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RESEARCH ARTICLE



# Institutional factors affecting fish passage in the Columbia River Treaty renegotiation

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## ABSTRACT

The United States and Canada have begun renegotiating the Columbia River Treaty, which is an international model for transboundary water governance. This paper identifies six institutional factors that will affect negotiations pertaining to fish passage during the renegotiation of the treaty: geographical advantage, issue linkage, a basin commission, the duration of agreements, negotiating autonomy and side payments. These factors and the methods used to determine them can be applied to other transboundary river basins where basin states have a history of transboundary resource governance. This analysis also serves as a policy-relevant resource for Columbia River Treaty negotiators and stakeholders.

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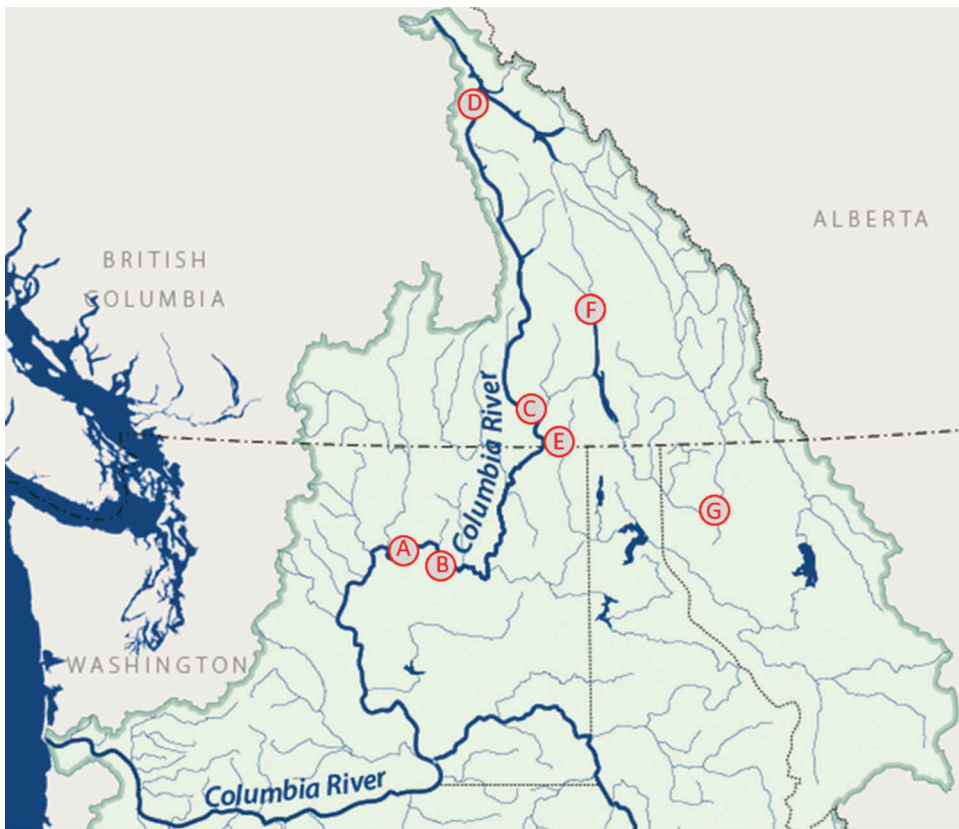
Dams; fish passage; governance; Indigenous peoples; salmon; Columbia River Treaty

## Introduction

Transboundary water governance involves a tension between the sovereign rights of states and their needs and responsibilities to cooperate to share water resources (Norman & Bakker, 2015). Today, there is also a growing tension between the numerous drivers of future uncertainty (e.g., climate change, population growth, ageing infrastructure), which will require institutional flexibility, and the traditional approaches to transboundary water governance, which focus on clear divisions of resources and responsibilities in the interest of protecting sovereignty (Cosens, 2011). Major infrastructure projects can play an outsized role in water governance because they can control the flow of water from upstream states to downstream neighbours. However, little specific and conceptual attention has been directed towards understanding the major drivers that lead to, for example, dam construction, decommissioning or modification on a transboundary river. In one case, dam construction on the River Nile led to tension among basin states, but the drivers that led to the dam building were straightforward (e.g., Salman, 2016). In another case, Blumm and Erickson (2012) reviewed dam decommissioning in the Pacific Northwest of the United States (PNW) and identified factors that were consequential in domestic settings that did not feature the transboundary complexities. Other scholars, such as Timmerman, Matthews, Koepfel, Valensuela, and Vlaanderen (2017), have emphasized that water management regimes (including processes pertaining to infrastructure) typically differ more between than within countries. This underscores the importance of understanding the forces that shape transboundary water governance in international river basins. Additionally, Richter and Thomas

(2007) note that a majority of global attention has been directed at controversies surrounding the social and ecological consequences of new dam construction. They further note that this has caused many to overlook the abundant opportunities that exist to enhance the environmental and social benefits of healthy river ecosystems through the modification of existing dams and their operations. Infrastructure modification in transboundary river basins warrants further study.

The coordinated management of major infrastructure is particularly important in the Columbia River Basin, an international river basin that straddles the border between the United States and Canada (Figure 1). In this water-rich region, no reservoirs or consumptive uses have historically been large enough to create water scarcity for other stakeholders. Instead, the Columbia River Treaty (CRT), the governing agreement between the two basin countries (described in detail below), stipulates that flows out of the large dams in the upstream portion of the basin, which is mostly in Canada, are



**Figure 1.** Northern half of the Columbia River Basin with dams relevant to this paper: Chief Joseph Dam (A) and Grand Coulee Dam (B) on the Columbia River block fish passage in the United States; Hugh Keenleyside Dam on the Columbia River, Brilliant Dam on the Kootenay River (both at location C) and Waneta Dam and Seven Mile Dam on the Pend Oreille River (both at location E) block fish passage in Canada; and Keenleyside Dam (C) and Mica Dam (D) on the Columbia River, Duncan Dam on the Duncan River (F), and Libby Dam on the Kootenai River (G) were built as part of the 1964 Columbia River Treaty.

Source: Image modified from the Columbia River Inter-Tribal Fisheries Commission (CRITFC) (2017a).

engineered to maximize flood control and hydropower production in the United States downstream. In May 2018, Canada and the United States began renegotiating this treaty. This presents a valuable opportunity for the two countries not only to update river management practices but also to modify major infrastructure in the basin to respond to new societal priorities.

A key issue that will be part of the renegotiation is that of fish passage (BC Treaty Review Team, [n.d.](#); Kramer, 2018; USA Entity, 2013). Presently, migratory salmonids cannot access their historical spawning grounds in the Upper Columbia Basin (i.e., in northern Washington and British Columbia – BC) because of large dams that have been built without fish passage infrastructure. All negotiating parties have stated generally that they wish to improve ecosystem function through the renegotiated treaty, which could include increasing salmon access to upstream habitat (BC Treaty Review Team, [n.d.](#); Kramer, 2018; USA Entity, 2013).

As the CRT is renegotiated, several factors will determine the relative power of the negotiating parties and the eventual outcomes on key issues such as enhanced fish passage. Because enhancing fish passage implies that modifications to major infrastructure projects will be an important part of this treaty renegotiation, the work of Blumm and Erickson (2012) on dam decommissioning is particularly relevant. These authors isolated five key interests of actors negotiating the removal of major dams: the size and technical difficulty of the project, the applicability of government relicensing (which can effect changes to dam structure or operations), the strength of local opposition or support, the presence of a political champion, and the funding available. While no dams on the Columbia River are proposed for removal, these ‘interest factors’ apply to the infrastructure modifications that would be necessary to expand the range of fish migration in the basin. This is because, in this region, the processes that allow dam removals are similar to those that would be required for major modifications to existing dams.

This paper adds to this previous work by identifying factors that characterize the institutions participating in the renegotiation of the CRT and influence their behaviour. These ‘institutional factors’ are drawn from a review of the history of the 1985 Pacific Salmon Treaty (PST) to understand a relevant example of resource governance between the United States and Canada. These factors complement the interest factors of Blumm and Erickson (2012). We apply our institutional factors to the challenge of salmon restoration in the Upper Columbia Basin to provide policy-relevant insights towards an international water treaty negotiation that serves as a model for peaceful transboundary water governance. Our approach of examining a past treaty between transboundary basin states is not unique to the Columbia River Basin; it can be used to understand other basins in which basin states have a history of negotiations with one another.

## **The Columbia River Basin and the Columbia River Treaty**

The Columbia River Basin covers portions of seven states of the United States as well as the Canadian province of BC. For millennia it ran wild and provided the region’s Indigenous peoples with the world’s largest salmon runs (Sandford, O’Riordan, & Harford, 2014). Since 1933, the river has been harnessed by dams to provide the region with abundant hydropower, water for irrigated agriculture, flood control and navigable waterways for shipping, among other benefits (Sandford et al., 2014).

The 1964 ratification of the CRT was a crucial step in the transformation of the Columbia. This treaty has been expertly reviewed by Sandford et al. (2014). Briefly, it required that Canada build Mica, Hugh Keenleyside and Duncan dams on its portion of the Columbia and authorized the construction of Libby Dam on the Kootenay River in the US state of Montana, whose reservoir crosses the international border (Figure 1). The three Canadian Treaty dams manage storage and releases to protect the United States from floods and optimize downstream hydropower generation. In return, the United States gives Canada half the additional hydropower. This is then sold back to US utilities, and the ensuing revenue is called the 'Canadian Entitlement'. The treaty allows for unilateral termination by either party starting on 16 September 2024 (60 years after entry into force) provided the terminating country gives the other 10 years' advance notice. Otherwise, it will continue indefinitely. Also in 2024, Canadian flood control obligations under the CRT change from providing assured storage for the United States to providing flood storage when 'called upon' in the event that the United States cannot manage its floodwater independently. This will increase flood risk in the United States (BC Ministry of Energy and Mines, 2013). Rather than terminate the treaty, Canada and the United States have both decided to renegotiate its terms and began the process of doing so in May 2018. In this paper, 'renegotiation' refers to the modification of the CRT under the existing treaty provisions or the creation of new laws or treaties that would complement the existing treaty, not the creation of a completely new treaty.

When Canada and the United States were initially negotiating the CRT, they excluded environmental interests and created an agreement that managed the river primarily for flood control and hydropower generation (Sandford et al., 2014). This matched the dominant values of the time and other Columbia Basin development. However, in the Columbia River Basin and on a global scale, one especially strong societal priority that has emerged in recent decades is the growing imperative to integrate ecosystem concerns into infrastructure development and operations (Matthews, Wickel, & Freeman, 2011; Sandford et al., 2014). The opportunity for action presented by the treaty renegotiation is also unique because the switch from relying on ecosystem services to engineered services, which has characterized the development of the Columbia River Basin since the era of dam construction began in the 1930s, has reduced the ability for systems of governance to register feedback from natural systems (Cosens & Fremier, 2014). This means that, without an occasion such as the renegotiation of the CRT, it is unlikely that the relatively gradual changes in ecosystem health that the Columbia River Basin is experiencing would motivate significant action by the government in time to execute a meaningful response.

Such action is needed. As a result of the damming and management of the river solely for hydropower and flood control, ecosystem health has declined severely. The Columbia Basin was once home to the world's largest salmon runs with as many as 16 million fish returning to spawn yearly (Sandford et al., 2014). Pacific salmon are born in inland streams, swim to the ocean to grow, return upriver to spawn, die there and thus depend on long-distance migration within rivers (Cederholm, Kunze, Murota, & Sibatani, 1999). Today, most species of Columbia Basin salmon (and steelhead trout) are designated as threatened under the US Endangered Species Act, and two populations are listed as endangered (Washington State Recreation and Conservation Office, 2009). Restoring salmon access to the Upper Columbia Basin offers a range of benefits that are described

elsewhere (Beechie et al., 2012; Blumm, 2013; Canadian Columbia River Inter-Tribal Fisheries Commission (CCRIFC), 2016; Columbia River Inter-Tribal Fisheries Commission (CRITFC), 2017b; Upper Columbia United Tribes (UCUT), 2015).

Restoration of salmon has motivated many dam removals (Blumm, 2013). However, removal of many large dams is impractical, and so the addition of fish ladders to them has permitted the migration of fish upstream to spawn (Williams, Armstrong, Katopodis, Larinier, & Travade, 2011). Adding fish passage infrastructure at six key dams (Figure 1) would restore access to much fish habitat in the Columbia Basin and thus do much to increase fish populations. Dams on the Lower Columbia River have fish ladders. However, fish passage to the upper watershed was initially eliminated by the construction of Grand Coulee Dam in 1942 (located at river mile 596 in central Washington). Subsequently, Chief Joseph Dam in the United States (river mile 545) and Hugh Keenleyside (river mile 782), Brilliant (river mile 1.7 of the Kootenay River), Waneta (river mile 0.3 of the Pend Oreille River) and Seven Mile (river mile 6 of the Pend Oreille River) dams in BC were constructed without fish passage infrastructure (UCUT, 2015). It has not been conclusively determined which method of fish passage would be most effective for each dam (UCUT, 2015). However, Chief Joseph (72 m high) and Grand Coulee Dams (168 m high) may be too large for existing fish ladder technology to provide effective passage (UCUT, 2015). Currently, the largest fish ladder in the Basin is at The Dalles Dam (61 m high) on the Lower Columbia at River Mile 192 (Portland State University and Oregon Historical Society, 2017). Thus, a restoration programme might initially involve a trap-and-haul operation in which fish are collected above and below the dams and trucked to the other side (UCUT, 2015). Permanent fish passage facilities such as fish ladders, locks, elevators or cannons (e.g., Whooshh Innovations technology) may be more immediately feasible at the smaller Canadian dams (UCUT, 2015). Hugh Keenleyside, Brilliant, Waneta and Seven Mile dams are 52, 42, 76 and 65 m high respectively.

We focus on fish passage past dams because it is the first major barrier to restoring salmon to the Upper Columbia River Basin, but other barriers complicate salmon restoration further. Young fish moving downstream past dams have been shown to have mortalities of 36–69% in one Columbia tributary (Keefer et al., 2013). Consequently, hydraulic and ecological studies are needed to understand optimal environmental flows in the Upper Columbia if salmon are allowed to pass beyond Chief Joseph Dam (Horne, Stewardson, Freebairn, & McMahon, 2010; Williams et al., 2011). These must both aid the travel of young fish to the ocean and restore spawning habitat to areas that have not seen salmon in decades.

Since development began, the values that inform American and Canadian management of the Columbia River Basin have not been limited to hydropower and flood control. The presence of reservoirs is crucial to irrigation in the basin (Biemans et al., 2011). Since the inception of the CRT, the health of natural ecosystems has increased in importance. The inclusion of Indigenous interests in societal governance has also become an increasing priority (Sandford et al., 2014; United Nations, n.d.). These priorities are linked; restoration of salmon habitat in the Upper Columbia is a major way to improve ecosystem health and advance Indigenous interests (CCRIFC, 2016; CRITFC, 2017b; UCUT, 2015). This local linkage exemplifies a global trend described by Poff and Matthews (2013) that seeks to broaden thinking around ecologically



informed river management to integrate social objectives with targets for environmental quality. Consequently, the United States has stated that it wishes to expand the CRT's role in preserving and enhancing ecosystem health (USA Entity, 2013). BC has advocated for the continuation of existing efforts to balance ecosystem values, but that salmon restoration in Canada is a federal matter and passage above Grand Coulee is a domestic issue for the United States (BC Treaty Review Team, n.d.).

The CRT is administered and implemented by 'entities' that represent their respective countries. They have led the review processes that will inform the treaty's renegotiation (BC Treaty Review Team, n.d.; USA Entity, n.d.). The USA Entity consists of the Administrator of the Bonneville Power Administration (BPA) and the Division Engineer of the Northwest Division of the US Army Corps of Engineers (USACE) (USA Entity, n.d.). When the treaty was originally created, Canada ceded authority to BC under the Canada–British Columbia Agreement, although it remains the official party of the treaty (Sandford et al., 2014). As a result, the Canadian entity consists of the BC Hydro and Power Authority (a corporation owned by the BC provincial government), which is responsible for the implementation of the treaty and the Canadian entitlement.

The interest factors described by Blumm and Erickson (2012) build understanding of the prospects for enhanced fish passage in this basin and during this treaty renegotiation. Restoring salmon to the Upper Columbia is technically difficult due to the size of the six important dams described above. Government relicensing may reduce difficulty of enhancing fish passage because the operational licences of Hugh Keenleyside and Brilliant dams require fish passage modifications there if salmon runs are restored past Grand Coulee Dam (Green, n.d.; UCUT, 2015). Fish passage enhancements are unlikely to draw local opposition, and they have drawn strong support from Indigenous Nations that are acting as political champions (BC Columbia River Treaty Local Governments' Committee, 2013; CCRIFC, 2016; CRITFC, 2017b; Orlando, 2013; Pearkes, 2016; UCUT, 2015). However, their influence is diminished by the lack of a commission or other process that includes them; instead, they are consulted like stakeholders by the American and Canadian entities. A formal international commission can empower state and non-state actors equally, and so the composition of such a commission will do much to amplify or diminish the importance of the other interest factors presented here.

## **The Pacific Salmon Treaty and institutional factors for the Columbia River Treaty**

We studied the PST because a review of treaties between the United States and Canada identified it as the most similar case to the CRT. Each was difficult to negotiate (each required over 10 years), each focuses on a natural resource (i.e., salmon and river flows respectively) and each contains major, zero-sum elements. In the PST, gains and losses are in terms of fish harvests. In the CRT, gains and losses are in terms of monetary compensation to Canada for services provided to the United States. Other agreements between the Canada and the United States were not evaluated because they were too simple (e.g., the Convention on Great Lakes Fisheries, the Niagara River Treaty of 1950 and the 1989 Souris River Basin Water Supply and Flood Control Agreement), insufficiently focused on a small number of coherent issues (e.g., the North American Free Trade Agreement – NAFTA), lacking major zero-sum elements that would force careful negotiation (e.g., The Great Lakes Water Quality Agreement and the

U.S.–Canada Air Quality Agreement), or focused on methods for dispute resolution rather than the sharing of resources (e.g., Boundary Waters Treaty of 1909).

Salmon reach the Pacific Ocean from nearly all North American rivers that reach the Pacific from Northern California to Southwest Alaska. Once there, they may cross the US–Canada international border repeatedly before returning inland to spawn. Specifically, fish reaching the ocean in the PNW or south-western BC often swim north along the coast of BC and south-east Alaska before turning west in the Gulf of Alaska and following the Aleutian Islands to the open ocean and eventually returning to the coast via a variety of routes (Miller, 2003). Consequently, in addition to catching salmon that spawned in their own rivers, Canadian fishers can catch salmon that spawned in Oregon and Washington and Alaskan fishers can catch salmon that spawned in Oregon, Washington and BC. Consequently, each country can compromise the attempts of the other to harvest fish sustainably (Caldwell, 1999; Miller, 2003; Miller, Munro, McDorman, McKelvey, & Tyedmers, 2001; Shepard & Argue, 2005). As salmon move freely throughout the ocean, it is impractical to ensure that fishers from each country only catch their own salmon (Caldwell, 1999; Miller, 2003; Miller et al., 2001; Shepard & Argue, 2005). In 1971, the two countries sought respective salmon harvests proportional to the number of fish born in each country (Miller et al., 2001). Such an agreement was reached in the form of the PST in 1985.

The 14-year delay in the agreement was attributable in part to opposition from Alaska (Caldwell, 1999), whose fishers can intercept many fish that originate from Canada (as well as some from Washington and Oregon). However, Canada cannot easily intercept many Alaskan fish (Miller, 2003; Miller et al., 2001). The equitable sharing proposed under the PST threatened to curtail this Alaskan advantage. We observe that parties with natural geographical advantages may oppose agreements that aim to establish fairness between parties and may leverage their advantages to sway treaty negotiations.

Alaskan opposition was overcome by pressure from the US federal government (Caldwell, 1999; Miller, 2003; Miller et al., 2001; Shepard & Argue, 2005). The administration of then-President Ronald Reagan sought to ratify the PST to improve relations with Canada that had suffered as a result of inaction by the United States regarding acid rain in the Great Lakes Region. We thus observe that parties may link the subject of a negotiation to other issues outside the negotiation to increase their negotiating power or advance an interest outside the negotiation. This is known as issue linkage.

The 1985 signing of the PST created the Pacific Salmon Commission (PSC) and tasked it with administering the treaty, coordinating necessary supporting research and handling disputes. Jointly funded by the Canadian and American governments (PSC, 2016), the PSC is composed of one delegation of four commissioners from each country. Action requires consensus (PSC, 2016). Canada is represented solely by its federal government, which appoints the Canadian commissioners. The US delegation is composed of five separate and mostly independent parties: the federal government, Washington and Oregon (represented jointly by a single commissioner), Alaska, and a group of PNW Native American tribes. At the time of negotiation, these tribes held rights to half the PNW's salmon harvest that passes or would pass through their traditional fishing grounds through treaties with the United States, and thus they are known as the 'Treaty Tribes' (Caldwell, 1999; Miller, 2003; Miller et al., 2001; Shepard &



Argue, 2005). The Treaty Tribes were included in the PSC because, in response to the initial Alaskan opposition, they had threatened to sue to secure their salmon harvest, and they dropped their lawsuit when they received an equal vote on PST decisions. Importantly, this shifted them from being concerned Basin stakeholders to coequal voting parties. The American vote in the PSC requires the consensus of the three voting commissioners on its delegation: Alaska, the Treaty Tribes and Washington/Oregon (Caldwell, 1999; Miller, 2003; Miller et al., 2001; Shepard & Argue, 2005). The consensus-based structure of the PSC means that Canada, Alaska, the Treaty Tribes and Oregon/Washington all have unilateral veto power.

We observe that a commission can structure an ongoing management process (including recurring negotiations of catch limits) and establish formal voices for each of its members. The composition of a commission can ensure that those most affected by a treaty or those historically excluded from resource management decisions (i.e., the Treaty Tribes) have a guaranteed voice in decisions.

The PSC negotiates 8–10 year fishing arrangements under the framework of the PST. These set allowable harvest levels for the United States and Canada that are key to the treaty (Caldwell, 1999; Miller, 2003; Miller et al., 2001; Shepard & Argue, 2005). We observe that agreements of shorter duration require not only less commitment from parties but also recurring discussion. This, in turn, would seem to increase the relevance of a commission by requiring it to make important decisions with regularity.

The harvest levels of the first eight-year agreement of the PST worked effectively, but, after the original fishing arrangements expired in 1992, the United States and Canada were unable to agree to any fishing arrangements for the next seven years (Caldwell, 1999; Miller, 2003; Miller et al., 2001; Shepard & Argue, 2005). This occurred because changing natural conditions induced Alaska to fish more heavily in areas where Alaskan salmon intermingled with fish from Northern BC. In response, Canada caught more fish from weak Oregon and Washington stocks. Consequently, Oregon, Washington and the Treaty Tribes needed Alaska to reduce its interception of Canadian salmon to take Canadian pressure off American fisheries in the PNW. This conflict within the American delegation rendered the United States incapable of negotiating cohesively with Canada, which became frustrated with the US subservience to regional interests. Negotiations collapsed until 1999 (Caldwell, 1999; Miller, 2003; Miller et al., 2001; Shepard & Argue, 2005).

We observe that limited negotiating autonomy implies reduced negotiating ability. In the PST, the United States had limited negotiating autonomy because its actions were contingent on approval from all members of the delegation. We also observe that including more parties complicates a negotiation. In the PST, these factors amplified each other.

In 1999, Canada and the United States overcame their stalemate and renewed fishing arrangements. The 1999 agreement also included a scientific committee, funding for scientific research and a revised fishery management policy (Caldwell, 1999; Miller, 2003; Miller et al., 2001; Shepard & Argue, 2005). The United States provided the vast majority of the funding for these new elements, and this contributed significantly to the 1999 consensus (Miller et al., 2001). A new set of fishing arrangements is presently in force from 2008 to 2018. We observe that side payments can be used to overcome an impasse in negotiations or advance an interest of the paying party.

The institutional factors identified here as consequential for a major resource-sharing agreement between the United States and Canada are consistent with those identified by Starkey, Boyer, and Wilkenfeld (2005) as generally consequential for international negotiations. These authors highlight the number of actors, the degree of team cohesion, relative actor capabilities (corresponding to geographical advantage in the PST), the use of issue linkage and the time frame of negotiation. Starkey et al. (2005) do not explicitly identify the use of side payments as a negotiating characteristic, but these differ from issue linkage only in that side payments connect one issue with a monetary payment instead of another issue. These authors note that a commission or means of structuring a negotiation generally has a significant impact on the outcome of a negotiation.

### **Application of institutional factors to salmon restoration in the Upper Columbia Basin**

Salmon restoration in the Upper Columbia will depend on the source and amount of funding available for restoring salmon above the two US dams. If that is successful, Canadian dams upstream will likely follow because of their government licence requirements. The United States has proposed sharing costs, whereas BC maintains that each country should improve its own infrastructure (BC Treaty Review Team, *n.d.*; USA Entity, 2013). Both countries share the goal of enabling fish passage, but disagree on whether BC and Canada should help pay to upgrade American dams (BC Treaty Review Team, *n.d.*; Kramer, 2018; USA Entity, 2013). We now examine this disagreement via application of our institutional factors.

The CRT case presents a negotiation in which each country holds a geographical advantage over the other. As the upstream party, Canada has a substantial advantage in the treaty negotiations because flood control, hydropower, ecosystem health, water supply, recreation and navigation in the United States all depend in part on planned and coordinated flows from BC (BC Ministry of Energy and Mines, 2013). Furthermore, since the treaty's inception in 1964, the American dependence on assured river flows from BC has increased along with population and development in the American portion of the basin. This dependence will only increase further in 2024 when the CRT stipulates that flood control changes from assured to 'called upon' and BC dams release water to satisfy other priorities (BC Ministry of Energy and Mines, 2013). In the overall CRT renegotiation, Canada's upstream location strengthens its positions.

However, from the perspective of a salmon seeking to spawn, the United States is *downstream* and thus encountered first by fish returning from the ocean. Without substantial American commitment, Canada cannot restore salmon to its portion of the basin. Canada's enhancement of the salmon fishery, its relations with First Nations and its efforts to improve the health of terrestrial and aquatic ecosystems in the Upper Columbia Basin are beholden to American decisions at Chief Joseph and Grand Coulee dams.

The different geographical advantages of each entity may lead to a more balanced renegotiation that resembles some other international examples. In the Great Lakes region, the International Joint Commission that was created by the 1909 Boundary Waters Treaty between the United States and Canada has been successful because it has forced equitable collaboration between two countries that are both up- and downstream at different parts of their eastern border (Grover & Krantzberg, 2015).

During the early history of dam building in the Nile, tensions between Egypt and Sudan were resolved by building reciprocal infrastructure (i.e., Egypt consented to a Sudanese dam in exchange for Sudan endorsing an Egyptian dam; Salman, 2016). Similar reciprocity could also occur in the case of the Columbia River, where fish passage infrastructure is needed on both sides of the border to achieve substantial restoration. Consequently, it is unsurprising that BC maintains that, because salmon were eliminated from the Upper Columbia before the CRT with the construction of Grand Coulee Dam, their restoration should not be part of the CRT renegotiation (BC Treaty Review Team, n.d.). If accepted, this position would reduce the only geographical advantage of the United States in the CRT renegotiation and thus strengthen Canada's position on other issues. When an upstream nation can wield its leverage unchecked, its ability to shape basin-wide water governance can be extreme (Salman, 2016). Accordingly, the United States may use its geographical advantage pertaining to upstream salmon migration to gain concessions from Canada, or Canada may use its geographical advantages in other dimensions of the treaty to push for American funding of salmon passage at its dams. Importantly, neither country can nullify the geographical advantage of the other by leaving the treaty without paying a high cost because Canada would lose much revenue from electricity sales and the United States would lose crucial flood protection.

In other river basins, issue linkage has shaped water governance. For example, Ethiopia earned Sudan's support for the Grand Ethiopian Renaissance Dam, a major project on the Blue Nile that will affect Sudan and Egypt downstream, when transmission lines were built from the dam's power plant into Sudan (Salman, 2016). Conversely, China entered into collaborative water governance with downstream Kazakhstan to promote good relations with its neighbour. Kazakhstan accordingly implemented security and economic policies that China desired in order to ensure its water security (Ho, 2017).

Fish passage in the Columbia Basin could be linked by either party to other issues, some of which are other dimensions of the CRT renegotiation. For example, the American control of the fish passage issue might embolden it to request reduced the Canadian Entitlement (BC Ministry of Energy and Mines, 2013). Conversely, Canada might remind the United States of its dominant position regarding flood control and induce concessions on the issue of fish passage. Canada appears to have greater potential to employ issue linkage because it has the advantage on all issues except fish passage.

Linkage with an external issue, either as an explicit trade or as an unspecific goodwill gesture, may emerge as a determining factor for fish passage improvement. Salmon restoration is considered a minor issue in the context of the greater CRT renegotiation. The American and Canadian entities as well as many other non-governmental groups place much greater emphasis on other issues such as the size of the Canadian entitlement and managing flood risk after 2024 (BC Treaty Review Team, n.d.; USA Entity, 2013). Should these other issues be linked to salmon restoration, it will be unclear whether major infrastructure modification will be more or less likely. Linkage to issues apart from river management is beyond the scope of this paper, but many contemporary points of contention could tip the balance of power in the CRT renegotiation.

The degrees of autonomy of the two entities differ. The Canadian federal government, insofar as it is involved due to the international nature of the treaty, will conform

in most cases to the position of BC (Sandford et al., 2014). This is unusual in Canadian environmental governance, which tends to be decentralized and fragmented (Bakker & Cook, 2011). In the United States, the PNW region is not similarly empowered. The federal government will lead the negotiation with input from the region via the regional entities (USA Entity, n.d.), but national and regional positions are not legally assured to conform. Consequently, the American entity may be less autonomous than the Canadian entity, which may thus negotiate with greater coherence and clarity.

Canada demonstrated the importance of its negotiating autonomy when it informed Columbia Basin First Nations that they would not participate directly in the CRT renegotiation (Okanagan Nation Alliance, Shuswap Nation Council, and Ktunaxa Nation Council, 2018). In so doing, it subrogated its unfulfilled desire to prioritize Indigenous Nations (Simms, Harris, Joe, & Bakker, 2016). This demonstrates that the political benefits of including Indigenous Nations in the negotiations were not important enough to nullify its advantage of autonomy and compromise its stance that fish passage to American Columbia dams ought to happen independently of the CRT renegotiation.

The United States has also excluded Columbia Basin tribes from the CRT renegotiation (Schwing, 2018), which will thus be bi-national with other national actors (i.e., First Nations in Canada and Tribes in the United States) consulted such as stakeholders by the Canadian and American governments. This differs significantly from the PST, and it implies that the number of negotiating parties may be unimportant for the renegotiation. However, for decades water governance across this border has trended away from bi-national treaties and towards subnational agreements that involve non-state actors (Norman & Bakker, 2015). If non-state actors, including Indigenous Nations, must be satisfied in some way for the CRT renegotiation to proceed, the number of influential parties in the negotiation will increase. This would present an opportunity for either the United States or Canada to align with the additional parties against the other country, but the ultimate effect of a multi-party negotiation on the funding dispute about salmon restoration would be unclear.

The duration of treaty agreements is not a significant factor for the issue of salmon restoration, which is likely to be permanent, regardless of the duration of the overall CRT agreement.

These institutional factors organize the relative power of the negotiating parties as they debate who will fund fish passage to the Upper Columbia. They might combine differently in other international water treaty negotiations. For example, the construction and placement of a key dam could also be the centre of a similar zero-sum negotiation, in which case geographical advantage would be the key institutional factor. The case of fish passage to the Upper Columbia shows one of many possible ways that institutional factors could combine to influence a negotiation. While they serve to organize an analysis of a transboundary resource negotiation, we see no predetermined theoretical relationship between these factors.

## Conclusions

The renegotiation of the CRT is complex, international, multifaceted and tied to political priorities that are not part of the present CRT. In particular, both the American and Canadian entities desire restoration of salmon past the large dams in

central Washington, but neither has committed to pursuing it (BC Treaty Review Team, n.d.; Kramer, 2018; USA Entity, 2013). The United States and Canada score highly on a scale of international water collaborations (Yoffe, Wolf, & Giordano, 2003), and a mutually agreeable renegotiation would reaffirm this close collaboration. The institutional factors identified here aid in the understanding of the characteristics of each negotiating party that will determine the balance of power in the negotiation to effect infrastructure modifications for the benefit of fish.

Previous work in international water governance rates the risk of international conflict over water supply (Yoffe et al., 2003), considers the power difference and the intensity of conflict between actors in disputed basins (Ho, 2017; Zeitoun & Warner, 2006), describes potential fair allocations of cost in water agreements (e.g., Frisvold & Caswell, 2000; Parrachino, Dinar, & Patrone, 2006), or describes water governance and water security broadly (Dore, Lebel, & Molle, 2012; Wilder et al., 2016). In most of these cases, water negotiations are contentious. However, the CRT is recognized as a model international water governance agreement because of its advanced management of complex infrastructure for the benefit of two peaceful neighbours (Sandford et al., 2014). This description of the institutional factors at play in its renegotiation provides specific details that can aid conceptual understanding of other water agreements between neighbours with a history of negotiation with one another.

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