquaculture, faces nitrogen influx from fish feed, drawing media scrutiny (CSIRO 2000; Coulter 2022). Agricultural practices, particularly stock grazing, are linked to poor riverine water quality (DPIPWE 2020). The Waterbug Blitz initiative, which evaluates insect species as a proxy water quality indicator, reveals a significant decline in the health of Tasmania's riverine systems from 1998 to 2020, primarily due to intensive eutrophication and oxygen depletion (Tasmanian River Alliance 2022).

Despite contributing to deteriorating water quality, primary industries serve as the economic backbone of Tasmania. Agriculture, forestry, and fishing (AFF) ranks as the state's second most valuable sector, accounting for 11.2% of total Gross Value Added (GVA) following healthcare and social assistance (DTF 2022). Key AFF contributors include salmonid aquaculture, contributing \$888 million; and dairy farming, contributing \$506 million in 2019–2020 (AgriGrowth Tasmania 2020). The AFF sector represents 5% of total employment in Tasmania, ranking as the ninth largest employing industry. Notably, 18% of the AFF workforce is engaged in aquaculture, 10% in dairy farming and 6% in forestry and logging (Worksafe Tasmania 2018).

Within this context, it is crucial to address water quality issues whilst ensuring the social and economic benefits derived from primary industries. Recognizing governance as a pivotal factor in effective environmental management and conservation (Bennett and Satterfield 2018, 1), we explore Tasmania's governance system for solutions for water quality management. Given the complexity of water quality governance, we advocate for a polycentric environmental governance framework.

Polycentric governance (Ostrom, Tiebout, and Warren 1961) involves decision-making centers across multiple localities, jurisdictions and scales converging toward a common goal (Bennett and Satterfield 2018; Ostrom 2010). Polycentric governance can provide institutional diversity; mechanisms for mutual learning; and opportunities for participation and cooperation (Carlisle and Gruby 2019; Marshall 2009). Polycentric systems can enhance adaptability and resilience, contributing to robustness in responding to shocks (Baldwin et al. 2018). This framework is beneficial for addressing various environmental and natural resources challenges including climate change, water governance and marine governance (Ostrom 2010; Baldwin et al. 2018; Morrison 2017). Yet challenges persist in achieving effective governance within a polycentric system. As authority and responsibility in the polycentric system are distributed among a network of state and non-state actors, legitimacy and accountability can become problematic (Bäckstrand, Zelli, and Schleifer 2018; Huitema et al. 2009). Higher transaction costs associated with coordination within a complex system to avoid “unnecessary duplication of efforts and counterproductive actions” are another challenge associated with a polycentric governance system (Huitema et al. 2009, 26). Furthermore, tensions within and between institutions and power asymmetries also underpin the effectiveness

of the polycentric governance (Morrison et al. 2019; Mudliar 2021), a key point which we will investigate in this study.

Discussions of polycentric governance have historically centered on local and decentralized contexts (e.g. Ostrom, Tiebout, and Warren 1961). This localized focus later contributed to significant paradigm shifts in natural resource governance, highlighting the value of decentralized, local institutions in addressing environmental and resource challenges (Ostrom 1990; Dressler et al. 2010; Wang, Fisher, and Connell 2019). While this shift has yielded numerous positive ecological outcomes and enhanced wellbeing at some sites (Oldekop et al. 2019; Western and Wright 1994), it may also obscure the benefits of adopting a broader perspective to tackle environmental issues more effectively.

Recent scholarship has advanced our understanding of polycentric governance by examining its implications beyond the local scale. Andersson and Ostrom (2008) contend that in a polycentric system, institutional arrangements operating at various scales play a critical role in natural resource governance. Pahl-Wostl and Knieper (2014) underscore the importance of coordination among different nodes of authority and advocate for balancing bottom-up and top-down influences within polycentric governance frameworks. Additionally, Gruby and Basurto (2013) explore how scalar politics impact the effectiveness and degree of polycentricity.

Building on this broader perspective of polycentric governance, this study addresses the challenges of water quality governance in Tasmania. Through this study, we aim to illustrate the utility of the polycentric governance framework in identifying and addressing latent obstacles within governance systems. Furthermore, we also apply a polycentric approach to propose solutions that extend beyond a local focus. Subsequent sections will outline the significance of three primary industries—agriculture, forestry, and aquaculture—in terms of their environmental, economic and socio-political contributions. Regulatory instruments will be assessed, focusing on power asymmetries among different actors and illustrating the challenges of water quality governance in Tasmania. The discussion and conclusion sections will offer policy recommendations.

Environmental, Economic and Socio-Political Perspectives of Primary Industries

In this section, we outline the environmental (focusing on water quality), economic and socio-political significance of the selected primary industries in Tasmania. Understanding this significance is crucial to discussing the environmental governance of water quality. Table 1 presents an overview of the different perspectives.

Agriculture, forestry, and aquaculture activities in Tasmania can significantly impact water quality. Agriculture leads to eutrophication from fertilizer run-off; altered river flow due to irrigation, and sediment build-up from land clearing. In particular, dairy farming can contribute to river pollution through effluent. Logging may increase nutrient levels, sediment concentrations, and turbidity, impacting rivers and reducing dissolved oxygen. Aquaculture—particularly salmonid aquaculture—is a major contributor to water quality deterioration in riverine and coastal ecosystems, releasing pollutants such as fecal deposits and antibiotics from fish feed. An ecological assessment

Table 1. Environmental, economic and socio-political (EES) perspectives of selected primary industries in Tasmania (2019–21).

Industry	Environmental (water quality)	Economic	Socio-political
Agriculture	Chloride, nitrogen, and phosphorus from fertilizers	2019–20: AU\$3.22b gross value (Agrigrowth Tas 2020)	‘Brand Tasmania’ depends upon a green, clean reputation to promote agricultural products and generate tourism revenue
Forestry	Turbidity from land clearance	2020–21: AU\$986m total sales (DPIPWE 2021)	Track record of effective environmental activism against logging
Aquaculture	Turbidity from fecal deposits; antibiotics from fish feed	2020–21: AU\$950m gross value (FPA 2021)	Political will to increase the economic contribution of the sector, especially salmonid aquaculture

of the Huon Estuary revealed that increased ammonium concentrations and decreased bottom water oxygen concentrations were likely due to the expansion of salmonid aquaculture (IMAS 2012). Yet these primary industries are fundamental to Tasmania’s economy despite contributing to water quality deterioration. AFF is the state’s second-largest industry, with a steady increase in production value. Agriculture and aquaculture contribute significantly to export value, generating profitable surpluses for interstate and overseas markets (Rockliff 2015).

These industries also present diverse socio-political dynamics relevant to environmental governance. Tasmania’s agriculture benefits from an image of a clean and pure environment, aligning with the state’s promotional efforts. The Brand Tasmania webpage states that “In Tasmania, we protect our environment. As a result, everything we grow and make here is different” (Brand Tasmania 2023). In comparison, the Tasmanian forestry industry has a dissimilar socio-political dynamic due to significant levels of old-growth logging, which has long been a target for environmental activism (Tranter 2010) by groups such as The Wilderness Society and the Tasmanian Greens.

Aquaculture, especially salmonid farming, may be the most controversial AFF industry. There has been a significant expansion of aquaculture’s operational capacity over the last two decades (EPA 2022b) during which time water quality deterioration has been evident. Higher salmon production may result in lower levels of oxygen and dead zones that are detrimental to water quality and events like the 2018 and 2025 mass fish deaths in different parts of Tasmania attracted significant attention (CSIRO 2018; Holmes 2025). Consumer-level campaigns include the Australian Marine Conservation Society’s “Say No” rating for Atlantic salmon farmed by Huon (GoodFish 2019) and local protests by the Tasmanian Greens and the Neighbors of Fish Farming (NOFF) against aquaculture expansion (Rojahn, Dunlevie, and Whitfield 2025). The 2022 Parliamentary Fin Fish Inquiry Report recommended a pause to expansion and a reduction of inshore fish farming; and further proposed that “an independent review of the impacts of fin fish operations on inland waterways should be conducted, and state-wide Water Quality Objectives developed” due to the “significant environmental impacts of salmon farming” in waterways close to the World Heritage Area (Tasmanian Times 2022, 30).

In summary, the selected primary industries exert varied and substantial environmental, economic and socio-political impacts, all of which are pivotal to the subsequent analysis of water quality governance.

Regulatory Instruments for Water Quality Governance in Tasmania

Environmental governance should be robust, responsive, equitable and practical. Effectiveness is defined as the ability of governance systems to support the integrity and proper functioning of the environment (Bennett and Satterfield 2018). This section will provide an overview of state-level regulatory instruments to understand the challenges to effective water quality governance in Tasmania.

Australia’s federal government system designates individual each state’s primary responsibility for water resource management (Bates 2023). In Tasmania, the State Policy on Water Quality Management 1997—overseen by the Environment Protection Authority (EPA)—serves as the overarching regulatory instrument, setting specific targets for inland, estuarine, coastal, marine and groundwater quality (EPA 2022a). Additionally, several regulations manage different aspects of water quality. The Water Management Act 1999 designates using river and estuary water to support economic activity, especially in agriculture (DNRE 1999). This Act facilitates the development of ‘water management plans’ with stakeholders to ensure “the sustainable development and management of a water resource” (DNRE 2023). The Environmental Management and Pollution Control Act 1994 pertains to riverine aquaculture and dairy effluent management; the Act addresses pollution sources and uses the TasWater Corporation to monitor drinking water quality (EPA 1994; TasWater 2022). The Forest Practices Act 1985 (Parliament of Tasmania 1985) was not designed to address specific water quality issues. However, it mandates forest practice plans, requiring a minimum distance between waterways and logging activity and employing physical barriers to prevent sediment run-off (FPA 2017). This Act is administered by the independent Forest Practices Authority (FPA) and enforced by Forest Practice Officers (Parliament of Tasmania 1985). Table 2 maps the main regulatory instruments to the relevant governance authorities.

Power Asymmetries through Polycentric Governance

Tasmania’s water quality continues to degrade despite the various regulatory instruments described above, raising concerns among civil, community and political entities. We contend that power imbalances among key actors within a polycentric water quality

Table 2. Selected water quality regulatory instruments and authorities, Tasmania.

Instrument	Industry	Relevance to water quality	Authority	Features
State Policy on Water Quality Management 1997	Cross-sector	Defines targets for inland, estuarine, coastal, marine, groundwater quality	EPA	Sets water quality targets
Water Management Act 1999	Agriculture	Develops management plans with stakeholders for sustainable management	DNRE	Ongoing supply of riverine freshwater for agriculture
Environmental Management and Pollution Control Act 1994	Agriculture, aquaculture	Prevent, reduce and remediate multiple pollution sources	TasWater	Relevant to aquaculture, dairy effluent management
Forest Practices Act 1985	Forestry	Requires: (a) minimum distance between waterways and logging activity; (b) physical barriers to protect waterways from run-off	FPA	On-the-ground enforcement by officers

governance system contribute to its ineffectiveness. As mentioned earlier, polycentric governance can heighten complexity (Newig and Fritsch 2009) and power disparities among key actors and may impede the effectiveness of intricate governance networks (Morrison et al. 2019). Morrison et al. outline three types of power within a governance system: ‘power by design’ involves formal authority to establish rules and incentives; ‘pragmatic power’ interprets and enforces rules; and ‘framing power’ establishes norms and influences discourse (2019). Below, we analyze Tasmania’s water quality governance based on these three power types.

Power by Design

The authorities listed in Table 2—EPA Tasmania, Department of Natural Resources and Environment (DNRE), TasWater, and the FPA—exercise power by designing and/or applying relevant policy instruments (outlined in the previous section). While EPA Tasmania holds the primary responsibility among all departments/agencies, power by design may not always translate to pragmatic power. In the current case, TasWater conceded its inability to manage aquaculture nutrient pollution in the Derwent catchment due to the geographical size of the site (Flanagan, Kurzel, and Castles-Lynch 2021), exemplifying a mismatch between power by design and pragmatic power.

Pragmatic Power

The economic and employment impacts of the Tasmanian primary sector are substantial, with a 2020–21 contribution of approximately AU\$3.59 billion (DTF 2021). The state government’s AgriVision 2050 strategy aims to increase primary sector revenue significantly by 2050 (AgriGrowth Tasmania 2018). Sustainable Timber Tasmania, Van Dairy and the three major salmon farmers—Huon Aquaculture, Petuna, and Tassal—hold significant pragmatic power.

Logging, which generated AU\$124 million in total state revenue in 2020–21 (Sustainable Timber Tasmania 2021), is represented by the government-owned Sustainable Timber Tasmania (STT) and regulated by the FPA. While old-growth logging in Tasmania historically intersects with environmental activism—and land clearing has potential impacts on water quality—no recent regulatory record of significant water quality deterioration is linked to STT.

Dairy farming is Tasmania’s second-largest industry within the AFF sector (Khan et al. 2010) and is regulated by the Tasmanian Dairy Industry Authority (TDIA). Effluent mismanagement has been a concern for years. In 1991, the state government tasked local councils with addressing this problem (Hubble and Phillips 1999) and the Managing Dairy Farm Effluent in Tasmania Code of Practice was established by the State Dairy Effluent Working Group (1997). Later regulatory action included an investigation by the TDIA and EPA Tasmania into Van Dairy—Tasmania’s largest dairy company—due to recurring issues which included “increases to herd size without upgrading the effluent system, a failure to maintain and clean out systems and a lack of infrastructure such as irrigation equipment” (Langenberg 2021). A temporary license suspension for effluent overflow followed the probe.

The ‘Big Salmon’ trio of Huon Aquaculture, Petuna and Tassal wields considerable pragmatic power in Tasmania’s water quality governance. Past instances, such as a lack of visible regulatory repercussions after Tassal failed a voluntary water quality standard in 2015 (SCS Global Services 2015), highlight potential governance issues. These were further underscored by the controversial Marine Farming Planning Review Panel (DNRE 2025), an expert panel which approved several fish farm expansions in 2018, after which two panel members resigned in protest on the basis that the panel was acting as a rubber stamp approving “operationally convenient” proposals for the industry (Humphries 2019a, 2019b). Despite the resignations, the panel approved further expansion for Petuna in 2019, even though the only members present at the approval meeting were industry and government representatives. The 2022 Parliamentary Fin Fish Inquiry Report recommended a pause to salmon farming expansion, but this inquiry’s impact on Big Salmon’s pragmatic power remains uncertain.

Framing Power

Multiple actors may hold framing power through their ability to set norms for and influence discourse around water quality governance. These actors encompass academic, civil, media, union and political entities, which may be loosely categorized as pro-environment or pro-industry—with some occupying a nuanced position. Key actors include:

- Academic: the University of Tasmania is a significant source of peer-reviewed water quality science, notably through its Tasmanian Institute of Agriculture research center. The University is also affiliated with the Australian Research Council’s Blue Economy Cooperative Research Center, which is partially funded by Big Salmon, raising potential concerns regarding conflicts of interest (Carter 2020).
- Civil: community and environmental groups, such as NOFF and Anglers Alliance Tasmania (AAT), may exert framing power. NOFF actively protests fish farming while AAT criticizes Van Dairy’s effluent practices, opposes logging near the River Leven and expresses concern over salmonid hatcheries (AAT 2020, 2021a, 2021b). The local not-for-profit group Environment Tasmania campaigns against water pollution by salmonid aquaculture, targeting major supermarket chains (Environment Tasmania 2019). Individuals may contribute to civil framing power, such the book ‘Toxic: The Rotting Underbelly of the Tasmanian Salmon Industry’ which investigated negative impacts and perceived rule-breaking behavior of Big Salmon (Flanagan 2021). While many civil actors tend to favor a pro-environmental stance, business groups such as the Tasmanian Farmed Salmon Alliance supports the industry primarily due to its close link to Big Salmon (Hewett 2021).
- Media: national broadcaster ABC News reports on water pollution and governance failures, often from a pro-environment stance (Coulter 2021a, 2021b).
- Union: the Australian Workers’ Union supports employment opportunities for the primary sector—particularly Big Salmon (AWU 2021)—and aligns with a pro-industry narrative.

- Political: both the Labor and Liberal political parties favor primary sector growth, while the Tasmanian Greens critique lax regulation of Big Salmon (O'Connor 2020) and highlight issues with Van Dairy's freshwater use and effluent management (O'Connor 2021).

Moreover, government bodies such as DNRE Tasmania may wield significant framing power. As an example of framing through selective information disclosure, the Department withheld and redacted a 2020 river health report which highlighted adverse water quality results such as "...mid to lower reaches are often degraded.... agriculture land use...associated with poor river condition. several information gaps relation to river health..." and finally "the health of several rivers appears to have declined recently" (DPIPWE 2020, iii). The decision to withhold this report was influenced by concerns about stakeholder reactions linked to business sectors and state initiatives such as AgriVision 2050 (Coulter 2021b). By choosing not to publish the report, the Department framed the water quality narrative by redacting negative statements/images of water quality. This underscores the influence of pragmatic power held by primary industries on framing power. Table 3 details the key actors, their roles and power types.

Discussion and Policy Recommendation

This study explores how power operates within a polycentric governance system and argues for the introduction of a national-level policy tool to support more effective water quality governance across Australia. Rather than replacing state-level interventions, this approach is intended to complement them, adding a layer of accountability, coordination and oversight across jurisdiction. This recommendation recognizes that "piecemeal attempts of policy reform" cannot remedy the complex problem of water governance; instead, a multi-level governance system with vertical and horizontal collaboration would be a pathway (Pahl-Wostl and Knieper 2023, 151). This recommendation diverges from state-level regulatory proposals put forth by the majority of environmental advocates, such as the Tasmanian Greens' call for increased water fees for industrial users, particularly dairy farmers; or Environment Tasmania's proposal for a new statutory authority to manage the state's freshwater resources. The 2022 Parliamentary Fin Fish Inquiry Report similarly suggested a state-based approach by granting more autonomy to EPA Tasmania as a statutory authority (CSIRO 2018, 4).

Table 3. Key actors in Tasmanian water governance, by power types.

Actor type		Power by design	
Regulatory	Environment Protection Authority	Forest Practices Authority	Tasmanian Dairy Industry Authority
	Tasmanian Irrigation	TasWater	
Political	Government of Tasmania	Tasmanian Liberal Party	
Actor type		Pragmatic power	
Commercial	Huon Aquaculture	Petuna	Sustainable timber Tasmania
	Tassal group	Van Dairy	
Actor type		Framing power	
Civic	Anglers Alliance Tasmania	Environment Tasmania	
Political	Australian Workers' Union	Tasmania Greens	Tasmanian labor party
Academic	University of Tasmania		
Media	Australian broadcasting Corporation		

The rationale for advocating a national approach stems from identifying power imbalances favoring primary industry actors, which can result in ineffective governance and compromise environmental integrity. Incremental state-based regulations, influenced by the pragmatic power of major primary industries, are deemed insufficient to improve water quality significantly. This pragmatic power is expected to grow as political commitments to substantial economic growth in the primary sector persist—providing vital employment opportunities, particularly for disadvantaged populations in Tasmania (Kirkwood and Dean 2018). Therefore, it is foreseeable that those state government agencies holding power by design will continue to favor a course to avoid the kind of punitive regulatory action that may threaten primary sector employment and/or dissuade external investors.

Instead of endorsing state-based governance actions, this study proposes an elevation of the status of the water quality issue to the federal level and the designation of water quality as a National Environment Protection Measure (NEPM) (NEPC 2022). NEPMs already exist in Australia for air quality, waste policy and chemicals management, but water quality is notably absent. A water quality NEPM could enhance oversight in Tasmania; discourage the suppression of critical evidence as witnessed in the redaction of the DPIWPE river health report; and support a baseline level of environmental protection across the country. The proposed national standard could also prevent a ‘race to the bottom’ in which different states might lower environmental standards in order to attract business investment. Polycentric governance allows these standards to be tailored to local conditions while ensuring national coherence. Moreover, a water quality NEPM could catalyze more effective governance responses to nationwide water quality challenges across different states, such as algal blooms in the Murray-Darling Basin (MDBA 2022).

This proposed federal-level intervention may seem counterintuitive to the conventional aim of polycentric governance, which proposes more local, decentralized decision-making authorities. Proposing a NEPM for water quality is more than simply endorsing a top-down and centralized intervention; instead, it elevates the importance of water quality issues and adds a further check-and-balance layer. While opponents of polycentric governance often focus on local and decentralized decision-making authorities, the role of a federal/national level authority can be overlooked. Yet the addition of a federal-level actor into the governance system of state-level water quality can minimize the impact resulting from power imbalance commonly seen at the state level (as in this case). One example demonstrating the advantage of federal intervention is the governance of the Great Barrier Reef. With the GBR Marine Park Authority heading the effort, water quality governance has been an ongoing collaboration between the Queensland and Commonwealth governments, including the Reef Water Quality Protection Plan (Reef Plan) and Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan), which contain more specific regulations implemented by the Queensland State Government (DCCEW 2024).

Our recommendation acknowledges potential challenges, including skepticism toward federal oversight (Wheeler, Hatton Macdonald, and Boxall 2017) and potential power asymmetries within the federal mechanism. Federal regulation alone will not resolve the issues at hand. We stress the critical importance of ensuring meaningful participation from various actors at different scales, which is essential for the success of

polycentric environmental governance. First, good coordination is a fundamental element in this process (Pahl-Wostl and Knieper 2014, 2023), emphasizing the need for effective collaboration between federal and state governments. In this context, the proposed National Environmental Protection Measure (NEPM) can serve as an overarching frame to guide efforts. Second, the genuine involvement of primary industries is crucial to ensure that regulations are correctly implemented. This involves aligning regulations with industrial cultures to promote compliance (Hamman and Deane 2018). Given the cultural differences between sectors such as salmonid aquaculture and dairy farming, tailored approaches are necessary to address specific contexts effectively. Last but not least, expanding the engagement of Traditional Owners can be instrumental in addressing potential challenges, supported by empirical evidence (Barnes et al. 2022; Diver et al. 2022). While the above three mechanisms are critical in ensuring meaningful participation, they lie beyond the scope of this paper.

Conclusion

This study critically examines Tasmania's intricate water quality dynamics through a polycentric environmental governance lens in order to navigate multiple socio-political-ecological complexities. Despite Tasmania's touted pristine environment, empirical evidence highlights a persistent decline in water quality attributed to the expanding footprint of agriculture, forestry and aquaculture activities. While these primary industries are vital for Tasmania's economy and society, their growth is paralleled by a concerning power imbalance in governance.

Analyzing three power types in the polycentric system—power by design, pragmatic power and framing power—reveals the significant concentration of power within these key industries. This concentration has led to expansive operations under a lenient regulatory framework, framing policy discussions in favor of economic growth. The resulting power asymmetry compromises the effectiveness of regulatory bodies with power by design, exacerbated by the suppression of evidence such as the redacted DPIPWE report on river health (DPIPWE 2020). Moreover, while the water quality issue presented seems to be a 'local' problem, this study highlights the complexity of current environmental conditions and the challenges they present for local action.

This power dynamic—accentuated by the weak sustainability model in which economic considerations overshadow environmental and social concerns—underscores our proposal for a national-level regulatory instrument. Proposing a shift from localized to combined with national governance, this study advocates for a robust and effective water quality governance system, emphasizing the imperative of addressing power imbalances for sustainable outcomes. Crucially, this is not a question of choosing between state and national governance, but of recognizing that effective environmental governance depends on their coordinated and complementary action.

The insights from this study extend beyond Tasmania and offer broader relevance for regions navigating the complex dynamics of environmental change. By unpacking the interplay of power and policy within a polycentric system, this research contributes to ongoing debates about achieving equitable and effective environmental outcomes. A useful international comparison, despite the different context, is the European Union's Water Framework Directive (WFD), which provides a binding,

basin-scale policy framework guiding member states toward integrated water management. While implementation remains the responsibility of individual countries, the directive sets common objectives and obligations, fostering accountability and cross-border collaboration. Although the political context differs, the WFD demonstrates how a supranational mechanism can support and align subnational efforts, particularly in managing diffuse pollution and transboundary water systems (Hering et al. 2010).

Whilst our study focuses on a context where subnational actors play a central role, future research could examine cases where national-level intervention is more pronounced or necessary, especially in contexts marked by fragmented authority. There is also scope to investigate how national and subnational efforts can be more deliberately designed to work together—reinforcing rather than duplicating or undermining one another. Understanding the conditions under which different levels of governance align or conflict remains critical to strengthening the legitimacy, inclusivity and efficacy of polycentric environmental governance systems.

Author contributions

CRediT: **Jerry Watkins**: Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft; **Ju-Han Zoe Wang**: Conceptualization, Formal analysis, Supervision, Validation, Writing – original draft, Writing – review & editing; **Dean Campbell**: Formal analysis, Investigation, Writing – original draft; **Keanu Caston**: Formal analysis, Investigation, Writing – original draft; **Macey McGhee**: Formal analysis, Investigation, Writing – original draft.

References

- AgriGrowth Tasmania. 2018. *Competitiveness of Tasmanian agriculture for 2050*. Department of Primary Industries, Parks, Water and Environment: Government of Tasmania.
- AgriGrowth Tasmania. 2020. *Tasmanian Agri-Food Scorecard 2019-20*. Department of Primary Industries, Parks, Water and Environment: Government of Tasmania.
- Andersson, K. P., and E. Ostrom. 2008. Analyzing decentralized resource regimes from a polycentric perspective. *Policy Sciences* 41 (1):71–93. doi: 10.1007/s11077-007-9055-6.
- Anglers Alliance Tasmania (AAT). 2020. River Leven win. <https://www.anglersalliance.org.au/news/2020/11/3/river-leven-win> (accessed 14 April 2022).
- Anglers Alliance Tasmania (AAT). 2021a. AAT's position on hatcheries. <https://www.anglersalliance.org.au/news/2021/6/10/aats-position-on-hatcheries> (accessed 17 April 2022).
- Anglers Alliance Tasmania (AAT). 2021b. AAT's position on Van Dairy. <https://www.anglersalliance.org.au/news/2021/6/10/aats-position-on-vandairy> (accessed 18 April 2022).
- Argent, R. M. 2017. *Australia state of the environment 2016: inland water*. Canberra : Independent report to the Australian Government Minister for the Environment and Energy.
- Australian Workers' Union (AWU). 2021. Australian Workers' Union defends Tasmania's Atlantic salmon from attacks. <https://www.awu.net.au/national/news/2021/07/14778/australian-worker-s-union-defendstasmanias-atlantic-salmon-from-attacks/> (accessed 19 April 2022).
- Bäckstrand, K., F. Zelli, and P. Schleifer. 2018. Legitimacy and Accountability in Polycentric Climate Governance. In *Governing Climate Change: Polycentricity in Action?* eds. A. Jordan, D. Huitema, H. van Asselt, & J. Forster, 338–56. Cambridge: Cambridge University Press.
- Baldwin, E., P. McCord, J. Dell'Angelo, and T. Evans. 2018. Collective action in a polycentric water governance system. *Environmental Policy and Governance* 28 (4):212–22. doi: 10.1002/eet.1810.
- Barnes, M. L., A. Datta, S. Morris, and I. Zethoven. 2022. Navigating climate crises in the Great Barrier reef. *Global Environmental Change* 74:102494. doi: 10.1016/j.gloenvcha.2022.102494.

- Bates, G. 2023. *Environmental law in Australia*. 11th ed. Sydney: LexisNexis.
- Bennett, N. J., and T. Satterfield. 2018. Environmental governance: A practical framework for design, evaluation, and analysis. *Conservation Letters* 11 (6):e12600. [10.1111/conl.12600](https://doi.org/10.1111/conl.12600)
- Brand Tasmania. 2023. Trade with Tasmania. <https://tasmanian.com.au/trade-with-tasmania/> (accessed 8 December 2023).
- Carlisle, K., and R. L. Gruby. 2019. Polycentric systems of governance: A theoretical model for the commons. *Policy Studies Journal* 47 (4):927–52. doi: [10.1111/psj.12212](https://doi.org/10.1111/psj.12212).
- Carter, C. 2020. Key challenges for offshore/high-energy salmon aquaculture production. <https://blueeconomyrc.com.au/project/key-challenges-for-offshore-high-energy-salmon-aquaculture-production/> (accessed 8 December 2023).
- Coleman, S. 2017. *Australia State of the Environment 2016: built environment*. Independent report to the Australian Government Minister for the Environment and Energy, Canberra.
- Commonwealth Scientific and Industrial Research Organisation (CSIRO). 2018. Not just fish poo – why Macquarie Harbour has an oxygen problem. <https://ecos.csiro.au/why-macquarie-harbour-has-an-oxygen-problem/> (accessed 10 November 2022).
- Commonwealth Scientific and Industrial Research Organisation (CSIRO). 2000. *Huon Estuary Study: Environmental research for integrated catchment management and aquaculture* Final report to the Fisheries Research and Development Corporation. 96/284, June 2000. CSIRO Division of Marine Research, Hobart.
- Coulter, E. 2021a. Tasmania is known for being clean and green, but experts are worried about its rivers. *ABC News*, September 8. <https://www.abc.net.au/news/2021-09-08/tasmania-river-system-health-decline-department-report/100424004>
- Coulter, E. 2021b. Tasmanian report showing waterways deteriorating was kept secret, Department did not want a ‘bombshell’, documents show. *ABC News*, November 28. <https://www.abc.net.au/news/2021-11-28/tasmanian-waterways-report-not-released-bombshell-advice/100655798>
- Coulter, E. 2022. Tasmania’s salmon industry must reform and be more transparent, parliamentary inquiry says. *ABC News*, May 24. <https://www.abc.net.au/news/2022-05-24/tas-salmon-industry-reform-parliamentary-inquiry-transparency/101094476> (accessed 8 December 2023).
- Department of Agriculture and Water Resources (DAFF). 2002. *Framework for marine and estuarine water quality protection*. Canberra: Department of Agriculture and Water Resources.
- Department of Climate Change, Energy, the Environment and Water (DCCEW). 2024. Protecting the Great Barrier Reef. <https://www.dccew.gov.au/parks-heritage/great-barrier-reef/protecting> (accessed 12 December 2024).
- Department of Natural Resources and Environment, Tasmania (DNRE). 1999. Water Management Act 1999. <https://nre.tas.gov.au/water/water-legislation-policies-and-strategies/water-management-legislation/water-management-act> (accessed December 8, 2023).
- Department of Natural Resources and Environment, Tasmania (DNRE). 2023. Water management plans. <https://nre.tas.gov.au/water/water-management-plans> (accessed 8 December 2023).
- Department of Natural Resources and Environment, Tasmania (DNRE). 2025. Marine Farming Planning Review Panel. <https://nre.tas.gov.au/aquaculture/aquaculture-regulation-and-planning/marine-farming-development-plans/marine-farming-planning-review-panel> (accessed 11 April 2025).
- Department of Primary Industries, Parks, Water and Environment (DPIPWE). 2020. *Temporal and spatial patterns in river health across Tasmania, and the influence of environmental factors*. Water and Marine Resources Division: Government of Tasmania.
- Department of Primary Industries, Parks, Water and Environment (DPIPWE). 2021. *Annual Report* Government of Tasmania.
- Department of Treasury and Finance Tasmania (DTF). 2021. *Treasurer’s Annual Financial Report 2020–21* Government of Tasmania.
- Department of Treasury and Finance Tasmania (DTF). 2022. *State Accounts 2021–22* Economic Policy Branch, Government of Tasmania.
- Diver, S., M. V. Eitzel, S. Fricke, and L. Hillman. 2022. Networked sovereignty: Polycentric water governance and Indigenous self-determination in the Klamath Basin. *Water Alternatives* 15 (2):523–50.

- Dressler, W., B. Büscher, M. Schoon, D. Brockington, T. Hayes, C. A. Kull, J. McCarthy, and K. Shrestha. 2010. From hope to crisis and back again? A critical history of the global CBNRM narrative. *Environmental Conservation* 37 (1):5–15. doi: [10.1017/S0376892910000044](https://doi.org/10.1017/S0376892910000044).
- Environment Tasmania. 2019. Salmon farming in Tasmania. https://www.et.org.au/salmon_farming_tasmania (accessed 5 May 2022).
- Environment Protection Authority Tasmania (EPA). 1994. Environmental Management and Pollution Control Act 1994. <https://epa.tas.gov.au/about-the-epa/policy-legislation-cooperativearrangements/acts-regulations/empca> (accessed 18 April 2022).
- Environment Protection Authority Tasmania (EPA). 2022a. Water quality objectives for Tasmania. <https://epa.tas.gov.au/environment/water/water-quality-objectives-for-tasmania> (accessed 1 May 2022).
- Environment Protection Authority Tasmania (EPA). 2022b. Salmon aquaculture. <https://epa.tas.gov.au/business-industry/regulation/salmon-aquaculture> (accessed 1 May 2022).
- Flanagan, R. 2021. *Toxic: The rotting underbelly of the Tasmanian Salmon Industry*. Australia: Penguin Random House.
- Flanagan, R., J. Kurzel, and C. Castles-Lynch. 2021. Tasmania's toxic secret. *The Monthly*, April 22. <https://www.themonthly.com.au/issue/2021/april/richard-flanagan-justin-kurzel-and-conor-castles-lynch/tasmania-s-toxic-secret#mtr>
- Forest Practices Authority (FPA). 2017. *State of the forests*. Hobart, Tasmania: Forest Practices Authority.
- Forest Practices Authority (FPA). 2021. *Annual Report*. Hobart, Tasmania: Forest Practices Authority.
- GoodFish. 2019. Say No, Atlantic Salmon Huon. <https://goodfish.org.au/species/atlantic-salmon/> (accessed 16 March 2025).
- Gruby, R., and X. Basurto. 2013. Multi-level governance for extensive marine commons: Politics and polycentricity in Palau's protected area network. *Environmental Science & Policy* 33:260–72. doi: [10.1016/j.envsci.2013.06.006](https://doi.org/10.1016/j.envsci.2013.06.006).
- Hamman, E., and F. Deane. 2018. The control of nutrient run-off from agricultural areas: insights into governance from Australia's sugarcane industry and the great barrier reef. *Transnational Environmental Law* 7 (3):451–68. doi: [10.1017/S2047102518000018](https://doi.org/10.1017/S2047102518000018).
- Hasan, T. 2019. Determining safe drinking water. *Water e-Journal* 4 (1):1–8. doi: [10.21139/wej.2019.013](https://doi.org/10.21139/wej.2019.013).
- Hering, D., A. Borja, J. Carstensen, L. Carvalho, M. Elliott, C. K. Feld, A.-S. Heiskanen, R. K. Johnson, J. Moe, D. Pont, et al. 2010. The European water framework directive at the age of 10: A critical review of the achievements with recommendations for the future. *The Science of the Total Environment* 408 (19):4007–19. doi: [10.1016/j.scitotenv.2010.05.031](https://doi.org/10.1016/j.scitotenv.2010.05.031).
- Hewett, R. 2021. Tasmanian salmon industry enlists business partners for fightback campaign. *ABC News*, December 1. <https://www.abc.net.au/news/2021-12-01/tas-salmon-industry-fight-s-back-against-negative-press/100661988>
- Holmes, A. 2025. Thousands of salmon dying in Tasmania as industry grapples with disease, antibiotics and 'chunks' washing ashore. *ABC News*, February 20. <https://www.abc.net.au/news/2025-02-20/dead-salmon-in-tasmanian-fish-pens/104954444>
- Hubble, I., and R. Phillips. 1999. Tasmanian dairy farm effluent management program. *Journal of Cleaner Production* 7 (2):167–8. doi: [10.1016/S0959-6526\(98\)00049-3](https://doi.org/10.1016/S0959-6526(98)00049-3).
- Huitema, D., E. Mostert, W. Egas, S. Moellenkamp, C. Pahl-Wostl, and R. Yalcin. 2009. Adaptive water governance: Assessing the Institutional prescriptions of adaptive (Co-)management from a governance perspective and defining a research agenda. *Ecology and Society* 14 (1). <http://www.jstor.org/stable/26268026>.
- Humphries, A. 2019a. Salmon industry panel is 'inherently compromised', experts told minister in leaked resignation letter. *ABC News*, February 24. <https://www.abc.net.au/news/2019-02-25/tas-salmon-experts-letter-reveals-reasons-for-quitting-board/10844520>.
- Humphries, A. 2019b. Greens label decision by incomplete fish farm panel in Tasmania an 'outrage'. *ABC News*, April 13. <https://www.abc.net.au/news/2019-04-13/tasmanian-salmon-farming-decision-labelled-an-outrage/10998490>

- Institute of Marine and Antarctic Studies (IMAS). 2012. Evaluation of broadscale environmental monitoring program (BEMP) data from 2009-2012. https://www.imas.utas.edu.au/__data/assets/pdf_file/0017/743300/Evaluation-of-Broadscale-Environmental-Monitoring-Program-BEMP-data-from-2009-2012.pdf
- Khan, S., M. A. Abbas, T. Rana, and J. Carroll. 2010. *Dairy water use in Australian dairy farms: Past trends and future prospects*. Australia: CSIRO, Water for a Healthy Country National Research Flagship
- Kirkwood, D., and A. Dean. 2018. *Health and wellbeing of children and young people in Tasmania*. Victoria : Australian Institute of Family Studies, Melbourne.
- Langenberg, A. 2021. Tasmania's environment protection authority is to investigate Van Dairy Limited. *ABC News*, April 15. <https://www.abc.net.au/news/2021-04-15/environmental-watchdog-to-investigate-van-dairy/100070206>
- Marshall, G. R. 2009. Polycentricity, reciprocity, and farmer adoption of conservation practices under community-based governance. *Ecological Economics* 68 (5):1507–20. doi: 10.1016/j.ecol-econ.2008.10.008.
- Murray-Darling Basin Authority (MDBA). 2022. Water quality. <https://www.mdba.gov.au/water-management/mdbas-river-operations/waterquality> (accessed 26 April 2022).
- Morrison, T. H. 2017. Evolving polycentric governance of the Great Barrier Reef. *Proceedings of the National Academy of Sciences of the United States of America* 114 (15):E3013–E3021. doi: 10.1073/pnas.1620830114.
- Morrison, T. H., W. N. Adger, K. Brown, M. C. Lemos, D. Huitema, J. Phelps, L. Evans, P. Cohen, A. M. Song, R. Turner, et al. 2019. The black box of power in polycentric environmental governance. *Global Environmental Change* 57:101934. doi: 10.1016/j.gloenvcha.2019.101934.
- Mudliar, P. 2021. Polycentric to monocentric governance: Power dynamics in Lake Victoria's fisheries. *Environmental Policy and Governance* 31 (4):302–15. doi: 10.1002/eet.1917.
- National Environment Protection Council (NEPC). 2022. About NEPC. <http://www.nepc.gov.au/about-us> (accessed 7 May 2022).
- National Parks and Wilderness. 2022. Discover Tasmania. <https://www.discovertasmania.com.au/about/national-parks-and-wilderness> (accessed 15 May 2022).
- Newig, J., and O. Fritsch. 2009. Environmental governance: Participatory, multi-level – and effective? *Environmental Policy and Governance* 19 (3):197–214. doi: 10.1002/eet.509.
- O'Connor, C. 2020. Primary industries – fish farming. <https://tasmps.greens.org.au/parliament/primary-industries-fish-farming> (accessed 19 April 2022).
- O'Connor, C. 2021. Liberals Silent on Van Dairy Cruelty and Pollution. <https://tasgreensmps.org/media-releases/liberals-silent-on-van-dairy-cruelty-and-pollution/> (accessed 25 April 2022).
- Oldekop, J. A., K. R. E. Sims, B. K. Karna, M. Whittingham, and A. Agrawal. 2019. Reductions in deforestation and poverty from decentralized forest management in Nepal. *Nature Sustainability* 2 (5):421–8. doi: 10.1038/s41893-019-0277-3.
- Organisation for Economic Cooperation and Development (OECD). 2011. *Water governance in OECD countries: A multi-level approach, OECD studies on water*. Paris: OECD Publishing.
- Ostrom, E. 1990. *Governing the commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.
- Ostrom, E. 2010. Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change* 20 (4):550–7. doi: 10.1016/j.gloenvcha.2010.07.004.
- Ostrom, V., C. M. Tiebout, and R. Warren. 1961. The organization of government in metropolitan areas: A theoretical inquiry. *American Political Science Review* 55 (4):831–42. doi: 10.2307/1952530.
- Pahl-Wostl, C., and C. Knieper. 2014. The capacity of water governance to deal with the climate change adaptation challenge: Using fuzzy set qualitative comparative analysis to distinguish between polycentric, fragmented and centralized regimes. *Global Environmental Change* 29:139–54. doi: 10.1016/j.gloenvcha.2014.09.003.
- Pahl-Wostl, C., and C. Knieper. 2023. Pathways towards improved water governance: The role of polycentric governance systems and vertical and horizontal coordination. *Environmental Science & Policy* 144:151–61. doi: 10.1016/j.envsci.2023.03.011.

- Parliament of Tasmania. 1985. *Forest Practices Act 1985*. Hobart: Government of Tasmania.
- Proemse, B. C., I. Koolhof, R. White, L. A. Barmuta, and C. Coughanowr. 2022. Nutrient sources and loads in the River Derwent catchment, Tasmania. *Australasian Journal of Environmental Management* 29 (2):159–76. doi: [10.1080/14486563.2022.2077847](https://doi.org/10.1080/14486563.2022.2077847).
- Rockliff, J. 2015. Record-breaking agriculture sector exceeds \$2 billion for the first time. [https://www.premier.tas.gov.au/site_resources_2015/additional_releases/record-breaking_agriculture_sector_exceeds_\\$2_billion_for_the_first_time](https://www.premier.tas.gov.au/site_resources_2015/additional_releases/record-breaking_agriculture_sector_exceeds_$2_billion_for_the_first_time) (accessed 8 December 2023).
- Rojahn, M., J. Dunlevie, and M. Whitfield. 2025. Anti-salmon protest held at Verona Sands, site of first dead fish wash up from Tasmanian mass mortality event. *ABC News* 16 March. <https://www.abc.net.au/news/2025-03-16/premier-backs-salmon-farming-verona-sands-protest-rally/105057766> (accessed 25 April 2025).
- SCS Global Services. 2015. *Aquaculture Stewardship Council Salmon Standard: Full Assessment Report*. CA: Emeryville.
- State Dairy Effluent Working Group. 1997. *Managing Dairy Farm Effluent in Tasmania Code of Practice*.
- Sustainable Timber Tasmania. 2021. *Annual report*. Hobart: Sustainable Timber Tasmania.
- Tasmania Parks & Wildlife Service. 2023. Franklin-Gordon Wild Rivers National Park. <https://parks.tas.gov.au/explore-our-parks/franklin-gordon-wild-rivers-national-park> (accessed 14 April 2023).
- Tasmanian River Alliance. 2022. Tasmanian River Health 1998 to present. <https://tasmanianriveralliance.com/tasmanian-river-health-1998-to-present/> (accessed 8 December 2023).
- Tasmanian Times. 2022. Parliamentary fin fish inquiry report released. 24 May. <https://tasmaniantimes.com/2022/05/parliamentary-fin-fish-inquiry-report-released/> (accessed 8 December 2023).
- TasWater. 2022. Environmental & public health monitoring. <https://www.taswater.com.au/community/environment/environmental-public-health-monitoring> (accessed 15 April 2022).
- Tranter, B. 2010. Environmental activists and non-active environmentalists in Australia. *Environmental Politics* 19 (3):413–29. doi: [10.1080/09644011003690898](https://doi.org/10.1080/09644011003690898).
- Wang, J.-H. Z., R. Fisher, and J. Connell. 2019. Participatory natural resource management in rural China: Making and unmaking environmental narratives. *Asia Pacific Viewpoint* 60 (2):205–19. doi: [10.1111/apv.12210](https://doi.org/10.1111/apv.12210).
- Western, D., and M. Wright. 1994. *Natural connections: Perspectives in community-based conservation*. Washington: Island Press.
- Wheeler, S. A., D. Hatton Macdonald, and P. Boxall. 2017. Water policy debate in Australia: Understanding the tenets of stakeholders' social trust. *Land Use Policy* 63:246–54. doi: [10.1016/j.landusepol.2017.01.035](https://doi.org/10.1016/j.landusepol.2017.01.035).
- Worksafe Tasmania. 2018. Tasmania industry overview: Agriculture, forestry and fishing. https://www.worksafe.tas.gov.au/__data/assets/pdf_file/0003/546546/2018-Industry-report-Agriculture,-Forestry-and-Fishing.pdf.
- Wuijts, S., P. Driessen, and H. Van Rijswijk. 2018. Towards more effective water quality governance: A review of social-economic, legal, and ecological perspectives and their interactions. *Sustainability* 10 (4):914. doi: [10.3390/su10040914](https://doi.org/10.3390/su10040914).