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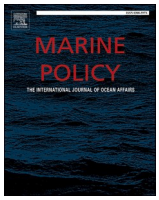

Full length article

Managing inter-organizational trust and risk perceptions in transboundary fisheries governance networks

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ABSTRACT

Transboundary fishery management represents a significant governance challenge that requires ongoing inter-organizational communication, collaboration, and collective action to ensure sustainability. Previous research suggests that different dimensions of perceived risk, trust, and control interact in complex ways to affect inter-organizational collaborative performance, providing an administrative 'architecture' that enables partners to share resources, engage in teamwork, resolve conflict, and coordinate tasks and responsibilities while also allaying their concerns about the alliance. However, the extent to which different control mechanisms influence trust and mitigate the perceived risks of collaboration between the diverse organizations involved in transboundary fisheries management remains unclear. This paper presents the quantitative results of survey research conducted in the Salish Sea of North America, an ecosystem spanning the Canada-US border between British Columbia and Washington State. The survey instrument operationalizes a multi-dimensional trust-control-risk framework considered suitable for studying inter-organizational natural resource management (NRM) networks. The findings support descriptions of the Salish Sea as having fewer nation-to-nation governing bodies resulting in a lack of effective formal controls, high perceived regulatory risk, and low procedural trust attributes that can negatively affect the collaborative performance of the fishery management network. This study represents the first quantitative analysis of the complex relationships between different inter-organizational management strategies, trust dimensions, and perceived risks in transboundary fisheries governance, and offers new directions for future research on NRM collaboration.

1. Introduction

The task of sustainably managing complex social-ecological systems (including ecosystem health, sustainable fisheries, tourism, and water quality) in a transboundary regulatory setting represents a significant and enduring challenge for governments [60]. In response, collaborative (also known as network) governance has become an increasingly popular approach to managing natural resources that span jurisdictions [48,66]. This has certainly been the case in fisheries management, where many of the commercially, recreationally, and/or culturally important fish species live and travel through shared or boundary waters [60], creating a high degree of interdependence, or a shared responsibility, among the different organizations involved. Collaborative governance focuses on building, managing, and maintaining inter-organizational networks that often involve multiple levels of governments, civil society, Indigenous groups, and local communities who share power, authority, and responsibility in the management of a shared natural resource [8,11,59]. The main goals of this approach are to build local capacities, share benefits, enhance livelihoods, build legitimacy, and manage conflicts [9,27,30,46] among the highly interdependent parties involved in transboundary fisheries governance.

Collaboration in this context is the interactive process involving a group of autonomous actors from two or more organizations that make collective decisions intended to create public value [3]. It is necessary in the NRM context because typically no single organization or government has the resources to create feasible and effective solutions [32].

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Inter-organizational collaboration is typically voluntary [33,43] meaning organizations remain fairly autonomous and cannot be forced to work together [32,53]. Due to this attribute, collaboration does not rely on traditional hierarchical control mechanisms and instead focuses on politics, bargaining, negotiation, and compromise [32,55]. Despite the utility of the collaborative governance approach in managing many transboundary fishery issues, the unique and complex nature of the resulting inter-organizational networks presents challenges [28].

Network management strategies (control mechanisms) used to attenuate dysfunction and improve performance include formal and informal rules, the exchange of resources, and the development of shared norms and structures that reflect participants' values, ideologies, constituencies, powers, and egos [4,7,22,42,45]. Key ingredients in success are the time and effort needed to develop the necessary relationships and trust among partners [13,62,75]. When trust is present in these collaborative relationships, conflict resolution improves, transaction costs are reduced, and there is greater resource exchange, all of which can stimulate coordination and collective action [32,61,63]. The presence of trust is one of the most important factors in creating better perceived collaborative outcomes [41,61]. Previous studies have also found that the risk management ability of a collaborative network is a key determinant of its overall success [6,57]. However, despite their recognized importance, the underlying mechanisms of how trust and perceived risk relate to different aspects of collaborative relationships in NRM networks require further investigation [15,28,29,40,63].

Recent research by Hickey et al. [28,29] suggests that different dimensions of perceived risk, trust, and control interact in complex ways affecting inter-organizational collaborative performance in NRM networks. Together these attributes provide an administrative 'architecture' that enables partners to share resources, engage in teamwork, resolve conflict, and coordinate tasks and responsibilities while also allaying their concerns about the alliance [29]. Recent work has focused on the effects of network management strategies (see [35,72]), the role of boundary-spanning leadership (see [70,71]) and the importance of trust in collaborative marine co-management [16,69]. There is, however, little empirical research evidence on the extent to which different control mechanisms influence different dimensions of inter-organizational trust and mitigate the perceived risks of collaboration in fishery management networks. Using the theoretical propositions (see Table 1) and the validated survey instrument put forth by Hickey et al. [29], in this paper we present novel empirical evidence supporting the potential utility of the integrated trust-control-risk framework using data collected in the transboundary Salish Sea of North America, a region that has been struggling to enact and sustain ecosystem-based fishery management for over a century [10,74].

1.1. The Salish Sea marine ecosystem

The Salish Sea marine ecosystem consists of the Puget Sound, Strait of Georgia, and Strait of Juan de Fuca which include the major cities of Seattle, Vancouver, Tacoma, Everett, Victoria, Nanaimo, Bellingham, and Olympia [23]. The Salish Sea is one of the largest inland seas in the world with a watershed encompassing over 42,000 square miles and containing one of the most ecologically diverse marine ecosystems in North America [68]. The multiple metropolitan areas surrounding the Salish Sea are growing rapidly [68] thereby placing an enormous amount of stress on the watershed and making effective transboundary governance crucial.

The Salish Sea is considered a key case study for understanding transboundary fishery governance, with efforts starting in 1909 with the Boundary Waters Treaty [75]. Compared to other Canadian-United States (US) transboundary efforts in the Great Lakes and the Gulf of Maine, the Salish Sea network is considered less developed, with fewer formalized institutional structures [5,31]. Unlike the Great Lakes Fishery Commission and the Gulf of Maine Council on the Marine Environment, formal transboundary management structures in the Salish Sea

Table 1
Proposed relationships between different dimensions of trust, control, and perceived risk based on Hickey et al. [29].

Number	Proposition	Supporting Theory
1	Affinitive trust between organizations participating in a collaborative NRM network will be enhanced by social control and undermined by behavior control and output control.	• Social control fosters confidence in the character of the trustee thereby increasing affinitive trust [14]. • Behavior and output control reduce participant autonomy and create doubt about the goodwill of partners thereby undermining affinitive trust [55,14].
2	Rational trust between organizations participating in a collaborative NRM network will be enhanced by social control and undermined by behavior control and output control.	• Social control can create socially defined standards that increase the norms-based information needed to build rational trust [63]; Braithwaite, 1998). • Output and behavior control can bring into question the ability of the alliance to achieve its goals which reduces rational trust [14].
3	Procedural trust of participants in collaborative NRM networks will be enhanced by social control, behavior control, and output control.	• Social control does not specify specific behavior or output and allows participants to develop their preferred process that are viewed as fair thereby increasing procedural trust [63]. • Behavior and output control can create cognitive expectations and belief in a normative consensus on procedures and priorities, thereby enhancing procedural trust [63].
4	Relational risk between organizations participating in a collaborative NRM networks will be reduced by behavior control and social control.	• Behavior control regulates the conduct of participants and reduces the fear of opportunistic behavior and relational risk [14]. • Social control establishes shared values which deters participants from acting opportunistically thereby reducing relational risk [14].
5	Relational risk between organizations participating in a collaborative NRM will be reduced by affinitive trust.	• Affinitive trust is based on the trustor's perceptions of the trustee as benevolent and having integrity [63] which enhances their belief that the trustee will not act opportunistically thereby reducing relational risk (Blackburn, 1998;[14].
6	Performance risk between organizations participating in a collaborative NRM networks will be reduced by output control and social control.	• Output control monitors alliance performance through key performance measures which can increase confidence in the performance of the alliance [14] thereby reducing performance risk. • Social control encourages participants to establish what they consider to be reasonable and achievable goals [14] thereby increasing participants confidence in alliance performance.
7	Performance risk between organizations participating in collaborative NRM networks will be reduced by rational trust.	• Rational trust is based on the predictability of past performances and perceived utility of the alliance (Coleman, 1990; Hardin, 2002; Möllering, 2006;[63], which develops confidence in the positive outcomes of the alliance and reduces performance risk.
8	Regulatory risk between organizations participating in collaborative NRM networks will be reduced by behavior control.	• [6] found that compliance and regulatory risk can be reduced by behavior control mechanisms such as "informal review of partner operations and

(continued on next page)

Table 1 (*continued*)

Number	Proposition	Supporting Theory
		accountability of alliance personnel".
9	Regulatory risk between organizations participating in collaborative NRM networks will be reduced by procedural trust.	• When procedures are perceived as fair (high procedural trust) participants place greater faith in the compliance of others [63] thereby reducing regulatory risk.

region have so far focused on individual species and issues (see, for example, the Pacific Salmon Commission and the International Pacific Halibut Commission) rather than the shared management of the ecosystem [74]. Despite several attempts at large-scale transboundary ecosystem governance (see, for example, the Puget Sound Georgia Basin International Task Force), sustained cooperation has been difficult to achieve [47,74].

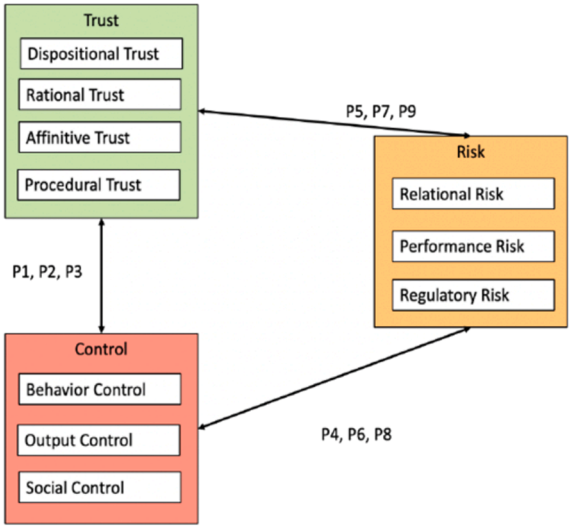
Recent transboundary fisheries work in the Salish Sea has focused on community-based activities and collaborative governance [25,44,47], to foster shared beliefs and collective identity [5]. However, many of these initiatives have been unable to sustain cooperation, failing to reach their management objectives [47]. Additional research is required to better inform the network management strategies that are being used to build inter-organizational trust, an important precursor to collaboration, and reduce risk perception, a key barrier to collaboration in support of transboundary fishery management in the Salish Sea.

2. Conceptual framework

Fig. 1 presents the conceptual framework and proposed relationships between the different dimensions of trust, risk perception, and control guiding our empirical study on inter-organizational collaboration in the Salish Sea fishery management network (for a full description, please see [29]. Adopting a trust-risk-control framework in transboundary fishery governance research can help to "increase conceptual clarity for how, when and why network managers might seek to develop different forms of trust through diverse management control systems in ways that further multi-actor collaborative network performance" [28], p. 9). Within the collaborative architecture, control, perceived risk, and trust are defined as multi-dimensional factors affecting collaboration, with control and trust considered antecedents of perceived risk [14] (see Fig. 1). According to Hickey et al. [29], this integrative conceptualization of the factors affecting inter-organizational collaboration offers a useful starting point for further exploring some of the 'inner' social dynamics affecting the performance of NRM networks. In what follows we briefly describe each of the main constructs within the proposed architecture (see [29] for more detailed description).

Perceived risk occurs in the context of a specific relationship with another party and relates to the estimated probabilities of several outcomes and their associated negative impacts [14]. Three types of risk have been identified in inter-organizational collaboration: relational risk (risk of opportunistic behavior), performance risk (risk of not achieving goals), and regulatory risk (risk of being exposed to third-party regulations such as government sanctions or fines) [6,14]. For collaboration to occur, the benefits of collaborating must be greater than the perceived risks [65] making the reduction of risk a central focus for network managers. Das and Teng [14] viewed trust and control as the main determinants of perceived risk in inter-organizational alliances, with no third factor of the same importance. Therefore, to reduce the perceived risk of collaboration, a network manager can turn to building trust and/or using control mechanisms [29].

Trust is the "psychological state in which one actor (the trustor) accepts some form of vulnerability based upon positive expectations of the intentions or behavior of another (the trustee), despite inherent uncertainties in that expectation" [63] p. 119). Trust is often viewed as the main antecedent of collaboration and a key factor in enhancing the performance of collaborative policy networks [1,20,24,49,50,51,56,67,73]. In addition, several characteristics are attributed to trust, for instance, trust has been found to increase mutual learning and lower conflict making the diffusion of trust one of the most critical tasks in boundary-spanning network management [2,12,61]. Four types of trust have been identified by Stern and Coleman [63]. Dispositional trust (personality trait of a person's predisposition to trust an entity), affinitive trust (based on emotions, shared identities, or feelings of benevolence), rational trust (a calculated assessment of benefits and risks based on past experiences), and procedural trust (based on the perceived



Dimensions

RISK

Relational Risk: probability and consequence of not having satisfactory cooperation.

Performance Risk: probability and consequence that alliance objectives are not achieved, despite satisfactory cooperation

Regulatory Risk: probability and consequence of a partner exposing the firm to sanctions from a third party by failing to comply with rules.

TRUST

Dispositional Trust: personality trait signaling one's predisposition to trust another entity.

Rational Trust: calculative assessment of expected benefits and risks informed by the past history of performance and predictability

Affinitive Trust: hinges on emotions, charisma, shared identities or feelings of benevolence developed from longer-term interactions.

Procedural Trust: fairness and integrity of the procedures involved.

CONTROL

Behavior Control: focused on process that turns appropriate behaviour into desirable output.

Output Control: focused on monitoring performance.

Social Control: focused on establishing a common culture and values.

Fig. 1. Integrated framework of trust, control, and risk in strategic alliance networks
Adapted from Das and Teng [14]; Hickey et al. [28] and Hickey et al. [29].

fairness of procedures involved). A diversity of trust types is necessary to initiate and sustain inter-organizational collaboration due to their differing network roles, leading to varying importance as the collaborative process evolves [64].

Control is a process intended to affect the behavior of people and make elements of the network more predictable [38,58]. It can be divided into two broad categories: formal measure-based control (further reduced into behavior and output control) and informal value-based control (labeled social control) [14,21]. Behavior control influences people's behavior to achieve the desired outcome such as the creation of procedures for meetings [14]. Output control monitors performance such as the creation of action plans or assessment reports [14]. Social control establishes a common culture such as the creation of joint decision-making and dispute-resolution processes [14]. Control mechanisms are important for achieving successful network management outcomes, playing varying roles as the collaborative alliance evolves [35].

Through their ability to reduce opportunistic behavior and increase predictability, control mechanisms can moderate the perceived risk of participating in a collaborative network [38,58]. The impact of control on trust is heavily dependent on the initial context of the relationship [19]. Different types of trust and control can serve as substitutes for one another in some contexts while being reinforcing in others [28]. If network objectives are not being met, affinitive trust may be diminished along with an increase in relational risk. Behavior control can substitute the role of affinitive trust and build relational risk [28]. Conversely, affinitive trust and rational trust can be enhanced by social control and their increased presence reinforces the effectiveness of all three control types [28].

Our research focused on measuring the perceived levels of inter-organizational trust and risk among a wide range of professionals working on fish and fishery-related issues in the Salish Sea region, as well as the self-reported impact of any existing control mechanisms on inter-organizational trust and risk scores. Through our analysis, the utility of the architecture framework to transboundary fishery management networks was also explored.

3. Methods

A survey instrument was developed that operationalizes the conceptual framework presented in Fig. 1 (presented in [29]. Psychometric scales were used to measure each of the different dimensions of trust, control, and perceived risk in the collaborative relationship between specified organizational pairs [29,61]. Adopting this approach made it possible to target multiple organization types in the network acting at various levels within the governance structure. The survey began with a series of biographical questions where respondents selected the organization they represented from its corresponding stakeholder category. Then respondents were asked to select the organizations they communicate with the most from eight different stakeholder categories, with the option to select none. For each of the selected organizations, the respondent was asked a series of follow-up questions using a five-point Likert scale (ranging from strongly disagree to strongly agree) for inter-organizational trust and risk measurement scales. Respondents were also asked to answer control mechanisms questions for two organizations randomly selected from those they had previously chosen. Respondents were asked to select the control mechanisms they employ in their relationship with the chosen organization. This resulted in a dataset with a dyadic structure, where the respondent answered questions about a target organization thereby depicting inter-organizational relationships. Additionally, a series of monadic questions that did not have a specific organization referent were asked for dispositional and procedural trust, concepts not operationalized as organization-to-organization measures (see Supplementary Materials for the entire survey).

3.1. Measuring trust, risk, and control

The survey drew on Das and Teng's [14] trust-control-risk framework and Stern and Coleman's [63] trust topology. The dyadic trust questions were adapted from previous survey questions developed and deployed in other fishery contexts (see [61] and [41]) (see Table 2). The risk questions were adapted from Zhang & Li [77], Zhang & Qian [76], and Katznelson [34] (see Table 2). Control questions were based on Das and Teng [14] (see Table 3). Six monadic dispositional trust and procedural trust questions were asked at the end of the survey (see Table 2). The performance of the trust, risk, and control scales was evaluated using exploratory factor analysis and structural equational modeling for confirmatory factor analysis, resulting in one question for each control factor being removed to reduce covariance between factors. Each of the resulting scales was found to be reliable and internally consistent (for full details see [29]). Only validated questions are included in Tables 2 and 3.

3.2. Data collection

The survey was conducted using an online tool (Qualtrics) between November 2021 and February 2022. The distribution broadly focused on individuals working on fish and fisheries-related issues in the Salish Sea who were affiliated with one or more of the identified stakeholder groups. The names, email addresses, and organizational affiliations of key individuals were identified from publicly available reports and online documentation. Potential respondents were contacted via email to introduce the study and provide a web-based URL for the survey. Initially, 102 groups and organizations were identified that fit into 8 categories: regional/binational organizations, state/provincial agencies, U.S. federal agencies, Canadian federal agencies, Indigenous groups, non-governmental organizations, business/trade groups, and research institutions. In total, 1715 email addresses of individuals from 102 groups and organizations were compiled to form a non-randomized convenience sample which resulted in 142 responses and created 662 dyads. Each dyad consisted of a survey respondent and a paired organization that the respondent reported communicating with on fishery-related issues. Respondents also had the option to write additional relevant organizations, which expanded the final list to 136 organizations (see Supplementary Materials). 111 organizations were represented in the survey responses as either a home or target organization. Table 4 shows the number of dyads created for each target stakeholder group by survey responses. All survey responses were anonymous with no names or identifying information collected beyond professional affiliation.

3.3. Data analyses

To measure the trust and perceived risk of network actors in the Salish Sea the dyadic trust and perceived risk scores of a respondent were grouped by the respondent's home organization category. These grouped trust scores were averaged so that each respondent organization category had a trust score for each trust dimension. This procedure was duplicated for each risk dimension. Figs. 2 and 3 depict the average Likert-scale score for trust and risk dimensions for each home organization category.

The predictive effects of control mechanisms on the respondents' trust and risk perception were analyzed using hierarchical and multiple regression analyses. Five distinct hierarchical regression models were created to determine 1) the impact of control mechanisms on affinitive trust; 2) the impact of control mechanisms on rational trust; 3) the impact of control mechanisms and relevant trust dimensions on relational risk; 4) the impact of control mechanisms and relevant trust dimensions on performance risk; and 5) the impact of control mechanisms and relevant trust dimensions on regulatory risk. To analyze the impact of control mechanisms on monadic procedural trust a multiple

Table 2
Survey questions operationalizing the four dimensions of trust and three dimensions of risk.

Variable	Name	Survey Question	Type	Reference
Affinitive Trust	AFFIA	Because we have been working with this organization for so long, all kinds of procedures have become self-evident.	Dyadic	Song et al. [61]
	AFFIB	In our relationship with the people in this organization, informal agreements have the same significance as formal contracts.	Dyadic	Song et al. [61]
Rational Trust	RATIA	This organization can be relied upon to perform its objectives.	Dyadic	Song et al. [61]
	RATIB	In our relationship with this organization, both sides treat each other in a consistent and predictable manner.	Dyadic	Song et al. [61]
Dispositional Trust	DISPA	You can't be too careful dealing with people.	Monadic	Song et al. [61]
	DISPB	People are almost always interested only in their own welfare.	Monadic	Song et al. [61]
	DISPC	Most people would try to take advantage of you if they got the chance.	Monadic	Song et al. [61]
Procedural Trust	PROCA	In the fishery management of this region the strongest side is expected not to pursue its interest at all costs.	Monadic	Song et al. [61]
	PROCB	When managing fish in this region it is expected that any unfair dealings will be avoided or rectified by existing regulatory, legal, or reputational measures.	Monadic	Song et al. [61]
	PROCC	When managing fish in this region people are expected not to make demands that can seriously damage the interests of others.	Monadic	Song et al. [61]
Relational Risk	RELAA	We think that the people in this organization may break promises.	Dyadic	Zhang and Li [77]
	RELAB	We think that the relationship with this organization will deteriorate in the foreseeable future.	Dyadic	Zhang and Li [77]
	RELAC	We think that the people in this organization will take advantage of us when the opportunity arises.	Dyadic	Zhang and Li [77]
Performance Risk	PERFA	We think that the performance of this project is likely to decline in the foreseeable future.	Dyadic	Zhang and Li [77]
	PERFB	We think that our objectives in the project with this organization will not be achieved	Dyadic	Zhang and Li [77]
	PERFC	We think that this organization has no ability to offer us support when faced with difficulties in the management of this fishery	Dyadic	Zhang and Li [77]
Regulatory Risk	REGUA	We feel that in opposing this organization we would be negatively affected in the future	Dyadic	Zhang and Qian [76]
	REGUB	The actions of this organization may expose my organization to additional regulations if relevant rules are not followed.	Dyadic	Katznelson [34]

Table 3
Control mechanisms listed on the survey and their corresponding control type based on Das and Teng [14].

Control Type	Acronym	Control Mechanism	
Behavior Control	PP	The creation of shared policies and procedures that outline appropriate behavior (e.g. Memoranda of understandings)	Dyadic
	RS	The collaborative creation of a reporting structure that outlines supervisory and monitoring roles	Dyadic
Output Control	OS	The objective setting between organizations (e.g. creation of performance measures for organization members)	Dyadic
	JIC	Joint information collection (e.g. monitoring of fish stocks and sharing data between organizations)	Dyadic
Social Control	RCN	Attending community events, ceremonies, and networking events	Dyadic
	EMI	Informal communication and meetings (e.g. work Happy Hour)	Dyadic

Table 4
Number of respondents who answered dyadic questions for each target stakeholder group.

Target Stakeholder Group	Number of Dyadic Respondent Responses for Target Group
Regional/Binational Government	74
State/Provincial Government	99
US Federal Government	78
Canadian Federal Government	71
Indigenous Groups	86
Non-Governmental Organization	66
Business and Trade Group	34
Research Institution	88

regression analysis was used. Due to its monadic data structure, procedural trust has a small n value compared to other dependent variables making multiple regression analysis more appropriate than hierarchical regression. To investigate the synergistic effects of control mechanisms with one another and control mechanisms with trust, models included two-way interaction terms. Nine interaction terms were subsequently created for incorporation into the hierarchical regression models.

Survey respondents scored multiple agencies on several dyadic questions thereby creating a repeated measures problem. Criterion scaling was utilized to account for individual response bias and issues related to encoding predictors with multiple categories [26,52,61]. Predictor sets were defined and entered into each hierarchical regression model in a pre-determined order using the following general logic: 1)

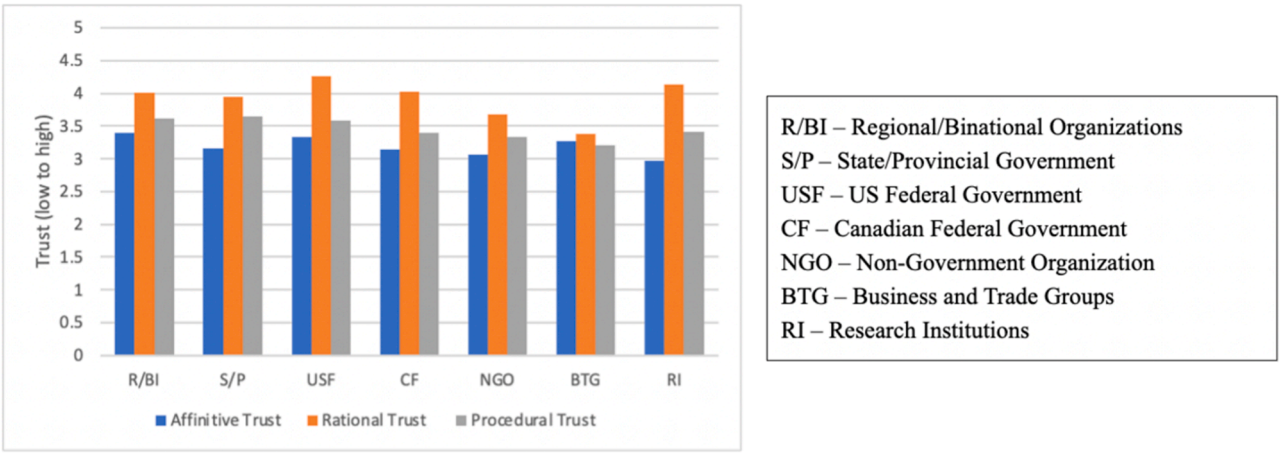


Fig. 2. (a) Average rating of each trust dimension by respondent organization groups comprising the Salish Sea fisheries policy network.

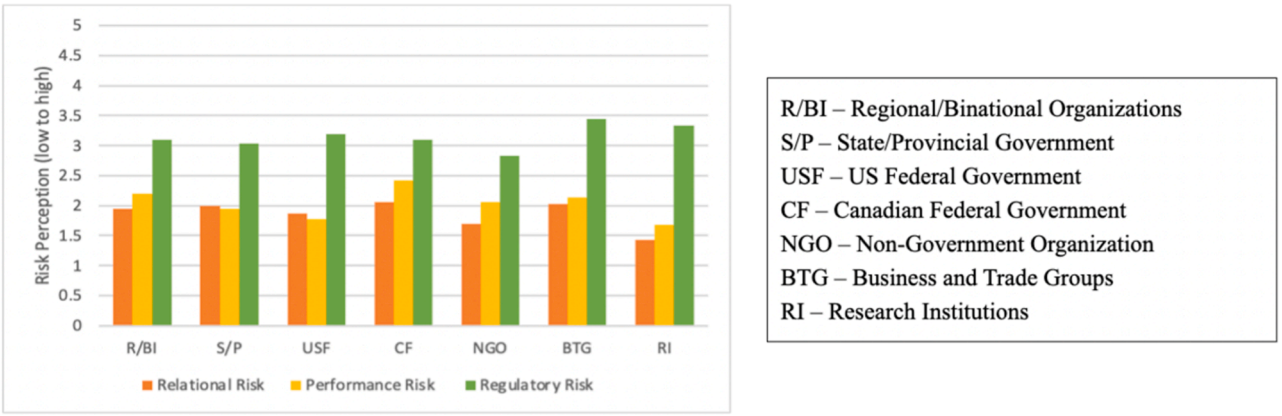


Fig. 3. Average rating of each risk dimension by respondent organization groups comprising the Salish Sea fisheries policy network.

control variables, 2) predictor variables, and 3) interactions. Control variables include the respondents' home organization, dispositional distrust, criterion scaling, and target organization. Only predictor variables in the proposition for each dependent variable were included in the model to limit the number of model terms. The specific order and rationale for each predictor set can be found in Annex 2.

3.4. Limitations and assumptions

The collection of survey data through purposeful sampling created a non-randomized convenience sample that had the potential to introduce bias and reduce validity. Several steps were taken to address this problem. Pre-tested questions used in previous research were adapted for the survey's trust and risk questions to increase construct validity. To avoid false survey entries participants were not allowed multiple entries from the same IP address and only responses from relevant organizations were included. Pre-testing of the survey instrument was also used to reduce potential bias. To reduce selection bias the survey engaged a diverse range of participants across multiple stakeholder categories. This also increased internal validity and provided a more trustworthy basis for interpretation. The structure of the survey, in which individuals affiliated with specific organizations answered follow-up questions about other organizations, facilitated the generation of data about low-response groups. However, it is important to note that there were no responses received from Indigenous groups, and although data were generated, we acknowledge that the survey results only capture the perspectives of network actors who chose to participate and therefore may not accurately reflect the views of all network participants. To check for non-response bias, a two-tailed t-test was conducted to determine if there were differences between early and late responses in the survey sample [36]. Dispositional distrust values were used for the t-test since this attribute changes slowly over time [63] and is considered a constant variable in our regression analyses. The results of the t-test showed no significant difference between early and late responses for dispositional distrust ($p = 0.1186$), indicating that timing did not significantly affect survey data.

4. Results

4.1. Inter-organizational trust, risk perception, and control patterns among stakeholder groups

Figs. 2 and 3 summarize the distribution of trust and perceived risk across the respondent organization groups comprising the Salish Sea fishery policy network. Overall, there appear to be moderate to high levels of trust and low to moderate levels of perceived risk in relationships. Rational trust is the highest trust type among participants followed by moderate affinitive trust in the interorganizational relationships reported in the Salish Sea network. Procedural trust has the lowest reported scores by respondents. Relational risk values were the lowest among participants with performance risk also being low. Regulatory risk was the highest perceived risk with moderate scores.

Table 5 summarizes the percentage of respondents who identified using behavior, output, or social control mechanisms with other organizations. Overall, social controls were selected the least by respondents. Business and trade groups along with state/provincial governments

Table 5
Percentage of survey respondents by organization group that identified utilizing behavior control, output control, and social control with select organizations.

Respondent Jurisdiction	Behavior Control	Output Control	Social Control
Regional/Binational Organization	48%	57%	38%
State/Provincial Government	48%	58%	58%
US Federal Government	31%	48%	25%
Canadian Federal Government	55%	40%	35%
Non-Governmental Organizations	67%	61%	44%
Business and Trade Groups	75%	90%	60%
Research Institutions	26%	21%	47%

partook in social controls more than other jurisdictional categories. Formal output and behavior controls were selected more frequently by respondents apart from research institutes that reported higher rates of social control. Governmental organizations reported moderate use of control mechanisms with all groups reporting less than 60%.

4.2. Impact of control mechanisms on trust and risk perceptions

4.2.1. Model results

Table 6 presents a summary of the significant predictor variables ($p < 0.10$). A significance level of.1 was chosen due to the exploratory nature of the research (Labovitz, 1968) and difficulties in identifying variable interactions. The standardized beta coefficients and ΔR^2 are displayed to indicate the strength and direction of the relationship from the five hierarchical regression models and one multiple regression model. After controlling for home organization, dispositional distrust, criterion scaling, and target organization, three predictor variables had a significant effect on rational trust. When social control and behavior control were sequentially accumulated in the hierarchical regression models, they showed significant and positive effects on rational trust ($\beta = +.117$ & $\beta = +.134$ respectively). However, the interaction between social control and behavior control had a negative and statistically significant coefficient for rational trust ($\beta = -.102$). This indicates that an increase in one of the predictor variables attenuates the positive effect of the other. The results suggest a crowding-out effect between social and behavioral controls for rational trust. The entire regression model predicted 59.1% of the variability in rational trust.

Table 6
The significant results ($p < .1$) of the hierarchical regression analysis and multiple regression analysis showing the predictive effects of predictor variables on six dependent variables.[11] The standardized beta coefficient depicts the direction and strength of the effect of predictor variables on the dependent variable standard deviation.

Dependent Variable Model	Significant Predictor Variable	Standardized Beta coefficient	ΔR^2	P-value
Rational Trust	Social Control	+ .117	0.1063	0.0384
	Behavior Control	+ .134	0.0128	0.0268
	Social Control * Behavior Control	-.102	0.0012	0.0987
Affinitive Trust	Social Control	+ .103	0.0981	0.0453
	Output Control * Social Control	+ .129	0.0062	0.0889
Procedural Trust	Output Control	+ .730		< .1
	Behavior Control	+ .648		< .1
Performance Risk	Rational Trust	-.400	0.0747	0
Relational risk	Affinitive Trust	-.169	0.0231	0.0049
	Social Control * Affinitive Trust	-.133	0.0146	0.0013
Regulatory Risk	Behavior Control	+ .078	0.0409	0.0641

As for affinitive trust, social control had a positive and statistically significant coefficient ($\beta = +.103$). Although output or behavioral control did not have an independent influence, output control was found to have a positive conditional effect on affinitive trust when social control was present. The coefficient of the interaction between social control and output control is positive and statistically significant ($\beta = +.129$). The use of output control amplifies social control's positive impact on affinitive trust. The entire regression model predicted 66.1% of the variability in affinitive trust. For procedural trust, behavior and output control had positive and statistically significant coefficients ($\beta = +0.648$ & $\beta = +0.730$ respectively).

Rational trust had a negative and statistically significant influence on performance risk ($\beta = -.400$). The entire regression model predicted 62.0% of the variability in performance risk. The assertion that relational risk will be reduced by affinitive trust receives strong evidence. The coefficient of affinitive trust is negative and statistically significant ($\beta = -.169$). Social control was found to have a negative and statistically significant conditional effect for affinitive trust on relational risk ($\beta = -.133$). It indicates that the use of social control by managers amplifies the negative effect of affinitive trust on relational risk. The entire regression model predicted about 77.3% of the variability in relational risk. Lastly, behavior control had a positive and statistically significant coefficient for regulatory risk ($\beta = +.078$). The model shows that, although the use of behavioral control increased two collaborative antecedents (rational trust and procedural trust) it also increased a source of risk that might undermine collaborative processes. The entire regression model predicted about 76.4% of the variability in regulatory risk.

Fig. 4 summarizes the main findings of our study, identifying the reinforcing and substitutive interactions observed between the key variables affecting collaboration. Table 7 compares the six propositions to the results of the hierarchical regression and multiple regression analysis.

5. Discussion

To better understand the factors affecting inter-organizational collaboration in the management of transboundary fisheries in the Salish Sea, we operationalized measures of multi-dimensional control, trust, and perceived risk among participating actors. The results confirm the measurability of these multi-dimensional concepts and their causal relationships in collaborative NRM networks. Our findings have global relevance for NRM, as they underscore the importance of using different control mechanisms and multiple dimensions of trust to reduce perceived risk between partners in inter-organizational collaborative contexts. This demonstrates how managers may enhance network collaboration through thoughtful use of control mechanisms and trust types to reduce perceived risk. We also empirically demonstrate the utility of the integrative control-trust-risk framework presented in Hickey et al. [29], which offers a suitable basis for future transboundary NRM network analyses.

Our study found that trust based on expected risks and benefits (rational trust) was the most developed form of inter-organizational trust in the network, while trust based on shared identities and culture (affinitive trust) was moderate throughout the network (Fig. 3). These findings support the existing theory that in networks with infrequent face-to-face interactions, and between people with different cultural backgrounds, such as the geographically spread-out Salish Sea, rational trust will be dominant while affinitive trust may be difficult to develop [17,18,39,54,61]. The high levels of rational trust paired with low procedural trust throughout the network suggest that participants may accept the need to collaborate with other organizations, but that their interactions potentially lack clear rules guaranteeing fairness [41] making smooth collaboration difficult. Our results support this theory showing that behavior control, which creates clear rules for interactions, was used only moderately (Table 4). Additionally, this is in line with

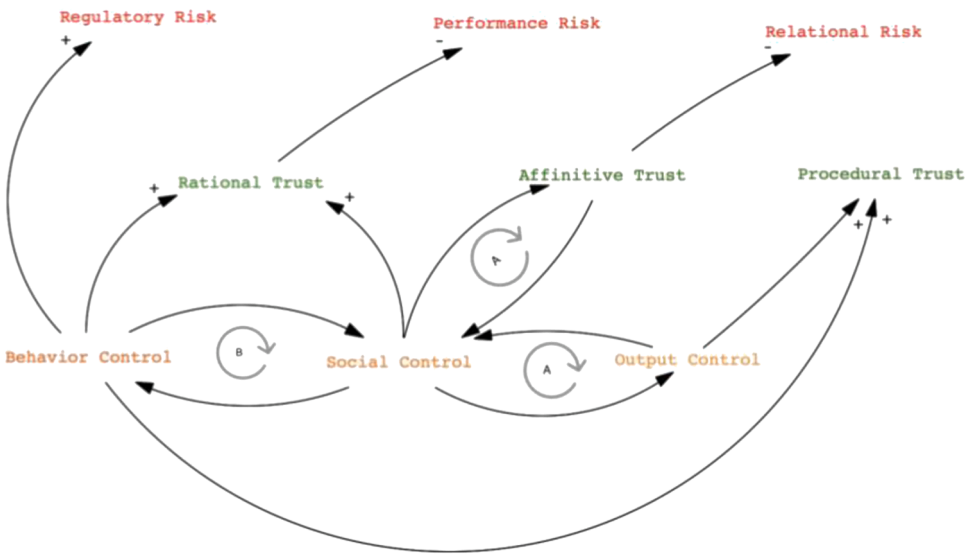


Fig. 4. Causal loop diagram depicting the identified relationships in the Salish Sea transboundary fishery. Recursive grey loops indicate an interaction between variables with A meaning reinforcing interactions while B indicates substitutive interactions (i.e., the presence of one variable reduces the ability of the other to build rational trust). '+ ' indicates the two nodes change in the same direction; '–' means the two nodes change in opposite directions.

Table 7
Summary of Regression Results: Table comparing the hypothesized results of the effect of dimensions of trust and control on risk perception with the results of the hierarchical regression and multiple regression analysis.

Proposition Number	Dependent Variable	Predictor Variable	Hypothesized Impact	Identified Impact
1	Rational Trust	Social Control	Positive	Positive
		Behavior Control	Negative	Positive
		Output Control	Negative	No Impact
		Social * Behavior		Substitutive
2	Affinitive Trust	Social Control	Positive	Positive
		Behavior Control	Negative	No Impact
		Output Control	Negative	No Impact
		Social * Output		Reinforcing
3	Procedural Trust (multiple regression)	Social Control	Positive	No Impact
		Behavior Control	Positive	Positive
		Output Control	Positive	Positive
4	Performance Risk	Social Control	Negative	No Impact
		Output Control	Negative	No Impact
		Rational Trust	Negative	Negative
5	Relational Risk	Social Control	Negative	No Impact
		Behavior Control	Negative	No Impact
		Affinitive Trust	Negative	Negative
		Social * Affinitive		Reinforcing
6	Regulatory Risk	Behavior Control	Negative	Positive
		Procedural Trust	Negative	No Impact

Norman and Bakker's [47] and Wondolleck and Jaffee's (2017) characterization of the Salish Sea governance network as lacking formal and administrative support for broader collaborative issues leading to an inability to identify shared problems and set clear goals.

The risk of being exposed by another organization to third-party sanctions (regulatory risk) was the highest perceived risk with high-to-moderate levels reported throughout the network. High regulatory risk indicates that participants have a lot at stake in these relationships and share a long history of interaction [29]. This finding is in line with the context of the Salish Sea where fisheries are a key economic resource and management has been occurring for over a century (Wondolleck and Jaffee, 2017). The network also had low-performance risk, possibly indicating a general belief among participants that the desired outcomes, to the extent they are defined, will be achieved [14]. Low reported relational risk values suggest that network members are not highly concerned about opportunistic behavior when collaborating and there is limited power asymmetry [76]. Low reported performance and relational risk levels may also be a product of the lack of formal transboundary administrative structures at the larger network level. Network members are likely not obligated to interact regularly with diverse Canada-US transboundary partners, and instead can choose which alliances to join. This could likely lead to alliance partners who represent low-performance risk and relational risk.

Management strategies that measure outputs (output control) were found to have a significant effect on trust in the fairness of procedures (procedural trust) which was the lowest in the network. This finding potentially indicates inadequate output control mechanisms that do not facilitate goal convergence and transparency. Without effective output control, organizations are unable to identify the extent to which the procedures or other systems in place are decreasing their vulnerability and enabling collective action [63]. Low procedural trust and ineffective output controls may lead to an inability to achieve shared goals and higher conflict in the network [61]. Managers could look to improve monitoring and assessment reports and specifically report on the effectiveness of measures taken by the alliance. Output controls that highlight the achievement of shorter-term or intermediate outcomes may help build procedural trust by clearly and quickly showing the ability of the network to achieve its goals [74].

[1] See Annex 3 for full model summary tables

Contrary to Proposition 1, our findings suggest that actions that regulate people's behavior (behavior control) and foster good relationships (social control) increase trust based on expected risks and benefits (rational trust), while the creation of output measurements did not have a significant impact (Table 6). Rational trust may be developed through clearly stated knowledge that shows the trustee to be competent, predictable, and consistent [63], which may be supported by behavior controls that create knowledge development. The interaction between social control and behavior control was negative in the rational trust model. This may indicate a substitutive effect between the two control mechanisms. The use of management actions that foster good relationships (social control) reduces the ability of those focused on regulating people's behavior (behavior control) to build rational trust and vice versa. Similar to the concept of trust ecology put forth by Stern and Baird [64], different control types appear to have buffering effects. In networks where social controls are too costly or time-consuming to implement, a network can rely on behavior control to foster rational trust. Then as the network evolves, and relationships are developed, managers can rely less on behavior control and focus on implementing social controls to build dimensions of trust. This result suggests a possible control ecology where the impact of control on trust fluctuates as the network changes [19].

Trust based on emotions and shared identities (affinitive trust) was found to be enhanced by management actions that foster good relationships (social control) confirming the importance of this control type for building multiple types of trust [14,28,29] (propositions 1, 2, and 3, Table 1). The interaction between social control and output control was synergistic. Therefore, using management actions that foster good relationships in tandem with those that create output measures is more effective at increasing affinitive trust compared to using either on their own. This effect stems from management actions that are institutionalized (formal controls) being needed to build resilience against network member turnover. Output control can help diffuse norms, rules, practices, and procedures developed through social control beyond individuals, thereby making the network more resilient [35,39].

The results of the hierarchical regression analysis showed that management strategies that regulate member behavior (behavior control) increased the risk of being exposed by another organization to third-party sanctions (regulatory risk) thereby not supporting proposition 8 (Table 6). Behavior controls include the creation of punishments and regulations guiding the collaborative relationships between network members. The establishment of these regulations may be necessary for the creation of regulatory risk. If behavior controls focus mainly on punishment and sanctions while ignoring the establishment of expected behavior practices, network members may be unclear about what behavior is appropriate and which will lead to sanctions, therefore, increasing regulatory risk. Network managers may need to focus on behavior control mechanisms beyond just punishment for non-compliance and establish the expected behavior of participants. Behavior control's ability to build procedural trust and rational trust while increasing regulatory risk demonstrates the potential tradeoffs of control mechanisms for improving the collaborative process [19,29].

The results of the hierarchical regression analysis show the role of different trust dimensions in reducing dimensions of perceived risk. Trust based on calculated benefits and risks (rational trust) was able to significantly decrease the perceived risk of objectives not being achieved (performance risk) supporting our fourth proposition (Table 6). Trust based on feelings of social connectedness (affinitive trust) was able to reduce the fear of opportunistic behavior (relational risk). Additionally, the interaction between social control and affinitive trust was found to reduce relational risk (Table 6). Networks with high levels of affinitive trust and that use social control are likely to be more effective at reducing the risk of opportunistic behavior (relational risk) compared to networks with only affinitive trust or social control. No independent effect of social control was observed, meaning without the presence of affinitive trust, social control will not be effective at reducing relational risk. This is because social control is considered most effective in high-trust situations and can build affinitive trust causing a co-evolution of trust and control (Ouchi 1979). These results support work by Edelenbos and Eshuis [19] showing that governance of complex inter-organizational networks is not done by either trust or control alone and instead requires the thoughtful combination of the two.

Overall, the survey findings indicate that the Salish Sea transboundary fishery network has effective but minimal social control and moderate but potentially inadequate behavior control and output control that has led to high rational trust, moderate affinitive trust, low procedural trust, low relational and performance risk, and high regulatory risk. Focusing on the development of more diversified control mechanisms that facilitate inter-organizational interactions, particularly at the governmental level, can build multiple dimensions of trust thereby reducing dimensions of perceived risk. Our results demonstrate that control can build and enhance multiple dimensions of trust while trust can enhance the impact of control on perceived risk. This double-acting means control and trust should not be viewed separately but in combination [19]. Wondolleck and Yaffee [74] describe this as the brick-and-mortar of NRM governance. Although the organizational structures or "bricks" are necessary, the "mortar" of governance, or what motivates people to engage and stay engaged in governance, is equally important [74].

6. Conclusion

Transboundary fishery management is complex, requiring a large amount of time and effort to properly implement effective governance. Thoughtful and informed adjustments to inter-organizational network management process are needed to collectively adapt to changing social, political, and ecological contexts. Our results demonstrate the utility of applying an integrative trust-risk-control framework when identifying the key network attributes of effective collaborative performance and the areas of the administrative network architecture that could be strengthened. We highlight the potential for managers to use specific control mechanisms to improve collaboration in inter-organizational networks. We also add to the growing body of literature showing the importance of understanding both trust and control in reducing perceived risk to achieve effective collaboration. Further research is needed to evaluate the collaborative architecture supporting more formalized inter-organizational fishery management networks such as Regional Fishery Management Organizations (RFMOs) and the bi-national organizations operating in the Gulf of Maine and the Great Lakes of North America for comparison. Gaining insight into how formal fishery management networks utilize control mechanisms to mitigate risk and build trust over time will advance inter-jurisdictional policy efforts to manage shared fisheries resources sustainably and equitably through networked forms of governance.

CRediT authorship contribution statement

Evelyn Roozee: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. **Dongkyu Kim:** Conceptualization, Formal analysis, Investigation, Methodology. **Antonia Sohns:** Conceptualization, Writing – review & editing. **Jasper R. de Vries:** Conceptualization, Writing - review & editing. **Owen F. Temby:** Conceptualization, Formal analysis, Methodology, Project administration, Funding acquisition, Writing – review & editing. **Gordon M. Hickey:** Conceptualization, Methodology, Project administration, Funding acquisition, Writing - original draft.

Declaration of Competing Interest

None.

Data availability

Data will be made available on request.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2023.105927.

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