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Research article

Assessing the influence of international environmental treaty secretariats using a relational network approach

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A B S T R A C T

The influential role of international treaty secretariats in coordinating bureaucracies across jurisdictional boundaries has been highlighted in recent years. While we now better understand how their influence occurs, the field still faces a substantial difficulty in answering the basic quantitative question of "how influential?" By employing network analysis, we devised and tested a survey to quantify secretariat influence within an international environmental regime. We applied the survey tool to two trans-boundary fisheries governance networks in North America and here focus on the Great Lakes Fishery Commission (GLFC) as our primary case study. The results demonstrate a high ability of treaty secretariat to influence the management decisions of federal and state/provincial agencies. Primary interview data collected with the GLFC secretariat staff helps explain this finding. This study advances the recon-ceptualization of secretariat influence via relational metrics, and offers a way to estimate secretariat influence despite their typically veiled modes of operation.

1. Introduction

The study of international organizations (IOs) and their partic-ular role in coordinating bureaucracies across jurisdictional boundaries to realize collective outcomes has become increasingly prominent in the fields of global environmental politics and public administration (Bauer, 2006; Biermann and Siebenhüner, 2009; Tallberg et al., 2013; Johnson, 2014; Knill and Bauer, 2016). In particular, there is a growing body of scholarship on understanding the role of international treaty secretariats (i.e., administrative bodies set up to support the multilateral institutional arrangements of IOs) and how they consequently impact (inter)governmental policy processes and outcomes (Busch, 2014; Jinnah, 2014; Eckhard and Ege, 2016; Tallberg et al., 2016). This has been mirrored by a concurrently developing literature on public management net-works examining the presence and effectiveness of leadership exercised through network administrative (or "collaborative") or-ganizations. These second-order organizations, composed of participant network members, bear interorganizational transaction

costs, distribute tasks, and facilitate collaborative processes (Provan and Milward, 2001; Imperial, 2005; Van Meerkerk and Edelenbos, 2014). In the scholarly field of international relations, the ascen-dance of the constructivist approach has enabled expanded con-ceptions of power and authority wielded by treaty secretariats, greatly beyond the initial frames of state-centred ontology offered by realists and neoliberals (Barnett and Finnemore, 1999, 2004; Barnett and Duvall, 2005). That treaty secretariats do not merely fill an administrative function within given power structures, but that they possess agency and autonomy in their own right (at least partially) to influence and even shape state preferences, has been a revelation in the field and opened new possibilities for enhancing the efficacy of global governance (e.g. Jinnah, 2010; Michaelowa and Michaelowa, 2017). Analysts have usefully identified and debated the sources of authority for treaty secretariats as well as the mechanisms and types of influence often observed, despite the admission that they nevertheless operate under a veil of neutrality and member state delegation (Depledge, 2007; Biermann and Siebenhüner, 2009). A number of important explanatory variables

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for the influence of secretariats have subsequently been proposed to illuminate how they increase influence and why such influence may vary across organizations. These include the ability to draw on moral authority and shared worldviews, control of information flow, and being a holder of institutional memory and specialized knowledge pertaining to scientific, procedural and diplomatic expertise (see Barnett and Finnemore, 1999; Biermann and Siebenhüner, 2009).

While constituting what has been previously described as an energized research field (see Eckhard and Ege, 2016 for a recent review), there remain important unanswered questions concerning secretariat influence. For example, how best to ascertain the level of secretariat influence against that of other actors within an international regime, such as national and subnational agencies, has not been sufficiently explored. To the best of our knowledge, no direct empirical research approach has been provided in the literature to measure, quantify, and compare secretariat influence. Instead, determining the extent or reach of influence has mainly relied on the use of in-depth case studies employing interviews with secretariat staff, participant observation, and reviews of official speeches and documents to enable process tracing and counterfactual analysis (i.e. whether there are any changes in policies, institutions, relationships, and/or norms in the regime, whether these changes can be attributed to the secretariat's observed mechanisms of influence, and whether alternative explanations that do not involve secretariats can be ruled out) (e.g. see Underdal, 2001; Biermann and Siebenhüner, 2009; Jinnah, 2014). While such an intensive approach can be suitable for elucidating the causal mechanisms that help reveal the strategies that secretariats use to exercise influence, it does not offer a way to assess the fundamental question of *how influential*? A large part of this methodological difficulty stems from the 'behind the scenes' character of treaty secretariats, which often operate through informal and less public channels. For example, because they do not explicitly announce preferences as part of their mandate, it is more difficult to estimate and evaluate their overt intention and therefore isolate their unique influence on interorganizational policy outcomes.

This study aims to address this research gap by developing and testing a network-based survey method capable of measuring and comparing secretariat influence. What we espouse is a relational methodology which treats influence as an outcome rather than an attribute. This perspective considers influence to be something that only materializes when others are connected and affected by one's action, not when one simply 'possesses' it. Method-wise, it builds on recent studies assessing secretariat influence among a network of state and non-state organizations using Twitter-derived data to depict network structure (see Jörgens et al., 2016; Kolleck et al., 2017). We take this body of work a step further by implementing an online survey designed to enable a more direct and purposeful estimation of influence within a given environmental regime. The case study of the Great Lakes Fishery Commission (GLFC) is presented below, which comprises a binational treaty secretariat aimed at facilitating transboundary fisheries governance in the Great Lakes region of North America. The results demonstrate a relatively high ability of the GLFC secretariat to influence the management decisions of federal and state/provincial agencies. We contextualize this quantitative estimation by analysing primary interview data collected with the GLFC secretariat staff to reveal the relational origin and persistence of such interorganizational influence. We highlight two factors — the non-substitutable functions and convening power of the secretariat. Together, this study offers an innovative reconceptualization of secretariat influence in terms

of relational metrics with a view to advancing the network-based understanding of an international environmental regime.

The next section briefly traces the existing methods used to assess the influence of treaty secretariats. We then describe the survey method developed to directly assess secretariat influence, along with a qualitative interview component, and present the case study in detail. Results are then analysed and discussed, revealing the level of secretariat influence and providing insight to the key organizational traits and activities leveraged to generate this influence.

2. Theory and methodology

2.1. Understanding and measuring secretariat influence

In understanding the influence exerted by international treaty secretariats and exploring ways to study it, an important observation has arisen. Because states had agreed to form a treaty and created a secretariat to administer treaty work by funding it, secretariats are not expected to have a voice of their own, but rather act as an "international servant" working to fulfil states' interests in a neutral and transparent manner. The mandates of these secretariats often tend to emphasize their logistical role while discouraging lobbying for any particular policy output or active participation in the multilateral negotiations themselves (Depledge, 2005; Busch, 2009). The potential for autonomous influence therefore challenges a fundamental tenet of how secretariats are supposed to derive legitimacy, i.e., via political neutrality (Abbott and Snidal, 1998; Mathiason, 2007; Bauer et al., 2012). Yet, as is well known, many secretariats (particularly in the environment sphere) perform a suite of authoritative functions, albeit in the background, that may affect state decisions (e.g. draft agendas, filter information, fund research, and frame policy ideas). Paradoxically, secretariat influence stems from this restrained aspect of secretariat politics, that is, through activities that are often unseen, informal and obscured (Jinnah, 2014).

Owing to such "veiled" characteristics of secretariats when it comes to deploying influence, conventional measures of ascertaining the extent of influence through qualitative and researcher-driven techniques (e.g. interviews, observation and document analysis, as done in Biermann and Siebenhüner, 2009; Jinnah, 2014) have had difficulty generating an explicit picture of who is more influential and by how much. Particularly, Jörgens et al. (2016, p. 982) notes that attempts at directly understanding hidden preferences through statements and observed behaviour from staff and documentation can be biased in one of two opposing directions — secretariat influence being either inflated or discounted. While advocacy-oriented administrators may exaggerate the policy impacts the secretariat generates for reputational gains, others are likely to downplay its effect to preserve an image of impartiality on which their authority depends (see for example, Bauer, 2009; Busch, 2009; Jinnah, 2011; Conliffe, 2011). In fact, Jinnah (2014, p. 21) avers that "secretariats often go to great lengths to conceal any activities that reflect their own political preferences."

In acknowledging this methodological challenge, Jörgens, Kolleck and colleagues took a different approach, aiming to infer influence from one's relative position or status in the communication networks that form an international regime (Jörgens et al., 2016; Kolleck, 2016; Kolleck et al., 2017). In so doing, the concept of influence was rephrased as the interactive pull through which behavioural change is induced between a group of actors. Such an analysis utilizes the broader structure of social relationships or

linkages that make up a governance network, rather than focusing on the open statements, resources and strategies of individual secretariats themselves (Isett et al., 2011; Verweij et al., 2013; Koliba et al., 2019). Casting political influence in these relational terms and highlighting its interdependent nature has subsequently enabled a novel methodological operationalization.

One way of inferring influence from an actor's relational position in policy networks (rather than individual preferences or capacities) involves using social network analysis. For example, Jörgens and colleagues used Twitter-derived data to explore the communicative influence of the UN Climate Change secretariat (under the United Nations Framework Convention on Climate Change) (Jörgens et al., 2016; Kolleck et al., 2017). With vertices representing Twitter users and edges indicating both 'mentions' and 'retweets', the authors applied the measures of 'betweenness centrality' and 'eigenvector centrality' to identify the most central Twitter users, those whose tweets connect a number of clusters and thus have the greatest chance at exerting influence. The analyses not only empirically demonstrated the feasibility of taking a network-relational approach, but also found that the secretariat under study occupied a unique and central 'brokering' position in climate change issue-specific policy debates, suggesting a dominant role in affecting and connecting multiple stakeholder groups.

While being innovative, this approach is in its relative infancy. Moreover, when concerned with ascertaining the extent of interorganizational influence, the use of social network analysis via Twitter data offers limited appeal in at least two ways. First, the issue-specific communication networks depicted on Twitter are an oversimplified proxy of the actual professional network underlying international policy-making. Notwithstanding the brief word limit on each communication (i.e. each [re]tweet), the Twitter exchange is one, and likely a minor, dimension of information exchange taking place in an international treaty regime, with more substantive and consequential discussions carried out through meetings, phone calls, speeches, formal memos, and informal conversations that form the suite of verbal and written communication occurring. Jörgens et al. (2016, p. 986) acknowledges that the use of Twitter data is more relevant for debates about general principles of an issue rather than about its technical and political details (e.g. see Saerbeck et al., 2020 which uses non-Twitter, original survey data). Secondly, social network analysis does not measure influence directly, but only infers it from an actor's position in a policy network, that is, "a central position of an actor is at best interpreted as a sign of empowering other actors and facilitating coalition-building, rather than direct influence on the policy outputs of multilateral negotiations" (Jörgens et al., 2016, p. 986). Hence, it fails to describe the tangible impact of treaty secretariats.

2.2. A direct approach to estimate influence via survey and interview

Our contribution in this article is consistent with the network-informed approach described above. The main innovation is that we develop and utilize a survey to obtain exact data on interorganizational influence. A burgeoning literature on governance networks, epistemic communities and 'post-bureaucratic organizations' provides an extensive theoretical backdrop (e.g. Heckscher, 1994; Agranoff and McGuire, 2001; Hafner-Burton et al., 2009; Isett et al., 2011; Hass, 2015; Young, 2017; Koliba et al., 2019). Engaging with this set of literature has enabled us to consider a more horizontal and decentralized as well as knowledge-, trust- and communication-based conceptualization of influence while supporting the design of a related survey methodology to capture these nuanced interorganizational relations (see Temby et al., 2015; 2017; Song et al., 2019a, 2019b; Lima et al., 2019 for a progression of earlier work).

Conducting the survey first requires compiling a list of relevant organizations that comprise a governance network (e.g. [sub]national government agencies, and treaty secretariats that form part of IOs). The survey would then begin by asking respondents to select an organization to which s/he belongs from the list and then asking to select all the agencies that they communicate with formally or informally in their professional role. This communicative history forms an essential basis for establishing a "working relationship", however banal or sporadic. To determine if and how much organizations included in the survey (including any treaty secretariats) exercise influence across the network, the respondents are then prompted to complete the influence question for all the relationships they specified in the preceding steps. We consulted Cox and Jacobson's (1973, p. 3) classic definition of influence, "the modification of one actor's behaviour by another". Our operationalization is also consistent with Jinnah (2014, p. 55)'s concept of 'moderate' influence that refers to "a change in practices not required by changes in official rules or widely adopted norms," and similar to the concept of double-loop social learning, consisting of correcting errors by examining policies (Artmitage et al., 2008). Furthermore, recent studies of influence within bureaucratic networks shows that it occurs differently through formal and informal channels (Temby et al., 2017; Song et al., 2019b). These differences were operationalized in the survey, which formulated the following two variables to measure interorganizational influence:

- How often has communicating with people in the following organizations through *informal* channels (e.g. chance conversations, spontaneous meetings, personal notes, emails and phone calls, drinks after work) led you to make professional choices or decisions that you would not have otherwise made?
- How often has communicating with people in the following organizations through *formal* channels (e.g., committee meetings, memos, official verbal or written business communication) led you to make professional choices or decisions that you would not have otherwise made?"

Although respondents represented themselves with self-identified affiliated organizations, their referents for these questions were the organizations with which they interact. Because each respondent is answering these two questions for all the organizations listed in the survey, the survey generates directional information about communication and influence on one-to-many relations. By collating all responses, this survey design permits capturing the extent of influence across a group of organizations, in addition to being able to separate the level of influence for each dyadic relationship. This was the basis for distinguishing IO secretariat influence from that of other organizations, and also being able to compare it with others.

The key informant interviews conducted with secretariat staff focused on probing relational explanations of secretariat influence. According to Bruno Latour (1986), influence is never of one's own making, but it only materializes through interactions and relationships with other parties, and only in the aftermath of being conformed to. He stated, "when an actor simply has power [or influence] nothing happens and s/he is powerless; when, on the other hand, an actor exerts power it is others who perform the action" (ibid, p. 264). In other words, no matter how influential one appears to be, it remains an illusion until others start to take action in response, e.g. change one's behaviour or adjust decisions. In this sense, influence must be treated as a consequence rather than as a property that causes action. Such theorizing provides an interesting alternative to the more mechanistic explanations of influence that delve into the mandate of the secretariat and the resources available to it, as well as more structural considerations that include the

problem structure, the polity framework, and the organizational procedures and cultures (Biermann and Siebenhüner, 2009). We shed light on this novel perspective by drawing on the case of the Great Lakes Fishery Commission.

3. Case study

Scholars of North American environmental politics have begun to view transboundary, multilateral environmental issues as complex problems, where multiple agencies within and between governments attempt to collaborate to bring about desired outcomes, and in which treaty secretariats behave entrepreneurially to maintain relevance, spotlighting particular problems or serving an interjurisdictional coordinating role (see Healy et al., 2014; VanNijnatten and Craik, 2015; Norman, 2015; Temby and Stoett, 2017; Young, 2017; Brooks and Olive, 2018). Several studies have highlighted the role of IOs and their secretariats within the proliferating number of environmental governance networks. This has included research on binational fishery commissions (Temby et al., 2015; Song et al., 2017), the trinational Commission for Environmental Cooperation (Simon, 2014; Jinnah and Lindsay, 2015) and binational boundary water commissions (Clamen and Macfarlane, 2015). However, aside from Jinnah and Lindsay's (2015) study of NAFTA influence, and Don Munton's (2006, 2007) critical analyses of Canada-U.S. Air Quality Committee, they have not directly examined organizational influence. And those that have done so have used process tracing case studies rather than surveys of network participants.

3.1. Great Lakes Fishery Commission (GLFC)

The Great Lakes Fishery Commission is a binational commission comprised of representatives from the United States and Canada with a mandate to establish "working arrangements" among governments (the Great Lakes fall under the jurisdiction of two nations, eight US states, one Canadian province, and several tribes), to ensure multi-jurisdictional fishery management (GLFC, 2019). According to the website of the GLFC (2019): "The commission became a focal point for cooperative Great Lakes fishery management, though was designed specifically to not supersede existing state or provincial management authority". The GLFC was established through a binational treaty, the 1954 Convention on Great Lakes Fisheries (Gaden et al., 2013), signed in response to the severity of the sea lamprey invasion that devastated both the commercial and recreational fisheries. In 1981, the original Joint Strategic Plan for Management of Great Lakes Fisheries was developed and signed by all major federal, state, provincial and tribal jurisdictions (updated in 1997) to provide a strategic, though nonbinding, means through which to manage the Great Lakes fishery across political boundaries as an ecosystem. The GLFC is headed by commissioners appointed by each of the two countries and supported by technical committees as well as Lake Committees that focus on the lake-specific management of each Great Lake. The Lake Committee representatives from all five lakes then form the Council of Lake Committees, representing a unifying body to address basin-wide issues such as sea lamprey control (GLFC, 2019).

The GLFC secretariat is comprised of approximately 20−25 permanent staff, and is located in Ann Arbor, Michigan. The GLFC secretariat has three main tasks, as outlined in the Convention. Namely, it implements a program of sea lamprey control, coordinates and conducts science, and maintains working relationships with government agencies and other public management organizations. The sea lamprey control program is the activity for which the GLFC owes much of its positive reputation. It has been successful at reducing the presence of the invasive species by 90%

from its peak (GLFC, 2014a); it also uses approximately 75% of the GLFC's annual budget. In its role as a science coordinator, the GLFC funds the scientific studies of its choice, publishes summaries of the current 'state of scientific knowledge' in areas of importance, and communicates research findings to government through a variety of media outlets (GLFC, 2014b). In maintaining working relationships, the GLFC facilitates meetings between state, provincial, and federal agencies to share information as well as implements dispute resolution mechanisms when agreement on fishery policy cannot be reached.

Fishery commissions such as the GLFC may play an important role in enhancing transboundary governance capacity, but the specifics of this role and the degree of their influence have not been clarified. Moreover, because IO research has tended to focus on a subset of large, global and well-publicized actors such as the World Bank and United Nations specialized agencies, smaller treaty secretariats with a more focused remit and a narrower set of state jurisdictions have not sufficiently entered the empirical base of this research field (Haftel and Thompson, 2006; Eckhard and Ege, 2016). Considering that the number of existing binational environmental agreements in the world far surpasses that of multilateral ones (2,296 vs. 1,344, according to the International Environmental Agreements Database Project, https://iea.uoregon.edu), we expect that empirical studies of binational fishery commissions will contribute to the understanding of international environmental treaties and their operations. After a brief description of study methods, the following section assesses GLFC's influence using survey data, complemented by the interview results that help explain the comparatively high influence detected.

3.2. Survey description

We used an online survey tool ('LimeSurvey') to target civil servants working in the public sector management of the Great Lakes Fishery. Individuals were selected based on their affiliation with the preselected organizations and their role related to fishery governance. These included employees affiliated with state/provincial and federal agencies on both sides of the Canada-US border as well as inter-governmental and tribal organizations. The names and email addresses of the potential respondents within these organizations were identified from publicly accessible reports and online documentation. They were contacted by email with an invitation explaining the purpose of the survey and with a link to the online survey instrument. A total of 45 organizations were included in the study. They comprised binational organizations such as the International Joint Commission and the Great Lakes Fishery Commission, tribal organizations such as the Great Lakes Indian Fish and Wildlife Commission, federal agencies such as Fisheries and Oceans Canada, Natural Resources Canada, the U.S. Geological Survey and the U.S. Fish and Wildlife Service, and subnational entities including the Ontario Ministry of Environment and Climate Change, and the Michigan Department of Natural Resources (see Fig. 1 for a full agency list). Of these, most respondents reported affiliations in agencies within the U.S. federal government (18%), the Canadian federal government (13%), the U.S. states of Ohio, Michigan, Wisconsin, New York, Indiana, Pennsylvania, Illinois, and Minnesota (46%), and the Ontario government (19%). A small percentage of respondents (<4%) reported primary affiliation with inter-state or binational organizations. Fewer than 2% of the respondents were from members of tribal fishery organizations. The survey was conducted between October and November of 2015, and resulted in 226 completed surveys. All responses were anonymous with no names or other identifiable information collected other than professional affiliation (see Song et al., 2019b for other details of survey processes).
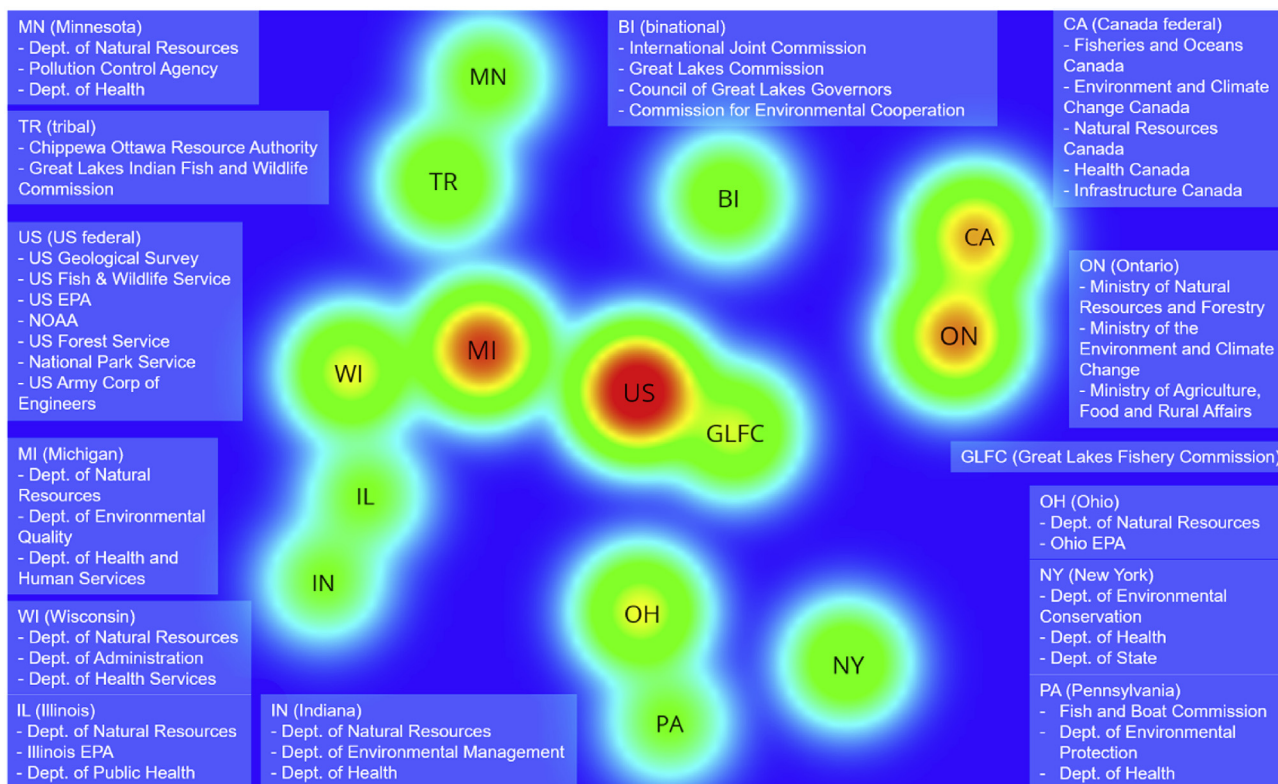
Fig. 1. Interjurisdictional communication pattern for governance networks pertaining to the Great Lakes fisheries.

A similar survey was also conducted in the context of the binational Pacific Salmon Commission (see Temby et al., 2015), the details and results of which are presented in Appendix to enable comparison and provide additional insight to the internal validity of the survey measures and external validity of the GLFC case study results.

3.3. Survey analyses and results

3.3.1. Aggregate patterns of communication

To produce the overall display of network connectivity as determined by the communicative patterns of the surveyed agencies, first, the weighted frequencies of formal and informal communication indicated by each respondent (i.e., 2 = regularly, 1 = occasionally, 0 = never) were tallied.

For the 226 respondents who participated in the Great Lakes survey, a total of 1828 formal and 1536 informal communication linkages were reported. From this, both the agencies with which each respondent was affiliated and with which she communicated were noted and classified according to the jurisdiction to which the agencies belong (with binational [not including the GLFC] indicated as [BI] and tribal as [TR]). Summation of this dyadic data resulted in a network configuration of 14 nodes, generating a 14 × 14 adjacency matrix. Important to emphasize is that it is not the number of individual respondents that are being aggregated, but the communication linkages reported by each respondent. Differently put, what we are measuring is the reported communication with target jurisdiction, not simply the volume of communication by the respondent's home affiliation. Fig. 1 presents the distribution of interjurisdictional communication in the form of density visualization using VOSviewer 1.6.0. Node colour denotes the level of

interjurisdictional communication reported for each jurisdiction (i.e., the redder the colour, the greater frequency of communication one node is associated with other jurisdictions). The distance between nodes indicates the intensity of relatedness, such that closely located nodes imply a proportionally higher occurrence of communication between them.

Fig. 1 displays the overall patterns of communication. Interestingly, the patterns mimic the geographical layout of the region itself, with respondents in adjacent jurisdictions shown to communicate most frequently with each other (i.e. indicated by shorter distances between nodes). For the purpose of this paper, the central placement of the GLFC among the multiple jurisdictions comprising the regime is noteworthy. Despite the lower number of reported communication linkages associated with the GLFC (549, light yellow colour) compared to, for instance, US Federal (2,009), Michigan (1,311), and Ontario (1,020), the communicative pattern suggests a strategic position through which it can reach all actors in the network. The government dominated communication patterns shown in Fig. 1 are not surprising given that typically a greater range of responsibilities and resources are at the disposal of federal and state agencies compared to international treaty secretariats. Still, what is striking is the centrality of the GLFC, implying strength of relation with most other jurisdictions in the network and subsequently a network-facilitating role (see van Eck and Waltman, 2010 for details of the mapping technique). This is especially so considering the marginal positions of the Canadian federal and Ontario agencies despite their role in managing four of the five Great Lakes. Based on this result, it appears that the GLFC, along with U.S. federal and Michigan, is playing the role of "hub" or "broker" through which interjurisdictional communication is being carried out. A similar finding that reveals the intermediate position

Table 1
The Effects of Formal & Informal Communication in the Great Lakes (Note: Standard errors in parenthesis).

Type	Organization	Percent Communicating	Occasional + Regular Informal Influence	Regular Informal Influence	Occasional + Regular Formal Influence	Regular Formal Influence
IOs	International Joint Commission (IJC)	.323	.384 (.057)	.014 (.014)	.493 (.059)	.068 (.055)
	Great Lakes Fishery Commission (GLFC)	.615	.640 (.041)	.173 (.032)	.813 (.033)	.338 (.040)
US	US Geological Survey (USGS)	.553	.720 (.040)	.184 (.035)	.832 (.033)	.248 (.039)
Federal	US Fish and Wildlife Service (USFWS)	.708	.706 (.036)	.181 (.030)	.819 (.030)	.263 (.035)
	US Environmental Protection Agency (USEPA)	.535	.471 (.045)	.107 (.028)	.686 (.042)	.182 (.035)
	National Oceanic and Atmospheric Administration (NOAA)	.381	.407 (.053)	.070 (.028)	.500 (.054)	.140 (.037)
	US Army Corp of Engineers (USACE)	.412	.398 (.051)	.065 (.026)	.667 (.049)	.108 (.032)
Canada	Fisheries and Oceans Canada (DFO)	.549	.613 (.044)	.113 (.028)	.710 (.041)	.185 (.035)
Federal	Environment Canada (ENVCAN)	.389	.511 (.053)	.091 (.031)	.636 (.051)	.159 (.039)
US	Michigan Department of Natural Resources (MIDNR)	.518	.650 (.044)	.120 (.030)	.769 (.039)	.265 (.041)
Subnational	Minnesota Department of Natural Resources (MNDNR)	.336	.553 (.057)	.079 (.031)	.618 (.056)	.092 (.033)
	New York State Department of Environmental Conservation (NYSDEC)	.389	.568 (.053)	.205 (.043)	.682 (.050)	.250 (.046)
	Ohio Department of Natural Resources (OHDNR)	.336	.579 (.057)	.105 (.035)	.671 (.054)	.224 (.048)
	Wisconsin Department of Natural Resources (WIDNR)	.381	.605 (.053)	.151 (.039)	.547 (.054)	.186 (.042)
Canada Subnational	Ontario Ministry of Natural Resources and Forestry (OMNRF)	.566	.680 (.041)	.148 (.031)	.805 (.035)	.336 (.042)
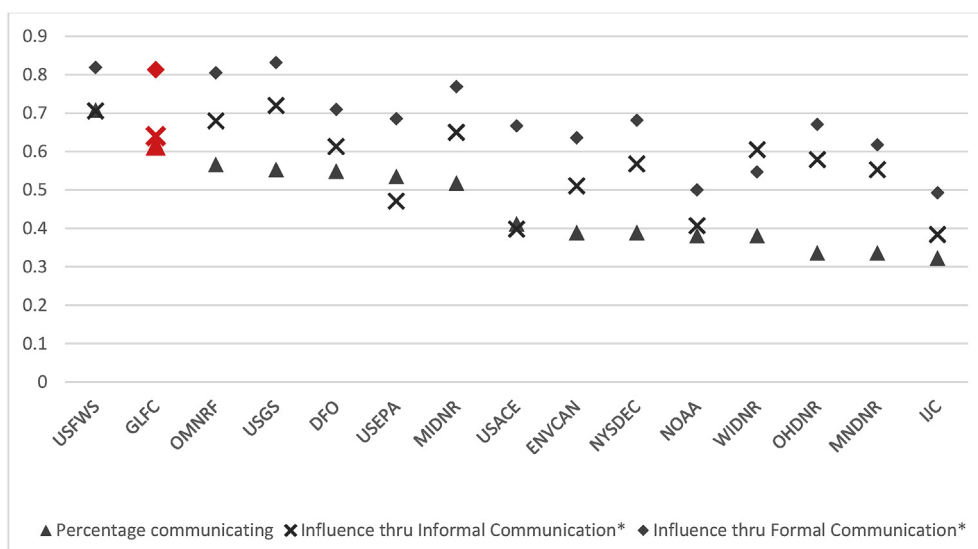
Fig. 2. Agency communication with each other, and communication-facilitated influence in the Great Lakes fisheries policy network (*Occasional + Regular Influence).

of a treaty secretariat was observed in the survey of the Pacific Salmon Commission (see Appendix).

3.3.2. Estimating the size of influence

The survey results on interorganizational influence are presented in Table 1 and graphically in Fig. 2. They include scores for the 15 (of the 45) organizations, who together represent 67% of all interorganizational contact reported in the survey (that is, one third of the organizations making up more than two thirds of the communication linkages in the network). The specific percentage for each organization is listed in the "percent communicating" column. The four columns to the right of the percent communicating column in Table 1 indicate the degree of influence derived from the self-assessment of staff of other organizations for the organization listed in the row, as measured by the survey questions. We show combined occasional and regular influence through informal channels; regular influence through informal channels; combined occasional and regular influence through formal channels; and regular influence through formal channels. For example, 70.6% of non-US Fish and Wildlife Service (USFWS)-employed

respondents who report communicating with the USFWS indicated being regularly or occasionally influenced by this organization through informal means (0.706), while 81.9% of them reported regular or occasional influence through formal means (0.819).

The survey results reveal that the GLFC, as represented by its secretariat, had a strong influence over the fishery management network. In terms of the percent communicating score, the GLFC was only second to the USFWS, with 61.5% of the non-GLFC survey participants reporting professional contact with the GLFC. Of these respondents who claimed contact with the GLFC, 64% reported occasionally or regularly basing their decisions on what was being communicated informally with the GLFC; this number rises to 81.3% when influence through formal communication is measured. Thus, while the GLFC's influence facilitated through informal communication was noteworthy (5th out of the 15 displayed), its influence through formal communication was considerably higher in comparative terms (3rd out of the 15, see Fig. 2). This suggests that the GLFC can be considered one of the most influential organizations in the network of agencies governing the Great Lakes fishery, roughly equal to, if not more than,

the highly funded Canada or U.S. federal agencies. We note similar findings for the Pacific Salmon Commission in another survey we conducted in the context of transboundary Pacific salmon fisheries in western North America (see Appendix).

3.4. Understanding relational mechanisms of secretariat influence

To further probe the relational determinants of influence, semi-structured interviews were conducted with twelve staff members of the GLFC secretariat in December 2016. The interviewees' roles spanned diverse programs/expertise from fisheries coordination to scientific research to policy and legislative affairs. While the survey analysis above revealed the extent of GLFC influence judged directly by the other organizations in the network, and displayed in an aggregate format, the interviews sought a reflexive perspective of how the GLFC secretariat itself perceives its role, how it may exercise influence across the policy and management network, and the strategies for doing so. Examples of the questions include:

- How much latitude does the GLFC secretariat have in interpreting its mandate? How does it operate in relation to government parties?
- To what extent does the GLFC create or define new tasks for itself, potentially expanding its mandate? What is the process for doing this?
- Are the GLFC secretariat's main functions and programs replicated by any other international organizations or government agencies? Or does it fulfill distinctive and non-substitutable functions?

The questions were broadly inspired by the sources and determinants of IO influence and power elaborated by Barnett and Finnemore (2004) and Jinnah (2014). The interviews lasted 1 h on average with the interviewees being assured of confidentiality. Afterwards, they were transcribed and coded, and thematic analysis techniques were applied to elicit key narratives (i.e. Braun and Clarke, 2006).

Three main traits were identified. First, among those interviewed, there was a strong sense that the GLFC is uniquely binational and therefore irreplaceable. The fact that the GLFC has been around for so long also seems to have contributed to its institutionalized status, which made it difficult for interviewees to hypothetically consider what would take its place if it did not exist. Members of the secretariat commented:

> There's dozens and dozens of projects that are directly influencing fishery management, so if the commission isn't coordinating this, who is? It falls apart because we are the only ones that have that sort of international mandate, we can coordinate across all of the boundaries across all of the jurisdictions. We can deal with moving data, money, funding projects across boundaries, all of that. So, the answer is the commission is critical in terms of that international oversight role … I think the basin will be completely different without the commission playing that sort of coordinating international role. (Respondent #10)

> You would probably backtrack by 50 or 60 years, with people then creating alliances and trying to get their own − this [the GLFC] is the mechanism that has been established and facilitated that conversation. (Respondent #7)

This view corroborates with Jinnah (2014) who argued that the secretariats of IOs are more influential if they perform functions that are not easily substitutable by another organization participating in a network governing a given issue. The other determinant of secretariat influence in Jinnah's theory is whether secretariats

work on an issue on which member government does not have firm and solidified preferences. Great Lakes fishery management is a well-established problem for which governments have dedicated bureaucracies with a record of articulated preferences. Interviewees indicated that this narrows the scope of influence, and that GLFC officials seek to appear facilitative rather than representative of a particular position. Two of the interviewees suggested that having regulatory authority (such as the ability to set fishing quotas) would undermine its apparent impartiality and make it less trusted by the other partners.

Second, the GLFC not only has access to relevant decision-making forums in the basin-wide fisheries management network and in the capital cities of the two countries; its unique binational presence has facilitated information exchange and relationship-building among the government agencies through a well-attended meeting structure it created for the region. Identified as a key source of influence for the GLFC (along with the ongoing success of sea lamprey control), several secretariat staff spoke extensively about the efficacy of these meetings:

> We have Lake Committee meetings, we have annual meetings, we have the biennial meetings. A lot of that are different members at different levels, but the Council Lake Committees, the Lake Committees, these are everyone coming together, people who are influencers, people who are decision-makers, heads of DNRs [Departments of Natural Resources], giving the authority to make these decisions or at least giving the ability to take that information back to their decision-makers. (Respondent #7)

> So, all of those meetings the structures had been in place for a long time … And one of the things that astounded me when I first got involved in this organization [the GFLC] back in the early 2000's was the discipline with which people came to meetings … You go to the Council of Lake Committees meeting and a 100 percent of the time a 100 percent of the jurisdictions are represented. And the same right up and down the whole, you know, tree. So, you ask yourself the question, why is that? As things get busier, you know as people's agendas fill up more and more … teleconferencing has replaced face-to-face meetings … it's easier to do things than it was before. Despite all of that, people come to the meetings and they participate, they engage. And so, when you think about it from that perspective, it's because the stakes are high. If you don't participate in the meetings within any of those layers, then you potentially miss out on some pretty important decision-making about, you know, anything to do with the management of the resource … [T]hey can't afford not to participate. (Respondent #8)

This understanding of influence is markedly relational in the sense that it only emerges and persists insofar as state agencies decide to participate. Once the discipline with which other agencies engage in the process is lost (i.e. "if people started to not show up"), there is a recognition that the Commission will begin to be undermined, as one interviewee puts it: "So if you had two jurisdictions that didn't come all of a sudden, the integrity of the whole thing starts to get compromised." (Respondent #8) Hence, the maintenance of this convening power is a critical element of GLFC influence.

Third, Barnett and Finnemore (2004) argue that IOs that are viewed as legitimate by governments are more able to exercise influence through the shaping of how issues are understood. In the case of the GLFC, through the secretariat activity of creating, coordinating and supporting the communicative structure across the entire network that is basin-wide, it appears that the GLFC has acquired a crucial means of shaping information and framing perceptions of the issues that affect

other parties. In the words of the interviewees, this was described as:

> People get to know people, relationships are built, there's credibility. It's all brought about because of the way the commission has structured the lake committees and helps facilitate their interaction; people get to know each other very well and that way you can lay the cards on the table and work together to achieve the goals … (Respondent #11)

> We [the GLFC secretariat] have the ability to shape some of the thinking … because we tend to speak for the collective basin and so, I think generally, the commission is viewed as being a spokesperson for our partners for the other agencies … I don't think it's this ability to control thinking, I think it's an ability to share a broader perspective and a history of doing that that provided us with a great deal of influence in directing some of these policy or science. (Respondent #5)

4. Discussion and conclusions

By approaching influence as a relationally derived construct in a network setting, this study devised and tested a survey that achieved a quantitative assessment of treaty secretariat influence. In this way, how influential is less a question of resources at disposal, the mandate of the secretariat, or its organizational cultures, but more directly pertains to how government agencies, who typically possess regulatory authority as well as larger budget and personnel, regard the secretariat as impactful. In other words, influence materializes to the degree that other organizations in the governance network judge their (internal) decision-making to be influenced by the work of the secretariat. An application of the designed survey to the binational Great Lakes Fishery Commission demonstrated a considerable degree of influence exerted by the secretariat — a finding essentially obtained by the members of the policy network expressing so. The comparatively high level of influence of this treaty secretariat, together with being the locus of interjurisdictional communication (a finding replicated in the case of the Pacific Salmon Commission survey results presented in Appendix) echoes a recent analysis of the global climate governance structure wherein the secretariat of the United Nations Framework Convention on Climate Change is ranked "sixth" in terms of the ability to influence the flow and content of policy-relevant knowledge within its stakeholder network (Saerbeck et al., 2020). Our result also corroborates previous findings based on qualitative methods, supporting their observations of the unique capability of a treaty secretariat in directing some of the policy or science (see Bauer, 2006; Biermann and Siebenhüner, 2009; Busch, 2014; Jinnah, 2014; Eckhard and Ege, 2016). This is an interesting and useful confirmation given the expectation of secretariats to downplay their influence and states' reticence to formally acknowledge secretariat influence. Yet in this case, elicitation of direct expression of influence was possible through our survey method.

Probing deeper, through key informant interviews, our study sought explanations of how this influence may come to be relationally derived. Findings from the GLFC secretariat suggest that a major means through which a secretariat can generate and maintain the control of the network, shape agendas, and intervene in regional priorities, is through ensuring robust attendance in the meeting structure it has convened and led for over half a century. The systematic meeting structures which strive to ensure participation of all levels of regulatory bureaucracy has served as a source of authority and legitimacy for the GLFC, as a member of the secretariat highlighted: "we have a combination of fiduciary and environmental responsibility and social interactions that all form kind of a nexus … It's a combination of collaboration, communication, coordination,

cooperation, all leading to something that looks like — well, it could be expressed as influence, but that's one descriptive word of a much bigger diamond that has lots of facets" (Respondent #9).

Two factors appear crucial in generating this outcome. One is the legitimacy and ostensive impartiality derived from the GLFC's long-proven ability to share a broader binational perspective. The GLFC (both the secretariat and the commissioners) has built a reputation of speaking and acting for the collective interests of the Great Lakes basin, hence being viewed as something of a 'spokesperson' for the common, interconnected fisheries issues. This is not the authority to manage the fishery per se, but the authority to set up working arrangements to bring about better transboundary fisheries management. Subsequently, being in contact with the GLFC has given individual agencies or jurisdictions a compelling incentive to consider what other states or the entire region is doing before deciding and taking on management actions. Hence, a long history of credibility on the part of the treaty secretariat has likely attracted significant body of listeners.

Another notable feature in the functioning of the Great Lakes fishery governance network is the occurrence of affinitive trust (i.e. a type of trust built on informality, familiarity and long-term interactions) which is shown to enhance one's aptitude to influence decision-making of others, as facilitated via communication (Song et al., 2019b). As shown in Fig. 2, the GLFC is an agency with the second highest proportion of communication linkages reported in the network, suggesting its potential to be influential amid the occurrence of trusting relationships among agencies (see also Leonard et al., 2011; Mulvaney et al., 2015). Indeed, collegial or personal relationships abound and are particularly valued in the Great Lakes fishery regime, where its community of professionals is likened to an epistemic community who "speak the same language" (Gaden et al., 2013). As an entity relied upon by others to coordinate these valued interactions, the GLFC is 'on the front foot' to shape information and perceptions of the issues, oversee diffusion of norms as well as influence the broad policy agenda (sensu Barnett and Finnemore, 2004). Likewise, as detailed in Appendix, the organization of the Pacific Salmon Commission (PSC) into a committee and panel structure, which brings together government managers, scientists, and representatives of fishing industry, combined with the existence of long-standing relationships among the participants, are noted to have similarly contributed to the effectiveness of the PSC in managing multi-jurisdictional coordination (McRae, 2010; Temby et al., 2015; Song et al., 2017).

What emerges from this study, therefore, is the salience of a relational structure of a governance network and the cooperative makeup of interactions built on mutual dependence and close relationships, which provides a source of influence for those entrusted to coordinate the exchanges. This is consistent with the conclusions of a general network scholarship which has shown network involvement, or embeddedness in a network, is positively related to key organizational outcomes such as trustworthiness, reputation and influence (Provan et al., 2012). Ironically, the strength of this approach may also pose as a limitation, for relationally derived influence would require relationship-building as a prerequisite. For the GLFC (and the PSC presented in Appendix), the backdrop of generally amicable binational relations between Canada and the USA, along with the perpetuation of the same language and similar culture, have all likely made them easier to function this way. For a multilateral treaty that draws together jurisdictions from different continents, histories, languages and economic standards of living, however, an international organization may undergo a more onerous process of engendering interorganizational trust and recognized interdependence, and therefore of deriving networked influence. Thus, how and to what degree secretariat influence in the relational sense develops in a multilateral setting with a more diverse range of actors represents a

useful direction for future research.

Situating the findings of this study within the existing understanding of secretariat influence yields additional insights. As discussed above, Jinnah (2014)'s theory of IO secretariat influence proposes two master variables explaining variation in influence, namely, preference solidification and the substitutability of functions. The fact that the multitude of challenges facing the Great Lakes fishery have a more than century-long history suggests that preferences on issues like fish stocking and harvesting limits would be well-defined. In fact, in the 1960s, the GLFC would set fishing quotas (although it did not have the formal authority to do so) because no one else had sufficient knowledge. Now, the state parties have quota preferences with which they come to the table. Even the issue for which the GLFC was explicitly created to address, the sea lamprey invasion, has a more than 70-year history. Thus, the GLFC secretariat operates in the context of solidified preferences, and Jinnah's theory would predict this to limit influence. The evidence here suggests, however, that the secretariat has adapted to steer policy more adeptly with its own institutional maturation.

With regard to the substitutability of functions, the GLFC secretariat's facilitation of policy coordination is relevant. History has shown that, in the absence of a coordinating organization, such as the GLFC, there would be fragmented parochialism (Gaden et al., 2013). The GLFC may perhaps be replaced by a more robust Canada-US transnational network; however, considering the fact that the GLFC is used even in the U.S. subnational context to coordinate policy in state waters, it is probably hard to dispense with. The alternative would be a working group without a treaty secretariat, with state/provincial resources, doing the coordinating. But given that the eight states and Ontario need to coordinate ecosystem management and the stocking and fishing quota setting of specific fish species, this does not seem realistic. Neither does giving the task to the International Joint Commission or Great Lakes Commission, each of which is not scaled appropriately and do not have the knowledge the GLFC has. The GLFC secretariat performs two other important functions on an ongoing basis. If the GLFC did not do these, it would leave a void in leadership in this area. First, for now, no other organization has the expertise to do sea lamprey management. Because it involves canals and dams in subnational waters and the coordinated chemical treatment of the lakes with lampricide, it would require something that may end up looking a lot like the GLFC. Second, the GLFC secretariat funds scientific studies and commissions papers synthesizing the state of scientific knowledge on a range of topics. This represents an important, yet subtle, form of technocratic power. Without this work, less knowledge of Great Lakes fisheries would be produced by scientists and it would likely be more fragmented – in terms of not centrally coordinated, and not centrally framed by way of synthesis reports.

There are certain limitations of our methodology. It is worth noting that the depiction of a governance network as pursued in this study is not perfect, given that the survey relied on respondents' voluntary participation while based on non-randomized, purposive sampling. What is attained is therefore a partial picture of the 'true' communicative relations and interorganizational influence in the regime. Nevertheless, because capturing all organizations and every pertinent agency staff in the data is often not a feasible strategy and because estimating the structure of a network itself is one of the major aims of network-based analysis, this constraint is grounded well within the generally implied caveat of network methodology (e.g. this also applies to Twitter-generated network data, see Jörgens et al., 2016; Kolleck et al., 2017). In addition, to show any changing trends of secretariat influence over time, a longitudinal design that incorporates multiple survey applications would be valuable.

Binational fishery commissions are a sub-continental organization focused on a specific natural resource base with smaller staff, budget and international reputation on offer. In the case of the GLFC, while it enjoys low substitutability, it nevertheless operates in areas of high preference solidification, meaning fishery challenges have existed for many decades for the national and subnational governments to develop a set of preferences for how fisheries should be managed. While such hypotheses may suggest sizable hurdles to overcome for small treaty secretariats in generating influence over other government entities, an exploration of the relational methodology above shows otherwise. Through convening power developed over decades of trust-building effort and the development of supporting management control mechanisms, the ability of the GLFC secretariat to steer norms and ideas and shape relationships across jurisdictional boundaries could be demonstrated. The results contribute to the deepening pool of evidence suggesting the high salience of IOs (of any size) in shaping decision-making within cooperative environmental regimes. Importantly, the relational approach is a useful research avenue through which one can attempt to directly elucidate the degree and reach of international treaty secretariat influence – an approach that would benefit from further sharpening and empirical testing.

CRediT authorship contribution statement

Andrew M. Song: Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing, Visualization. **Owen Temby:** Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing. **Dongkyu Kim:** Methodology, Formal analysis, Writing - review & editing. **Gordon M. Hickey:** Conceptualization, Methodology, Writing - review & editing, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Andrew Song, on behalf of all authors.

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APPENDIX

We also conducted a survey of the transboundary fishery policy network governing Pacific salmon fisheries in western North America. In what follows we summarize the results to offer a degree of insight to the external validity and potential generalizability of our Great Lakes survey findings to other treaty secretariats.

Pacific Salmon Commission (PSC)

The PSC was originally created in 1937 as the International Pacific Salmon Fisheries Commission and has existed in its current

form since the 1985 Pacific Salmon Treaty. Its main purpose is to advise on the conservation of the Pacific salmon to achieve optimum production and fair harvest allocation. The 1999 Canada-US Pacific Salmon Agreement (and subsequently the 2008 Agreement) amended the 1985 treaty by improving the PSC's process of measuring stock abundance and setting commercial and recreational fishing quotas (Miller 2003). The management of the Pacific salmon is a complex and politically sensitive endeavor owing to the numerous biologically distinct fish stocks traveling through inland rivers and ocean basins, across national and state borders, and through multiple governance regimes (Ebbin, 2002). The organization is advised by five panels (Northern, Southern, Transboundary, Fraser River and Yukon River), each of which manages a specific region and submits quota recommendations to a group of commissioners appointed by Canada and the US, who then review and forward the negotiated plans to the governments for final approval and regulatory implementation, or, in the case of the Yukon River Panel, directly to the two governments (Miller, 2003). Uniquely, the Fraser River Panel engages in the in-season regulation of Fraser River-origin sockeye and pink salmon fisheries within its designated area including the decisions to open or close the fishery. Several joint technical committees support the overall process by reporting relevant scientific information to the panels and commissioners. The secretariat, located in Vancouver, perform a variety of functions, such as running field programs, facilitating meetings, preparing reports and providing technical information and scientific advice on stock assessment, fish biology and hydroacoustics among others (PSC, 2016).

Survey description

The Pacific salmon data were collected during September and October 2013, and consists of 92 complete survey responses. For this survey, we restricted data to the region represented by the Northern Panel of the PSC. All responses were anonymous with no names or other identifiable information collected other than professional affiliation (see [masked for blind review] for other details of survey processes).

We identified 30 organizations as relevant public agencies that potentially formed the Pacific salmon fisheries governance network. They included Pacific Salmon Commission, US National Marine Fisheries Service, Alaska Department of Environmental Conservation and Fisheries and Oceans Canada (see Figure A.1 for a full list of agencies included in the survey). The preponderance of its respondents was from agencies belonging to the US federal government (20%), the Canadian federal government (16%), the state of Alaska (29%), and the Canadian province/territory of British Columbia and Yukon (30%).

Survey analyses and results

Aggregate patterns of communication

For the 92 respondents who participated in the Pacific salmon study, a total of 388 formal and 350 informal communication dyadic linkages were reported. From this, both the agencies with which each respondent was affiliated and with which she communicated were noted and classified according to the jurisdiction to which the agencies belong. We used four jurisdictional groupings (US Federal, Alaska, Canadian Federal, Canadian province/territory) for enhanced analytical clarity, plus the PSC and non-state actors. Having included 6 groupings meant that a 6×6 adjacency matrix was used to create the interjurisdictional communication network (i.e., 6 nodes). Figure A1 presents the distribution of interjurisdictional communication in the form of density visualization using VOSviewer 1.6.0. Node colour denotes the level of interjurisdictional communication reported for each jurisdiction (i.e., the redder the colour, the greater frequency of communication one node is associated with other jurisdictions). The distance between nodes indicates the intensity of relatedness such that closely located nodes imply a proportionally higher occurrence of communication between them.
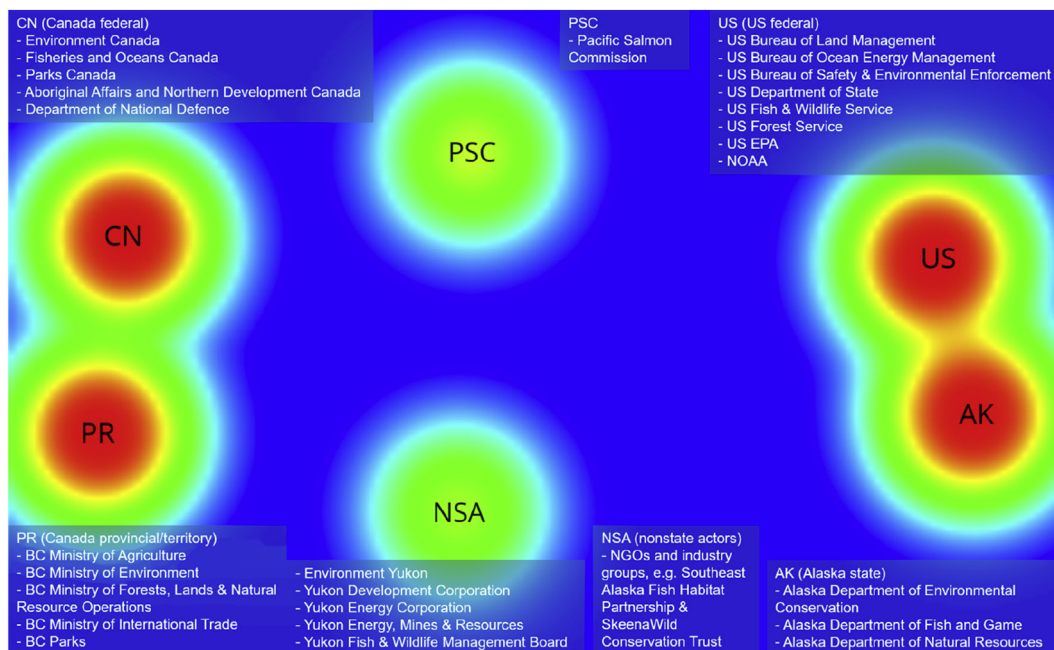

Fig. A.1. Interjurisdictional communication pattern for governance networks pertaining to the Northern Panel of the Pacific salmon fisheries.

As suggested by the node colour, communication is concentrated at, and between, the US Federal and the Alaska state agencies (i.e., 341 and 329 units of communication, respectively), and on the Canadian side, at and between the Canada Federal and the Province/Territory agencies (330 and 321). Meanwhile, markedly fewer communication linkages were associated with the PSC (85). Such patterns are not surprising given the typically a greater range of responsibilities and resources that are at disposal with federal and state agencies compared to international treaty secretariats. What is strikingly depicted in this result, however, is the centrality of PSC (as well as the non-state actors), implying its network-facilitating role in the way the PSC communicates with the federal and subnational management bodies.

Estimating the size of influence

The survey results on interorganizational influence are presented in Table A.1 and graphically in Figure A.2. Of the 30 organizations included in the Pacific salmon survey as choices for respondents to report communicating with, we focused on the top 10 organizations with the highest frequency. These organizations represented more than two thirds of all interorganizational contact reported in the survey. The calculation and interpretation of the figure and table are the same as for Table 1 and Figure 2 in main body of the manuscript. For example, 51.5% of non- US Fish and Wildlife Service (USFWS) employees reported communicating with USFWS. Of these, 64.7% indicated

being regularly or occasionally influenced by this organization through informal means (0.647), while 80.1% of them reported regular or occasional influence though formal means (0.801).

The PSC has the same percentage of respondents in the network communicating with it as NOAA (which regulates fishing in US federal waters) and more than any British Columbia government agency (39.4%). Only four organizations are communicated with more, and three of these are highly funded regulatory agencies. Of the respondents that reported communicating with the PSC, 53.8% reported influence through informal means, and 69.2% reported being influenced through formal means. The influence of the PSC facilitated through informal communication, such as phone calls, chance conversation and social interactions was not remarkable. However, the influence of the PSC determined through formal communication channels that include committee meetings and official memo was relatively high, equivalent to that of national agencies such as Fisheries and Oceans Canada (DFO) and US Environmental Protection Agency (USEPA) and even surpassing that of Alaska Department of Fish and Game (ADFG). The overall portrait is of the Northern Panel of PSC that is roughly or nearly equal in influence to the national and sub-national public agencies governing the transboundary Pacific salmon in southeast Alaska and northern British Columbia.

Table A.1
The Effects of Formal & Informal Communication: Pacific Salmon (Note: Standard errors in parenthesis).

| Type	Org	Percent Communicating	Occasional + Regular Informal Influence	Regular Informal Influence	Occasional + Regular Formal Influence	Regular Formal Influence
IO	Pacific Salmon Commission (PSC)	0.394	0.538 (.080)	0.103 (.049)	0.692 (.074)	.231 (.067)
US Federal	US Environmental Protection Agency (USEPA)	0.303	0.567 (.090)	0.133 (.062)	0.700 (.084)	.300 (.084)
	US Fish and Wildlife Service (USFWS)	0.515	0.647 (.067)	0.137 (.048)	0.804 (.056)	.235 (.059)
	US Forest Service (USFS)	0.343	0.500 (.086)	0.147 (.061)	0.735 (.076)	.235 (.073)
	National Oceanic and Atmospheric Administration (NOAA)	0.394	0.590 (.079)	0.103 (.049)	0.744 (.070)	.179 (.061)
Canadian Federal	Environment Canada (ENVCAN)	0.414	0.537 (.078)	0.122 (.051)	0.732 (.069)	.171 (.059)
	Fisheries and Oceans Canada (DFO)	0.525	0.596 (.068)	0.135 (.047)	0.712 (.063)	.173 (.052)
Alaska State	Alaska Department of Fish and Game (ADFG)	0.444	0.568 (.075)	0.114 (.048)	0.636 (.073)	.250 (.065)
BC Provincial	BC Ministry of Environment (BCME)	0.374	0.703 (.075)	0.216 (.068)	0.784 (.068)	.216 (.068)
	BC Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO)	0.303	0.667 (.086)	0.200 (.073)	0.800 (.073)	.267 (.081)
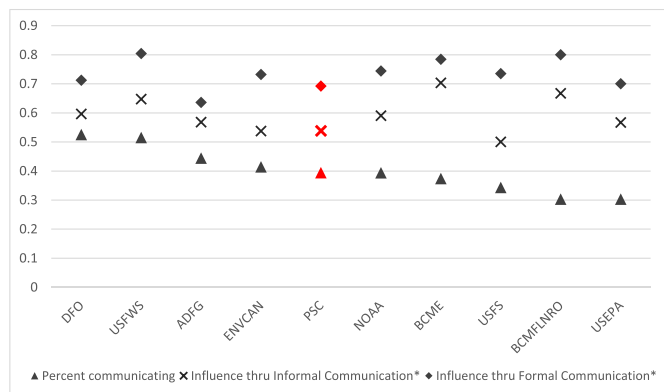
Fig. A.2. Agency communication with each other and communication-facilitated influence in the Pacific salmon fisheries policy network, Northern Panel (*Occasional + Regular Influence).

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