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Collaborative Problem Solving for Sustainability

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Collaborative Problem Solving for Sustainability: Analyzing Conversations During a Science-Based Role-Play Negotiation Simulation

By

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Abstract

Conflicts over water resources, like other sustainability-related conflicts, are opportunities for discussion, learning, and resolution. Although miscommunication and competition are often barriers to developing effective solutions for water management, parties can productively negotiate their conflict, strengthen relationships, and challenge the status quo. The two most common strategies negotiators use are commonly referred to as competitive, in which negotiators view their goals in direct conflict and seek to claim as much value as possible, and interest-based, in which negotiators strive to create value and reach an outcome that meets all parties' interests, as well as their own. This research investigated how the ways negotiating groups use scientific data in competitive and interest-based negotiation strategies impacts negotiation outcomes.

I analyzed the dialogue from four negotiation groups who participated in a science-based roleplay negotiation simulation focused on decision-making about dams in New England. I found that the time negotiating groups spent discussing scientific information, which for this research focused on use of a system dynamics model, whether groups focused on individual fish species, and the ways negotiating groups used scientific information in the value creation and value claiming stages of the negotiation did not explain differences in their negotiated outcomes. How much each group focused on all system performance variables provided the most compelling explanation for their different observed outcomes. The two groups with preferable outcomes considered fish moderately, in addition to hydropower generation and project cost, while the two groups with outcomes that performed worse considered fish less in their negotiations, relative to the other two issues. The findings from this research support the use of

discourse analysis for analyzing how scientific information is used in negotiations and for evaluating outcomes from role-play negotiation simulations.

1. Introduction

Conflicts over water, like other sustainability-related conflicts, are opportunities for communication and competition and, when parties productively manage their conflict, for strengthening relationships and challenging the status quo (Fisher, J., 2014). Negotiations are a process of decision-making in which interdependent parties communicate to manage disagreements or perceived disagreements and develop solutions preferable to what they can otherwise achieve (Pruitt & Rubin, 1986). Because negotiations are communications that aim to manage conflict productively, analyzing negotiating dialogue can provide information about how negotiators use scientific information to influence outcomes through bargaining (Weir et al., 2020). My research analyzes whether the ways scientific information is used in negotiations explain observed differences in negotiated outcomes.

1.1 Common negotiation strategies

The two most common strategies negotiators use are commonly referred to as competitive (also referred to as hard bargaining, zero-sum, position-based, or distributive) and interest-based (also referred to as integrative, win-win, consensus building, or mutual gains) (Lewicki et al., 2015). Two critical differences between these negotiation approaches, among others, are (1) the focus on achieving positions as compared to meeting interests, and (2) the focus only on claiming value versus the focusing on both creating and claiming value.

Positions are what a negotiator wants, and interests are why they want what they want (Fisher et al., 2011). An example commonly used to illustrate the difference between interests and positions describes two sisters arguing over an orange. When the girls use a competitive negotiation approach, they focus only on who gets how much of the orange. Eventually, the girls

compromise by dividing the orange in half. One sister then eats her half and throws away the peel, while the other discards her half of the fruit and uses the peel in baking a cake (Fisher et al., 2011). Although splitting the orange in half satisfied each sister's desire for the orange, this solution "fails to realize that one wanted only the fruit to eat and the other only the peel for baking" (Fisher et al., 2011). In contrast, in an interest-based approach negotiators explore different possible outcomes to satisfy everyone's interests. In the example of the orange, the sisters could have reached an even more satisfactory mutual agreement if they had shared with each other why they wanted the orange and recognized they each wanted different parts of the orange (Susskind & Cruikshank, 1987).

Negotiators who adopt a competitive negotiation approach endeavor to "gain the largest piece of the available resource" that they can, i.e. claim as much value as possible, and push other negotiators to accept as little value as possible (Lewicki et al., 2015) (Fisher et al., 2011). Negotiators perceive their goals to be in direct conflict (Lewicki et al., 2015, pp. 28-55). Competitive negotiation strategies include guarding information carefully, only sharing information when beneficial to one's own interests, and influencing the other party's perception of what they should be willing to accept (Lewicki et al., 2015, pp. 34-74). Competitive negotiators view one another as adversaries or opponents and have little regard for the other's interests in their efforts to claim value or for the impact on their relationship.

In contrast, interest-based negotiators focus on both claiming and creating value (Lewicki et al., 2015). Value is created in a negotiation when an outcome will either make all parties better off or make one party better off without making the others worse off (Mnookin et al., 2000). Thus, negotiators who negotiate with a value creating approach seek ways for all parties to meet their objectives (Lewicki et al., 2015). Negotiators create value, for example by building on

noncompetitive similarities, which are interests they share in common, such as the need for security and economic well-being, by identifying differences in the way they prioritize their interests and then trading across them (also called logrolling), such as the in the example of the orange, and by building on economies of scale and scope (Mnookin et al., 2000). In an interest-based negotiation, after identifying one another's interests, negotiators brainstorm multiple strategies to meet those interests and then use objective criteria to decide on a mutually acceptable strategy.

According to the negotiation literature, interest-based negotiations can lead to "better" outcomes, as compared to competitive negotiations. Good agreements are efficient outcomes that claim more overall value, wise outcomes that are informed by all relevant knowledge, including scientific knowledge, and outcomes that improve relationships (Fisher et al., 2011). Forums and procedures are needed to engage experts, decision-makers, and the general public in discussions and rigorous analysis of scientific information, and negotiations that recognize different interests (Karl et al., 2007). Often referred to as joint fact finding (JFF), such a process entails a collaborative effort to generate information in a transparent manner all stakeholders can agree on (Susskind & Field, 1996). Findings that are translated into accessible language allow for the inclusion of a diverse membership of the stakeholders and engage all participants. The JFF process, when successful, generates a shared understanding of the scientific and technical information relevant to decisions that need to be made (Susskind & Field, 1996).

Despite the significant literature on the potential for an interest-based, as compared to a competitive, negotiation approach to create more value (see for example (Fisher et al., 2011)), much of the research evaluating whether an interest-based negotiation leads to greater value creation has taken place in laboratory settings and has not involved stakeholders. For example,

"Experimental research in economics has sought to describe the strategies and outcomes of communication, rather than focusing on the content of the communication" (Weir et al., 2020). The way options are framed or presented (positive/negative) can strongly affect an individual's or stakeholder's willingness to reach an agreement (Neale & Bazerman, 1991). The specific language used in bargaining is important to how participants interpret the interaction and frame the context of the negotiation (Weir et al., 2020). As discussed by Weir et al, the specific types of frames in communication can be viewed as a strategy for negotiators to reach their desired outcomes. For example, distributive and integrative strategies are concepts sometimes used to analyze value creation in negotiations (Weir et al., 2020).

1.2 Science-based roleplay negotiation simulations

Science-based roleplay simulations are one participatory research methodology that can be used to analyze the use of scientific information in decision-making. Role-play simulations, also referred to as serious games, or policy games, are an approach to support policy decision-making, foster learning and engagement about the science-policy interface in decision-making, facilitate communication, and promote innovations in problem-solving.

Role-play simulations (RPS) engage stakeholders from different organizations and decision-making roles in a negotiation about a realistic, but fictional, scenario-based sustainability challenge. They are often used to facilitate learning about how science and policy interact in decision-making, to foster policy deliberations and innovations, and less commonly for research (see for example (Rumore et al., 2016); (Haug et al., 2011); (Stokes & Selin, 2016); (Urcuqui-Bustamante et al., 2023); (Urcuqui-Bustamente, 2022)).

Important role-play design elements include the design of a decision-making scenario, development of stakeholder roles, and a plan for an interactive session to engage participants. Typically, the decision-scenario and roles are based on a prior stakeholder assessment that identifies the most common issues, stakeholder groups, and their interests related to the specific challenge. Participants are often assigned a role different from their role in actual decisions and provided with detailed instructions about their role's interests and constraints. Switching roles helps create a forum in which participants can share ideas and experiment with negotiation strategies and policy ideas they may not be able to or feel comfortable doing in a real-world setting due to societal or professional constraints. Process management strategies, such as a role for a neutral mediator or facilitator and negotiating ground rules, help participants in their efforts to reach consensus. Science-based roleplays are designed to guarantee certain issues arise during the negotiation and to foster learning about negotiation skills, policy issues, and scientific information. In science-based role-play negotiations participants are provided with scientific information about the behavior of actual socio-ecological systems and likely outcomes of different possible decisions to inform their negotiations and decisions.

For example, the Indopotamia role-play negotiation introduces the Water Diplomacy Framework and is designed for professionals and students to engage in and learn about transboundary water management conflicts (Ashcraft et al., 2011). Indopotamia introduces and explores the uses of a mutual gains approach to negotiation in a science-based dispute wherein negotiators can gain insights into a range of relevant perspectives. Another negotiation simulation, the Mercury Game, is based on global mercury treaty negotiations and was designed to for education about how scientific uncertainty can affect decision-making about how politics and economics affect environmental negotiations (Stokes & Selin, 2016). A third science-based

RPS, the Crystal Basin, centering on payments for hydrological services (PHS) applies an incentive-based approach to achieve conservation and socioeconomic goals (see (Urcuqui-Bustamante, et al., 2023); (Urcuqui-Bustamente, 2022)). This RPS was designed to engage diverse participants who don't typically interact in discussions to inform PHS policy innovation in Veracruz, Mexico.

Participants in role-play negotiations confirm their practical value, as these games can be used to give negotiators a chance to experiment with situations relevant to those in which they make decisions (Susskind & Schenk, 2014). Nevertheless, systematic evaluation of the effectiveness of science-based roleplay negotiations remains under-theorized and under-researched (Haug et al., 2011) and they have only infrequently been used as a methodology for studying negotiation. The Crystal Basin RPS is one exception. Researchers found the RPS was effective in encouraging multi-stakeholder participation and policy innovations that reflects local environmental and socio-economic values and needs (see (Urcuqui-Bustamante, et al., 2023); (Urcuqui-Bustamente, 2022)). However, little research has so far focused on how groups in RPS use scientific information and what explains differences in negotiated outcomes between groups.

2. Research Design and Methods

This study analyzes the discourse from a science-based roleplay negotiation to understand how negotiators use scientific information in their negotiation and analyzes whether differences between negotiating groups can explain observed variations in negotiated outcomes. Based on the negotiation literature, my overarching research question is:

Question 1: In what ways can differences in how negotiating groups use scientific data explain differences in negotiated outcomes?

Hypothesis 1a: My hypothesis was that groups that spend more negotiating time discussing the model would reach better outcomes, as defined by optimizing and balancing the system performance indicators (see Figure 1 and discussion below).

Hypothesis 1b: I also hypothesized that groups that adopt an integrative negotiation approach would be more likely to reach better outcomes, as compared to groups that adopt a competitive approach.

Question 2: Do differences in the variables groups focus on when they use the model explain differences in negotiated outcomes?

Hypothesis 2: My hypothesis was that groups that prioritize all variables reach better outcomes than groups that prioritize some variables over others.

I use a case study approach to analyze conversations from a science-based roleplay negotiation simulation (SRPS) focused on decision-making about dams in New England. A case study is an empirical inquiry that investigates a phenomenon (the 'case') in depth, which are appropriate for exploratory research asking 'how' and 'why' questions. A case study allows the researcher to focus on a specific case, while retaining a holistic perspective (Yin, 2018), and is useful when "boundaries between phenomenon and context may not be clearly apparent" (Yin, 2018). Role-play negotiation simulations are one participatory approach to learn about how "science and policy interact in decision-making" (Stokes & Selin, 2016).

The SRPS analyzed in this research was developed as part of the National Science Foundation-funded "Future of Dams" research project, the Pearl River Negotiation Simulation. This SRPS was based on a stakeholder assessment of decision-making about dams in New England and a system dynamics model showing the outcome of dam decisions on select variables. The SRPS was designed to engage stakeholders in a dialogue to inform dam policy, to research the use of scientific information in negotiations and policy decisions, for education about negotiation strategies and systems thinking, and to consider policy innovations.

The setting for the Pearl River SRPS is a hypothetical dam-decision scenario in which participants are faced with decisions about how to manage five dams on a river system, who will participate in implementing any agreed upon management plan for the dams, and who will pay to implement the plan. The scenario has eight distinct roles including federal and state regulators interested in fish, water, and historical preservation, a municipal representative, a hydropower developer, a representative from a homeowners association, an environmental nongovernmental organization, and a facilitator. Dam management options include whether to remove, repair, add hydropower generating capacity, add fish passage, or do nothing. Negotiators employ a web-based user interface to access the system dynamics model and evaluate the impact of their decisions on four fish populations, hydropower generation, and project costs.

The SRPS was implemented with four negotiating groups across two workshops in 2019 in New Hampshire and Rhode Island, which engaged stakeholders involved in dam decisions. The Rhode Island workshop engaged seven participants in one negotiating group and the New Hampshire workshop engaged 21 participants in three separate negotiating groups. During the SRPS, stakeholders were assigned to play roles different from their actual roles in dam decisions (see (Song et al., 2021); (Diessner, 2021)) for information on the development and

implementation of the SRPS). Song et al. (2021) presented the negotiated outcomes from each of the four negotiating groups, analyzed how well these negotiated outcomes perform in terms of six system performance indicators: four fish populations, project cost, and hydropower generation, and compared the negotiated outcomes to the performance of six optimized, balanced outcomes and the status quo outcome, compared the performance of the negotiated outcomes to six balanced Pareto-optimal solutions, and compared the performance of the negotiated outcomes to the status quo solution (Figure 1).

Figure 1: Performance of negotiated outcomes, as compared to optimized, balanced and status quo outcomes (this figure and table are copied here from (Song et al., 2021).)

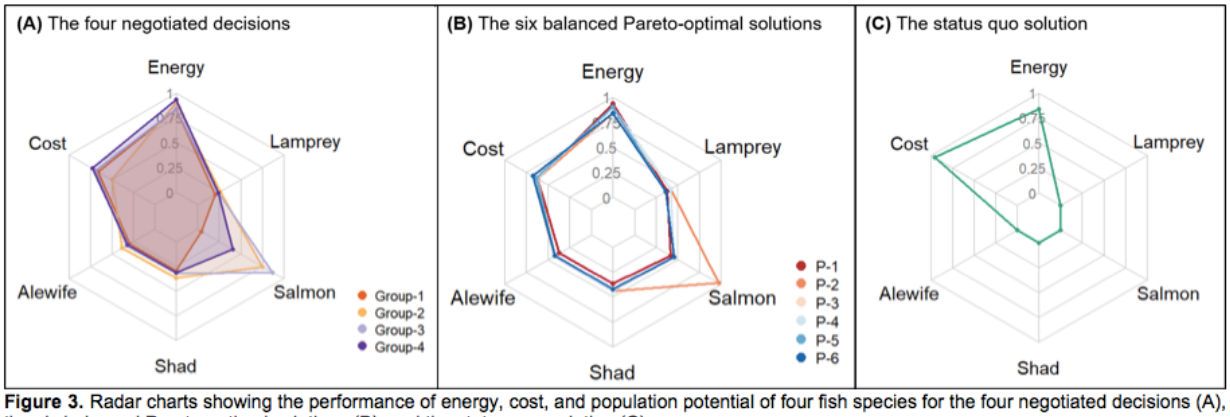

Figure 3. Radar charts showing the performance of energy, cost, and population potential of four fish species for the four negotiated decisions (A), the six balanced Pareto-optimal solutions (B), and the status quo solution (C).

Table 3. Net gain/loss of the four negotiated decisions, as compared to the six balanced Pareto-optimal solutions (P-1~6) and the status quo solution. Group 3 (highlighted) is considered preferable over the others as its decision results in either the greatest gains or lowest losses when compared to each of the six balanced Pareto-optimal solutions.

Negotiating groups	Net gain/loss compared with balanced Pareto-optimal solutions ($T_{a,s}$)							Net gain/loss compared with status quo ($T_{a,s}$)
	P-1	P-2	P-3	P-4	P-5	P-6	Average value	
Group 1	−0.74	−1.40	−0.93	−0.95	−0.86	−0.83	−0.95	0.54
Group 2	0.09	−0.56	−0.09	−0.12	−0.02	0	−0.12	1.37
Group 3	0.21	−0.44	0.03	0	0.1	0.12	0.02	1.49
Group 4	−0.14	−0.79	−0.33	−0.35	−0.25	−0.23	−0.35	1.14

The analysis by Song et al. identified six Pareto-optimal outcomes by modeling all possible management options for the 5 dams in the basin and identifying the dam management scenarios that dominate others, meaning that no one of the six performance measure can be improved without making another worse, and that met threshold levels of benefits for all six performance indicators. Song et al. then analyzed the performance of each of the six Pareto-optimal outcomes according to the six system performance indicators (Figure 1B). Similarly, the status quo outcome and the negotiated decisions were analyzed according to the six system performance indicators (Figures 1 C and 1A, respectively), and then compared to the six Pareto-optimal outcomes. Groups 1 and 4's outcomes result in fewer benefits for salmon, as compared to Groups 2 and 3. In contrast, Group 2's outcome is more costly. All negotiating groups reached outcomes that provided net gains relative to the status quo outcome. Out of the four negotiated outcomes, Group 3's outcome results in the smallest losses and greatest gains relative to the Pareto-optimal outcomes and can therefore be considered preferable over the other negotiated outcomes. Group 2's outcome performs somewhat less well, but is still preferable relative to Groups' 1 and 4 outcomes, which lead to greater losses relative to the Pareto-optimal outcomes (Song et al., 2021).

My analysis builds on the analysis by Song et al., with the goal of providing insight into *why* the negotiating groups reached different outcomes and, in particular, why some negotiating groups (Groups 3 and 2) balanced the six system performance indicators better than others (Groups 1 and 4). Previous research evaluated roleplay simulation outcomes through pre- and post-survey and interview approaches (see for example (Diessner, 2021); (Urcuqui-Bustamante, et al., 2023); (Stokes & Selin, 2016)), which can lead to concerns about reliance on self-evaluation questions (Haug et al., 2011). This research responds to this concern by using a new methodology for research into role-play negotiations by analyzing the negotiation discourse to

understand how participants use of scientific information in their negotiation strategies influences the observed differences in outcomes across the four negotiating groups.

Using discourse analysis is a way to analyze environmental disputes (Lewicki et al., 2003), especially when seeking detailed insights into "*micro-processes of interaction*, i.e. patterns, sequences, and structures of communication" (Kilgour & Eden, 2010). Putnam asserts that issue development and framing in negotiations is an instrumental activity or the "substantive content of individual bargaining," that is dependent on changes in discourse patterns and meanings of content over time (Putnam, 2010). Framing refers to the way negotiators shape, focus, and organize their thoughts. It involves a representational process in which participants present or express how they make sense of things (Lewicki et al., 2003). Language, in conjunction with characterization frames, is formed into the "act of enacting and recognizing identities" (Gee, 2014). Within the context of the SRPS, identity is a type of performance framed in a way that the role dictates (Gee, 2014); (Fisher, J., 2014).

There is an emphasis on a conversation-based approach to discourse within the SRPS structure. The interaction among participants is crucial as a basis for analyzing the dialogue. Specifically, the discourse analysis framework allows a focus on how people talk about their relative interests and positions through conversations. In treating the discourse as a system of rules for sense-making, the analysis focuses on the meanings that arise from language patterns that participants employ while they are involved in a negotiation (Putnam, 2010). In the context of coding the dialogue transcript for analysis, the discourse is situated through the lens of the predetermined codebook that lays a foundation for interpretation. Similarly, each code allows for expansion of how to interpret and analyze the discourse.

Using this conversation-based approach to analyze the dialogue provides context for understanding the meaning of how people are framing their statements. Discourse analysis, as the analysis of language, is sometimes referred to as a way of looking at conversation "beyond the sentence" (Tannen et al., 2015). This contrasts with types of analysis more typical of modern linguistics, which are chiefly concerned with the study of grammar: the study of smaller bits of language, such as sounds (phonetics and phonology), parts of words (morphology), meaning (semantics), and the order of words in sentences (syntax). Discourse analyses typically study larger chunks of language as they flow together. Due to the conversational nature of the SRPS, employing a discourse analysis approach to the analysis helps operationalize discursive statements that are interest-based or position-based.

a. Data collection and analysis

The conversations for each of the four negotiating groups were audio recorded using multiple audio recorders to ensure maximum audio quality. An external transcription service transcribed the audio files. I quality-controlled the transcripts. I developed a codebook based on the literature pertaining to negotiation theory (Figure 2). The negotiation literature I discussed in the Introduction served as a foundation for my codebook and the framework for my analysis. After coding an initial portion of a transcript, I discussed how I was applying the codebook to analyze data with another researcher engaged in the project. Based on our discussions, I revised the codebook and completed coding the transcripts.

Based on my hypothesis that more time spent discussing the model would lead to better outcomes, I selected text to analyze that signified participants were consulting the model or

talking about the model or scientific information. Thus, to answer my research questions, I narrowed the focus to text that was specifically related to consulting the model and using scientific information during the negotiations. The primary text selected for analysis was specifically based on instances where negotiators directly used some iteration of the phrasing "run the Model" or "consult the Model," in addition to the use of scientific information where it is implied that the model is being consulted and therefore negotiators are clearly using scientific information. The majority of the dialogue I used for the analysis was based on text coded to the model, or what is deemed scientific information for the purposes of the negotiation.

Figure 2. Codebook for Analysis

Parent code	Child code	Definition (from literature)	Example (from negotiations)
Use of scientific data	Use of model	Specific reference to the model	Run the model; let's look at the model to show us cost and impact to fish
Integrative negotiation approach	Focus on interests	Statements and/or questions about interests	Increasing fish passage, preserving aesthetics, preserving hydropower generation capacity, protecting property values, maintaining industrial history, maintaining recreation, restoring the free-flowing river, improving public safety, protecting farm land, managing water for all to use
	Creating value	Brainstorming ideas that meet multiple parties' interests; use of information to answer questions negotiators have shaped	What if we tried….? What would happen if we did X? How can we all work together? Is there a solution that would satisfy the entire group?
	Use of objective criteria for making a decision	Performance of package relative to criteria-fish passage; use of model to evaluate different outcomes	The model suggests that we should do it this way; looking at the model results, it is reasonable to assume that we should do X rather than Y
Competitive negotiation approach	Focus on positions	Statements and/or questions about positions; use of information to undermine the position of others or support own/individual position	Repairing the dam, installing a new fishway, installing additional hydropower capacity or removing the dam
	Concession trading to claim value	Compromises to divide value; hard bargaining tactics	I need more; threaten and give ultimatums; How about your revenue drops by half and we take the dam down? How much compensation is paid?

This research focused on the use of scientific information. I therefore selected all discourse in which negotiators discussed the system dynamics model in their negotiations. In

working through the data, I applied the codebook structure to the written transcripts. I then entered the selected text into NVivo to code and categorize the language based on the elements of the codebook. Upon generating the NVivo outputs, I subsequently applied and categorized them in Excel for clarity and management of the analysis. As I began to write up the analysis, I consulted the Excel files to select reference text for examples to prove or disprove my hypothesis.

I then analyzed the length of time in each negotiation that negotiators spent discussing the scientific model, as a percentage of the total negotiating time. I then analyzed the discourse during which negotiators discussed the system dynamics model to understand whether they were using interest-based or competitive negotiation approaches, as defined by whether negotiators focused on interests or positions, whether negotiators engaged in brainstorming to create value (interest-based approach), and whether negotiators engaged in claiming value by using objective criteria to choose between possible outcomes and make decisions (integrative approach) or through concession trading (competitive approach). Finally, I analyzed whether the negotiating groups seemed to value one modeled variable over others by analyzing whether their discussions focused more on some system performance indicators as compared to other groups' discussions. This becomes a secondary research question, What variables do the groups focus on when they use the model? For example, I analyzed whether the negotiators primarily discussed cost as the main criterion to choose between different possible outcomes, or whether they discussed cost along with energy and fish. Given the negotiated outcomes (Figure 1), I used this analysis to consider whether the groups whose outcomes better balanced the system performance indicators also discussed the system performance indicators in a more balanced way, as compared to the discussions of the groups whose outcomes were less preferable. Data were collected, managed,

and reported in accordance with the University of Rhode Island's Institutional Review Board project approval, HU1516-003.

3. Results and Analysis

In this section, I first respond to the hypothesis that spending more negotiating time discussing the model would lead to a better outcome. Therefore, I consider whether the group's different outcomes could be explained by how much time the groups focused on using the model in their negotiations to consider system dynamics and the impacts of different decisions. Second, I look at the results from each of the individual negotiating groups in terms of creating value, claiming value, and focal criteria. This method addresses the hypothesis regarding groups adopting an integrative negotiation approach would be more likely to reach more balanced outcomes, as compared to groups that adopt a competitive approach.

3.1 Time spent discussing model

One way to evaluate how much the groups focused on using the model is to look at the percentage of the negotiation during which each group discussed the model. I found that the four negotiating groups differ in the percentage of the negotiating time they spent discussing the model (Table 1). I perceived that the differences in outcomes could be at least partially explained by the amount of time each group spent discussing the model. My initial hypothesis was that groups that spent more time discussing scientific information and directly referencing the model would have more balanced negotiated outcomes. Therefore, as an initial method to analyze the data, I calculated the amount of time each of the four groups spent discussing the model and what that was as a percentage out of the total time.

Table 1: Analysis of Negotiating Time Spent Discussing the Model

Negotiating Group	Total negotiating time (minutes)	Total negotiating time spent discussing model (minutes)	% of negotiation time spent discussing the model
Group 1	124.5	23.4	18.8%
Group 2	125.0	19.3	15.5%
Group 3	122.2	8.1	6.7%
Group 4	130.2	16.4	12.6%

Group 3, the negotiating group with the outcome that performed the best out of all four groups in terms of optimizing and balancing the system performance indicators, spent the least amount of its negotiating time discussing the model (6.7%). In contrast, Group 1, the negotiating group with the outcome that performed the worst out of all four groups in terms of optimizing and balancing the system performance indicators, spent the most amount of its negotiating time discussing the model (18.8%). These results do not support my hypothesis that spending more negotiating time discussing the model necessarily leads to a better outcome, as defined by optimizing and balancing the system performance indicators. In light of these results, I next considered whether there was a difference in the content of how the groups used scientific information in their negotiating strategies.

3.2 Results from the individual negotiating groups

In this section I first analyze how each of the four negotiating groups uses scientific information during value creation, value claiming, and discussions about the six system performance indicators, and then compare results across negotiations.

Group 1: Creating Value

Negotiators in group 1 consulted the model to explore systemwide impacts of dam management options. For example, in the excerpt below negotiators considered how multiple dams on a system impact overall fish passage and limit the benefits of upstream improvements.

> *Speaker 8: Well, so part of it is passage rates. So the first dam on a system has some sort of pool weir. A pool weir is 30% successful. The second dam on the system, which is a-- whatever. It's 50% successful. Your population isn't going to increase. And then your third one is probably around 30%, so you're going to see a very small amount of fish actually get to that third dam because of the inefficiency.*
> *Speaker 3: Yes. And when you build a fishway on Dam A, if you do, it's still going to-- at that point, you're going to have 0.3 times 0.5 times 0.3; you're not going to have a big population.*

Using insights from the model, Speaker 3 identified the impact of Dam One, the most downstream dam on the river system, "So the only way to increase, so far, alewife and shad and lamprey is to remove Dam One or to change the fish passage of Dam One."

Negotiators in Group 1 also used the model to brainstorm dam management options and to consider and compare outcomes.

> *Speaker 8: Package five is the same as package one with the [inaudible] less as a [inaudible].*
> *Speaker 2: Oh, that's true. Okay. Well, you said repair or fish ladder, so do you want to run the repair?*
> *Speaker 8: I have to do both.*
> *Speaker 9: I think he's implying you can do whatever you want. So, I suppose we could take out—*
> *Speaker 2: We could take out one of the fish ladders and see.*
> *Speaker 8: Yeah, take out the fish ladder.*
> *Speaker 2: Okay. Just for comparison, okay. So just repaired it.*
> *Speaker 3: Just repair damage [crosstalk]. I can't add another one. I mean, without running this, it's going to be $500,000 removal-- or $500,000 repair. There's going to be no cost of a fishway, and you're not going to get a boost in salmon population.*

In this example, the negotiators used the model to explore options beyond their stated positions, such as "I have to do both", through brainstorming, "do whatever you want" and "just for comparison". They are also using the model to consider the connections between different

system performance indicators, cost and salmon population in this case. As a negotiator said early in the negotiation, "…we've got a model here which we can rely upon…we'll then have the cost figures there in front of us. And then we'll pick our options." This quote highlights cost as a primary consideration.

Negotiators also recognized and discussed the inability of the model to represent all relevant system variables because it did not show the impacts of dam management options on variables (and interests) that are not included in the model.

> *Speaker 2: But the model will only be able to show the cost, the impact to the fish. So there are other [variables].*
> *Speaker 1: And you're assuming the model's going to [take care of] socioeconomic considerations?*

Group 1: Claiming Value

Nearing the end of the negotiation, negotiators used the model to identify the performance of different options on cost and to choose between options. The following excerpt highlights how this negotiating group used cost over other variables to choose between options.

> *Speaker 2: Can we get the total cost of package two?*
> *Speaker 3: Package two? Package two, the total cost is $600,000 plus $2.3 million, so it's almost $3 million.*
> *Speaker 4: $3 million?*
> *Speaker 3: Oh, $3.5 million. Is that right?*
> *Speaker 2: Yep. So then package three is $1.1 million.*
> *Speaker 3: Yup, $3 million. Okay.*
> *Speaker 2: Package four is $4.5 million. What was package one?*
> *Speaker 3: Package 1 is $1.1 million total, adding the fish ladder.*
> *Speaker 2: Okay. And then that's $500,000. All right. So just by a show of hands, who is in support of package one?*

Group 1: Focal Criteria

Negotiators in Group 1 discussed all four fish species: Salmon, Shad, Alewife, and Lamprey (Table 2).

Table 2: Group 1 – mention of individual fish species

Salmon	Shad	Lamprey	Alewife
S8: So package one is doing virtually nothing for any fish populations except for salmon. That's what we were seeing there, okay. It's only helping salmon. And it's only helping them by a small amount.	S8: So I have to ask, that shad population model, was that [barely?] at all? Because that's when I'm there. My grandson [wrote?] it [laughter].		
S2: So I think that people are talking about this salmon graph. So you can see that the baseline is $3K. And then the-- what is run two?	S3: So number one here is our package two where we're removing Dam One. And that dramatically increases [wildlife?] and shad and migrating populations. But it cuts hydro power.		
S3: Just repair damage [crosstalk]. I can't add another one. I mean, without running this, it's going to be 500K removal-- or 500K repair. There's going to be no cost of a fishway, and you're not going to get a boost in salmon population.	S8: A lot of them are. Yeah. Can you hover over-- under shad, can you hover over base? Does that give you a number if you click on it, or?		
	S3: So the only way to increase, so far, alewife and shad and lamprey is to remove Dam One or to change fish passage of Dam One.		
	S2: All right. So what should I record here on package three? The cost of dam removal is 1.1. Oh, yeah. And then we're also noticing that alewife, shad, and lamprey are reduced. They're the same--		
S3: So here's your hydro power from A and B, bumping the [inaudible] level a little bit, changing [on that?] Denil, increased alewife, shad, and lamprey, and it boosted salmon even a little bit more.			
S3: How come the shad and the alewife and then the lamprey-- only the salmon-- because I think the alewife, the shad, and lamprey are stopped by Dam One.			

Negotiators are concerned with fish and how much it will cost to maintain the fishway in different scenarios of running the model: *Speaker 3: It repaired Dam A, created dam removal at Dam Three, which costs $1.5 million, and it requires $2.5 million, almost, in fishway installation and maintenance.* In addition, some participants in Group 1 value fish over other variables and are willing to negotiate with competitive hard bargaining tactics as it pertains to fish: *Speaker 8: And I would like everyone to realize that, because of the dam owner's poor passage at Dam One and Two, nothing you do to my dam is going to help fish operations until they fix them.*

In Group 1's negotiation, the predominant way in which scientific data are utilized was to inform negotiators of the costs of their decisions, over other considerations. For example, in the excerpt below negotiators focus on cost considerations in deciding which fishway to install, but don't mention the different fishways' differing benefits for fish passage.

> *Speaker 3: So this was Denil, and this was nature-like. The repair cost is $500,000 regardless of the fish ladder. The difference is in the fish ladder. It looks like a Denil is $640,000 and nature-like is $577,000.*
> *Speaker 4: And the fish lift is $1.1 million? Was that what we came up with? It was just over-*
> *Speaker 2: So the repair is $500,000. The nature-like was-- I forget already.*
> *Speaker 3: $577,000*
> *Speaker 2: Okay. And then the fish-- and then the Denil?*
> *Speaker 5: So $640,000?*
> *Speaker 3: Yeah.*
> *Speaker 4: Yeah, $1.1 million for the fish ladder.*

In another example, one negotiator in the role of hydropower operator said, *"With a willingness to financially help us with increased fish passage at Dam One, we may have an interest in letting go of Dam Three, potentially. We'd have to run the numbers first."* Running the numbers refers to trying out a scenario using the system dynamics model to see what the impacts would be on system performance indicators. Here, the negotiator used the model to determine the

feasibility of the fish passage with regards to the cost. To them, the decision on *fish* is determined by cost.

Group 2: Creating Value

Group 2 demonstrates an integrative negotiating approach through using the model to brainstorm ideas that meet multiple parties' interests. The dialogue below illustrates brainstorming that engaged almost all the group's negotiators in suggesting options to try out using the model to explore options that could meet interests, without making any decisions.

Speaker 10: So Dam A, you would repair that.
Speaker 8: And you would turn that into hydropower for A.
Speaker 10: Good. Okay.
Speaker 8: Hydropower for B. Fish lift for A. And pool and weir for B.
Speaker 3: Right. A and B go to hydropower. A with whatever fish passage you mentioned.
Speaker 8: Fish lift.
Speaker 3: And B with no fish passage because it serves an incredibly small percentage.
Speaker 10: I think you would have [inaudible].
Speaker 8: Yeah. You don't have to put it. But we can put a-- yeah. That's fine.
Speaker 11: [inaudible] repair if necessary.
Speaker 5: ...repair.
Speaker 8: That comes with the hydropower, does it not? Or do you have to--
Speaker 5: You have to click the [crosstalk] Dam 1.
Speaker 7: Are we adding two fish lifts or two fishways on Dam 1 or are we getting rid of the pool and weir?
Speaker 6: Dam 1.
Speaker 8: No. There's no need to update the pool and weir current condition [inaudible] has already at Dam 1 [crosstalk] remove it and spend more money.
Speaker 6: Okay. So it's just going to stay as is.
Speaker 8: HPAS/Allen Pond hydro [inaudible].
Speaker 5: I didn't agree to any of this.
Speaker 9: But it's additional hydropower.

In another example of a value creating dynamic, in this group negotiators also tried to create value with other participants beyond the modeled outputs. For example, negotiators discussed

how investing in hydropower has broad benefits and looked at options to include the hydropower generator in other business transactions.

> *Speaker 7: We want to involve the hydro company in the real estate transaction. There's 20, 35-- there's a lot of acreages that can get developed and sold just along dam 1, 2, and 3 logging 50,000 acres. They can't be owned by the existing homeowners. What was the original transaction? Who owns the land down the road?*

A third observation is around the role of the facilitator. In this negotiating group the facilitator prompted participants more actively to brainstorm options, as compared to the other negotiating groups. The following comment by the facilitator is from the beginning of the negotiation.

> *[Use the] Model. Okay. So for the next 10 minutes, this is an opportunity for you guys to talk to each other. It's not facilitated by me. It's up to you guys to reach out to each other and find out where you're going to have conflicts and where you have supporting interests and try and explore those so that we can move faster through the process. So this is kind of a networking session. If you don't want to talk to each other, I'll force you to. But I don't want to have to do that. We're all adults. So good luck.*

Coming at the very beginning of the negotiation, this prompt steered the negotiation toward discussing interests and using the model to better understand others' interests and preferences. Position-based statements that mentioned specific preferred outcomes, such as *removing dams* and *adding fishways*, were expressed primarily as part of discussions in which negotiators used the model to evaluate outcomes during the early to mid-point of the negotiation.

Group 2: Claiming Value

In Group 2, although negotiators made strong positional statements about their preferred dam management options, they ultimately relied heavily on the model to choose between different packages. The following exchange illustrates positional statements.

> *Speaker 5: We can't do $2 million unless there's a removal.*

Speaker 1: You have to have a removal?
Speaker 5: Yeah. If there's no removal of dams, we can only do $100,000.

Speaker 5 states that their financial contribution is contingent on a dam removal being included in the final outcomes. In contrast, in the following dialogue Speaker 4 links their preference for dam removal to their interest in an increase in the fish population.

Speaker 4: If you do not remove any of the dams under idea four, there's going to have to be a pretty significant increase in fish population to get the federal money.
Speaker 7: Or our money.
Speaker 8: But we're asking-- but we're adding all the-- we're adding all the access to habitat—
Speaker 4: Let's run it.

In this excerpt, Speakers 4 and 7 link their interest in fish population to their willingness to contribute funding to the outcome. In advocating for an alternative option, Speaker 8 referenced an interest: benefits for added access to fish habitat. Speaker 4 then responded by suggesting the negotiators try out the alternative using the model. In this example the negotiators used the model to evaluate the performance of different outcomes, instead of arguing over whether the outcome included their preferred dam management option.

This group's reliance on the model for choosing between options is echoed in other statements, such as "*We have to work with a model"* and "*Now, let's run the other models and see what kind of results we get."* The facilitator in Group 2 often prompted negotiators to "run the model" and the negotiators often asked to "run the model" to analyze different options.

After using the model to run different possible outcomes, the negotiators compared the results based on the system performance criteria, as illustrated by the following dialogue.

Speaker 1: All right. So this is going to be hydro revenue, up. Fish, way up [inaudible]. But the fish ladder cost approaches almost $4 million.
Speaker 8: Fishway installation [crosstalk].
Speaker 1: No removal costs and same repair costs.
Speaker 8: There are two fish ladders.

> *Speaker 1: Yeah. We had to do the fish ladder on 1 to get [everyone] happy and then we did the pool and weir on Dam B.*

They also mention their focus on consensus, *"to get [everyone] happy."* Another negotiator made a similar statement, "*So thinking of trying to build consensus among members…*" Interests that were not modeled were also important for Group 2 for reaching consensus, as the following excerpt illustrates.

> *Speaker 9: And I don't want to lose my water power museum money from the generous hydro guys, therefore, I don't think you guys should impose a fish passage on Dam B. It might sink the whole thing. I don't know.*
> *Speaker 1: Well, remember, this is one that has that creative financial arrangement that might make the hydro guys [interested]—*

Negotiators mention interests in preserving industrial history and in creative financial arrangements as important for reaching consensus.

Group 2: Focal Criteria

As the dialogue between Speakers 1 and 8 quoted above illustrates, Group 2 often discussed all three modeled performance variables, fish, hydro energy or revenue, and cost, together. In all but one exchange, the negotiators discussed fish as a single performance criterion. There was only one instance in which an individual fish species, salmon, was mentioned (Table 3).

Table 3: Group 2 – mention of individual fish species

Salmon
Speaker 5: Look at the salmon.
Speaker 1: Yeah. We don't have salmon here.

Group 3: Creating Value

Group 3 only infrequently made direct reference to the model, as compared to the other negotiating groups. The dialogue below illustrates how the group used the model to brainstorm different scenarios.

> *Speaker 1: So you want to create another scenario to--?*
> *Speaker 3: That's pretty much one, isn't it?*
> *Speaker 2: It's one except for the fish lift. It's a fish lift in Dam 1. You could change that if you wanted to do a fish lift to Dam 1.*
> *Speaker 4: For the model, repair? Is that repair to current standards, or is that repair and improve to--?*
> *Speaker 1: You want to-- You guys want to run an option five here to see what it looks like? And did I get this right? You want to repair and fish lift, or just the fish lift? Yeah. So the same as A. The only difference is that we have the fish lift [inaudible] so.*

Another example in which the group referenced the model shows negotiators' interest in using modeled results to inform their deliberations.

> *Speaker 1: So you want to see the analysis done before those decisions are made on who—*
>
> *Speaker 6: Well, I want to know-- if you want to save Dam A, fixing it's going to cost a million dollars-- I know people say, "Well, if we put up a power plant there as well, then it'll cost $3 million, but it will bring back--" oh, let's see-- "whatever 500-kilowatt energy provides."*

In this excerpt Speaker 6 is wants to use modeled results to inform their decision. Their use of "if" signifies consideration of different options and tradeoffs. The group did discuss scientific information at other times in the negotiation, but mostly without direct reference to the model.

Group 3: Claiming Value

Negotiators used the model to evaluate different scenarios based on the three modeled performance variables, cost, fish populations, and hydro power generation. As exhibited in the

following excerpt, this negotiator states that they want to use the model before making a decision.

> *Speaker 5: "Maybe we can sort of look at some of the models and then run it, before we actually decide on who would actually pay for it. Because I know folks that-- we have a certain amount of funds that can help towards a certain amount of activities, but I mean I can't say like, "You should pay for it. You should pay for it," without really knowing what—".*

Another negotiator also expressed their interest in using the model to consider different options, *"But I want to see the structure. I want to see the actual data, the model."*

Group 3 discussed different scenarios using positional statements for preferred outcomes, a competitive negotiation approach, as illustrated in this quote.

> *Speaker 2: So, Rivers-R-Us says that if the lift is put in 1 and Dam A is-- and then it's just like fish lifts-- in other words, option four, we'd be willing to throw a little money in, like maybe $250,000 or something. But if the fish lift could go in Dam 1, and Dam A could be like option one, and Dam B come out, we'll give up $1.5 million.*

In this quote financial considerations are linked to specific dam management options (positions). Similarly, this negotiator links their willingness to contribute money to dam removal, "*… for instance, I can fund dam removal, but I might not fund something else."* The following example also shows a competitive approach, focused on compromise.

> *Speaker 8: Although, to reach an agreement on any of this stuff that deals with Dam 1 through 3, Hydro Energy has to agree to the work plan. So I guess, when it comes down to it, what would you be willing to do to any of these? Is anything on the table?*
> *Speaker 2: Would you be willing to put in a fish lift?*

Speaker 8 recognizes the importance of including the hydropower representative in any agreement that includes a dam they own. Speaker 8 asks "*So I guess, when it comes down to it, what would you be willing to do to any of these? Is anything on the table?,"* which portrays a suggestion of negotiating for compromising to divide value. Speaker 2 then asks, *"Would you be*

willing to put in a fish lift?," which focuses on a specific dam management option (a position), instead of an interest, the impact on fish passage.

3: Focal Criteria

Group 3 mentions all four specific fish species in the negotiation (Table 4).

Table 4: Group 3 - mention of individual fish species

Salmon	Shad	Lamprey	Alewife
Speaker 9: Yeah. If you see, there are line graphs. The first line is alewife, shad, and salmon. So the yellow bar on the first is the baseline. It's the current situation. And the orange one, it shows the offshore line. If the offshore line is effective, there will be more alewife and shad and salmon population compared to before. So for alewife they increased from 50k to more than 100k, for the lifecycle of this removal project. And the shad will show increase from around 2k to more than 6k population, and also salmon and lamprey as well. And the total energy generation will be decreased from current situation-- is 10k megawatts decreased to around 5k. It's more than 50% decreased, and hydropower revenue will also decrease by 50%. And also, the fishway installation cost compare now. We need to find around $600k right now to install the fishway. The dam removal cost will be around more than $3 million. And the repair cost is around $500k. So, for these three, we don't have current situation. It's more like what we need to get the funding--			
Speaker 9: Okay. So the third part in green is our second option. So it's inside the alewife, shad, and salmon and lamprey increase a little bit compared to the current situation, but definitely they are less population compared to our option one. But the total energy generation and hydropower revenue remain the same as current conditions. And the fish installation cost and repair almost double compared to the option one, and the repair cost remain the same, and the removal cost is zero.			
Speaker 8: It sounds so shy. Don't do anything to alewife, don't help the lamprey, don't help-- I don't think it'll help the salmon. It will cost a million dollars. A million dollars [inaudible]	Speaker 1: Shad.	Speaker 8: It sounds so shy. Don't do anything to alewife, don't help the lamprey, don't help-- I don't think it'll help the salmon. It will cost a million dollars. A million dollars [inaudible]	Speaker 8: It sounds so shy. Don't do anything to alewife, don't help the lamprey, don't help-- I don't think it'll help the salmon. It will cost a million dollars. A million dollars [inaudible]
Speaker 4: Right. Because the salmon can get through. Dam 1 is the pinch point for fish passage. So, the salmon can get through Dam 1, but possibly the alewifes and shad can't [crosstalk] or only a fraction-- the fish lift at Dam A is only helping the salmon get through Dam 1. It's not helping the other species. [inaudible] Got to fix Dam 1. Got to fix Dam 1.			Speaker 6: [inaudible] the lampreys.
Speaker 7: Salmon, right? Salmon.			
Speaker 5: [crosstalk] if you get-- if you added an elevator, fish lift, that helps the salmon.			

Negotiators focus on the fish population increase and benefits to their natural habitat. With a focus on fish over cost and hydroenergy, Speaker 9 discusses how the fishway installation will need to be paid for benefit of the fish despite the lack of funding and decrease in energy generation. Addressing a modeled scenario, Speaker 9 states the following regarding the three variables, linking cost hydropower generation, and fish:

> *So for alewife they increased from 50k to more than 100k, for the lifecycle of this removal project. And the shad will show increase from around 2k to more than 6k population, and also salmon and lamprey as well. And the total energy generation will be decreased from current situation-- is 10k megawatts decreased to around 5k. It's more than 50% decreased, and hydropower revenue will also decrease by 50%. And also, the fishway installation cost compare now. We need to find around $600k right now to install the fishway. The dam removal cost will be around more than $3 million. And the repair cost is around $500k. So, for these three, we don't have current situation. It's more like what we need to get the funding--*

Here, fish seem to be valued over other variables. Speaker 9 goes on to discuss another package option and focuses on fish as the important variable, while also linking hydroenergy and cost to the overall consideration of potential viable scenarios.

> *"...our second option. So it's inside the alewife, shad, and salmon and lamprey increase a little bit compared to the current situation, but definitely they are less population compared to our option one. But the total energy generation and hydropower revenue remain the same as current conditions. And the fish installation cost and repair almost double compared to the option one, and the repair cost remain the same, and the removal cost is zero."*

The importance of fish in this negotiating group is further exhibited by the evidence of a systems approach. For there to be any significant improvement for the fish, a comprehensive plan is needed that involves hydroenergy as well as consideration of cost. Negotiators contemplate how any changes to the waterway and dam structure will affect fish populations. A

focus on positions in the following passage clearly depicts how fish species is given attention as a variable as it related to hydroenergy options.

> *Speaker 4: Right. Because the salmon can get through. Dam 1 is the pinch point for fish passage. So, the salmon can get through Dam 1, but possibly the alewifes and shad can't [crosstalk] or only a fraction-- the fish lift at Dam A is only helping the salmon get through Dam 1. It's not helping the other species. [inaudible] Got to fix Dam 1. Got to fix Dam 1.*

When Speaker 4 mentions how "*Dam 1 is the pinch point for fish passage"* and *"Got to fix Dam 1,"* it reveals a positional with fish as a focal criterion.

Group 4: Creating Value

Negotiators in Group 4 used the model to brainstorm options that meet multiple parties' interests.

> *Speaker 4: … So, if you get a quicker review on dam 1, you stated earlier that you'd be willing to put in a better fishway because you [crosstalk].*
> *Speaker 6: Right based on what I ran on my model, but I guess that I should have left the pool and weir on because I unchecked it assuming that it would be-- you know what I mean? So now it's frozen, so [laughter].*
> *Speaker 2: Right now, we don't have hydro. We don't have the addition of hydropower to dam A in package one.*
> *Speaker 6: Right.*
> *Speaker 2: So the question would be to have something that would be a necessity for you to support package one if you want to see hydro.*
> *Speaker 4: Yeah, we would, in order to support that.*

In this exchange Speaker 4 uses an interest-based negotiation approach by recognizing Speaker 6's interest in *"a quicker review on dam 1"* and links this interest to their interest in installing better fish passage. In another example, Speaker 3 asks another negotiator about their priorities, another interest-based approach. "…*is your number one priority keeping the pond, or is your number one priority getting cheaper energy?"*

This following statement from Speaker 2 also characterizes the use of an integrative negotiating approach where participants are brainstorming ideas using "if" to generate scenarios. "*Yeah, based on different scenarios as far as what we can develop for hydro, for our electricity. So if we're able to install hydro on dam A, we'd be willing to pay…"* The clear strategy in this value-creating stage of the negotiation is to brainstorm possibilities for hydroenergy while integrating cost and considering fish as well. Scientific data here are used to determine potential scenarios for optimized outcomes, with hydro and cost as driving factors.

Group 4: Claiming Value

Group 4 predominantly discussed the model towards the end of the negotiation during the decision-making process when deciding among options. The following example illustrates how negotiators in Group 4 brainstormed and adjusted options late in the negotiation to craft options acceptable to all parties, yet which benefitted themselves as well such as suggestions for adding a nature-like fishway and installing hydropower capacity.

> *Speaker 4: Okay. Then add the hydropower.*
> *Speaker 2: So…, what you're going to need you to clarify is well, we have a fish passage, and what method of fish passage [crosstalk].*
> *Speaker 1: I think, yeah, for round two it is dam A repair, add a nature-like fishway, and install hydropower. You're going to see a big increase, salmon, and hydropower company will also get around-- how much money?*

In support of the participant's position, this statement is indicative of how competitive strategies are employed to make decisions in the latter stages of the negotiation. Speaker 1 responds to Speaker 4's suggestion to *"add hydropower"* by stating that the action, along with repairing Dam A and adding a nature-like fishway, will result in *"see[ing] a big increase, [in] salmon."*

Although discussing an increase in salmon may be viewed as an objective criterion, the way it is used here links the fish population increase to a position.

In the following excerpt during the decision-making stage, participants aim to claim value and advance their preferred options by focusing on specific dam management options, such as repairing the dam, installing new fishway or hydropower, and repairing existing infrastructure. In contrast, negotiators using an integrative approach would focus more on how well the options meet system performance indicators and other interests.

Speaker 1: - For dam 3, there is hydro [crosstalk]--
Speaker 5: - But it's not exhibited in this scenario.
Speaker 1: - You couldn't add it because it is [crosstalk].
Speaker 2: - So it would be removing, yeah.
Speaker 3: - This was the fourth scenario that [inaudible].
Speaker 2: - Right.
Speaker 1: You're happy with it all side-by-side, everyone?
Speaker 2: - Okay.
Speaker 4: - But you didn't add hydro on either of them?
Speaker 5: Yeah, I think on number one, if I'm correct--
Speaker 2: Number one.
Speaker 4: I think it included hydropower. So you might want to make that note on package one.
Speaker 1: Yeah, can we add hydro, then, to package one? Repair A with fish passage and hydro on A. Dam A repair, nature-like fishway, and hydro.
Speaker 4: Add hydro. Yeah.
Speaker 1: Okay. Hydropower--
Speaker 2: And you've got a Denil ladder at 1.
Speaker 1: And, okay, dam 1, Denil. Dam 1 the new fishery. Repair [inaudible], and then--
Speaker 3: Hydropower.

Group 4: Focal Criteria

Group 4 only rarely distinguishes between the four fish species included in the model (Table 5).

Table 5: Groups 4 – mention of individual fish species

Salmon
Speaker 1: I think, yeah, for round two it is dam A repair, add a nature-like fishway, and install hydropower. You're going to see a big increase, salmon, and hydropower company will also get around-- how much money?
Speaker 4: Salmon. That's it.

Typically, Group 4 mentions fish in the context of installing fishways and how they will impact hydropower generation and revenue, as illustrated in the following excerpt.

> *Speaker 4: We're getting pretty good improvements in fishery with this.*
> *Speaker 2: Yeah. There are improvements for four types of fishes, actually. There's no loss of hydropower generation and the revenue from hydropower, but you need to pay for the fishway installation and the repair. Fishway installation costs around, maybe, when [counted meaning?], the dam repair cost is $500,000.*
> *Speaker 3: So if we did that, did that satisfy your funding services?*
> *Speaker 2: Yes, because we'd be improving fish passage and—*
> *Speaker 6: All right, so you would be able to kick in half a million?*
> *Speaker 2: Potentially, yes.*
> *Speaker 6: And the feds would be able to put in 1 million. And if we could come up with some sort of agreement between the feds and hydroenergy, you said you'd be willing to foot the entire cost of a new Denil on dam 1?*

In general, Group 4's dialogue focuses more on cost and hydropower revenue as primary criteria to choose between different possibilities, as illustrated below by Speaker 3.

> *Speaker 3: But I like [name]'s math, roughly. Looks like the cost of the option would be like $230,000 and potential revenue sources to pay for it are $280,000.*

4. Discussion

In this section I discuss the results across the four negotiating groups and the similar yet distinct ways each group uses the model. As mentioned before, there doesn't seem to be any pattern between time spent discussing the model and the performance of groups' negotiated outcomes. This section therefore focuses on the focus of the negotiations across the four groups (Table 6). In addition to categorizing the negotiating groups' dialogue based on a competitive or integrative approach, Table 6 identifies each group's relative focus on the three categories of system performance indicators, cost, hydro, and fish), according to how much the negotiating group focused on it: significant, moderate, or low.

Table 6: Cross Group Analysis of Use of Scientific Information and Negotiation Strategies

Negotiation Group	Q1: Creating value	Q2: Claiming value
1	Explored systemwide impacts of dam management options; Model used in brainstorming options to benefit all system performance indicators, with greater emphasis on cost	Focused on cost when deciding Cost: significant Hydro: moderate Fish: low
2	Model used in brainstorming options to benefit all system performance indicators	Hydroenergy, fish and cost are often discussed together when deciding Decisions focus on meeting interests and system performance criteria. Cost: significant Hydro: moderate Fish: moderate
3	Little reference to the model throughout the negotiation; Model used in brainstorming	Use of model and objective criteria to make decisions; Hydroenergy, fish and cost are often discussed together when deciding; Considered system impacts; Decisions focus on positional statements and concession trading Cost: significant Hydro: moderate Fish: moderate

4	Model used in brainstorming- all performance indicators considered; Negotiators ask each other about their priorities.	Model is predominantly discussed late in the negotiation; Participants use position-based approach to adjust options to craft packages Cost: significant Hydro: significant Fish: low

All four groups considered scientific information in an integrative way in the value creation stage, using the model to brainstorm different dam management options. However, differences emerge in the value claiming stage of the negotiation. One of the groups that reached a more balanced, optimized negotiated outcome, Group 2, used more interest-based statements to claim value. However, Group 3, which also reached a more balanced optimized negotiated outcome, used more position-based statements to claim value, characteristic of a competitive negotiation approach. These results do not support the hypothesis that groups that adopt an integrative negotiation approach are more likely to reach "wiser" outcomes, as compared to groups that adopt a competitive approach.

The most compelling explanation for the groups' different observed outcomes emerges from analyzing how much each group focused on each of the system performance variables. Looking at the criteria on which groups focused, all four groups considered cost significantly and hydropower at least moderately. The overall cost for implementing the outcomes negotiated by Groups 2 and 3 were more expensive, as compared to the outcomes negotiated by Groups 1 and 4. While Groups 2 and 3 often discussed funding opportunities to pay for strategies to augment energy and fish, Groups 1 and 4 focused more on cost as a standalone variable, for example on the cost of a fishway over benefits to the fish population.

Importantly, the two groups with preferable outcomes considered fish moderately, while the two groups with outcomes that performed worse relative to modeled balanced, optimized

outcomes considered fish less in their negotiations. The discourse shows that the four negotiating groups that reached outcomes that were closer to optimized, balanced outcomes, also had negotiations that included discussion of all modeled system variables without any one variable dominating the others. Where some variables dominated, the negotiating groups reached outcomes that performed poorer relative to the optimized, balanced outcomes.

Looking across the four groups, there is a difference in the way negotiating groups discuss individual fish species, but there does not seem to be any pattern between how often groups mention specific fish and how well their negotiated outcomes balanced system performance variables. The negotiated outcomes from Groups 2 and 3 are closer to the optimized, balanced outcomes. While Group 3 mentioned individual fish species more, so did Group 1, while Groups 2 and 4 barely mentioned individual fish species. Group 3 mentions salmon more than any other group, which may be important because salmon populations change somewhat differently, as compared to other fish species, in response to different modeled decision options.

4.1 Limitations and learning

There are some limitations to this approach to considering how stakeholders negotiate about conflicts surrounding dams and environmental considerations. The focus of this analysis on dialogue when participants used the model could result in findings that do not give the entire picture of the negotiation. Because discussion of the model was primarily conducted in the latter stages of the negotiations, there could be preference or weighted privilege given to the value claiming stage of the negotiation. In this regard, the use of scientific information (as described by

the “model”) becomes limited to instances when participants are actively engaging in discussion about using the model. Although scientific information is mentioned throughout the entire negotiation in all four groups, specific reference to the “model” was more prevalently observed in the later stages.

There are some insights to be gained from these observed limitations. First, how dialogue was defined and coded could have significant impacts on what constitutes integrative or competitive approaches. This aspect of definitions, in terms of dialogue context within the coding structure, in and of itself would likely heavily influence the analysis. In addition, all outcomes were relatively preferable, as compared to the status quo, which signifies that variations in negotiating approaches may not be significant enough to detect differences.

The role of the facilitator could play a role in some of the differences in the negotiated outcomes. It is interesting to consider the facilitator’s role in Group 3, as this group used the model least, yet had one of the best outcomes. Although Group 3 spoke about the model the least, they also talked about fish more than any other group. Fish could be an important aspect of the overall outcome, which raises some questions such as: What can be learned from how fish are thought about and discussed in a negotiation like this? What is the broader context of the meaning of fish? How can we analyze outside of the theoretical framework of how fish are viewed?

Thinking with fish differently in a negotiation like this calls into question the theories we use and how they shape what we see. For example, Dr. Zoe Todd describes fish as kin as a reorienting to fish as a way of reorientating our relationship to the world. Some indigenous cultures of North America view fish as sentient beings with their own thoughts and feelings. In this perspective, fish should be listened to and learned from. By paying attention to the specific

environments and listening to fish within their communities, we can gain a different perspective. An alternate view starts to take shape – one that gazes from a distinct vantage point of how humans exist because of the way fish have shaped the world. Maybe the fish are studying humans, while weaving us into their histories and lives. Recognizing fish in this way, as relations instead of specimens, would perceivably change the SRPS negotiation structure (Todd, 2021).

4.2 Recommendations for future research

This research has practical applications for decisions about dam management across a variety of contexts. There are a number of ways that the analysis and research design could be augmented to mitigate some of the limitations mentioned above. To build out some of the important points of this discussion, I consider some additional concepts and their potential benefits to this research.

Tracking the statements of individual speakers throughout the entire negotiation could present a more in-depth analysis based on specific participant roles. As discussed in Weir et al., differences in outcomes emerge when analyzing the entire group versus individual participants claiming value statements. In their study, individual roles, such as dam owners, received better outcomes when positional language was employed (Weir et al., 2020). Greater individual gains were realized when language was associated with claiming value statements, without increasing benefits for the entire group. Similarly, analyzing the role of the facilitator could be beneficial. Looking more closely at how that role influences the negotiation could offer further insights into how participants' conversations are directed towards specific topics or how discussions are framed.

This SRPS was based on very specific societal structures. Further recommendations for future study include shifting the vantage point on environmental communications. In other words, could we possibly think from a different perspective? Perhaps we could take on the role of the fish and look through their eyes. Experiencing negotiations from a different point of view presents several new research opportunities. Shifting the vantage point - seeing through the eyes of nature and wildlife or imagining beyond human experiences - could significantly expand the research scope. Opportunities emerge to consider how conflict would be negotiated and how interests and positions may be framed if seen through another lens.

5. Conclusion

Across the northeastern United States, thousands of aging dams affect river flow, water temperature and oxygen levels. In many cases these dams reduce the available fish habitat and alter spawning migrations. Restoring streams to their natural state often brings benefits including reduced maintenance, as well as being more effective and sustainable systems over the long term. Removing small, aging dams is politically and practically more feasible than removing major hydropower dams, yet stakeholder views and preferences often make any dam removal challenging. Stakeholders and interested parties such as private landowners, municipal leaders, federal agencies, and others seek to remove or rebuild dams, but they often have differing views, needs, and preferences that result in many competing priorities. From local to international settings, roleplays with a fictional yet realistic context can be reenacted for a broad range of science-based topics and scenarios. The collaborative problem-solving approach in a multi-party

SRPS negotiation provides a novel strategy for stakeholders to gather and interpret information while also gaining insight into new ways of approaching environmental and natural resource conflicts.

Engaging in a multi-party and multi-issue SRPS that involves water resources and dam management presents a novel structure for conflict resolution. SRPS enable participants to discuss interests and policy innovations. SRPS with stakeholder participants can also be useful for analyzing how scientific information impacts decisions. In this Pearl River Dam SRPS, there are several areas where this novel approach could be compared to the broader context of both lab-based and real-world negotiations. From international to local environmental discussions, this structure for decision-making on science-based issues is a novel way to inform stakeholder interactions. As previously mentioned, the lab experiment negotiations discussed in Weir et al. give some insight into my analysis.

My findings suggest little difference in the value creation stage. Even using an integrative or competitive approach in the value claiming stage did not explain differences in outcomes. It is relevant to consider how these findings relate to the findings from other research. This can be related to the Weir et al findings that integrative language in bargaining revealed no significant differences between interests and positions language in regards to increasing favorable outcomes for the groups. The bargainer's dilemma, as stated in Weir et al., is consistent with my findings that there is no significant difference between employed language that claims a larger share of groups' assets or that increase joint gains. This is indicative of the differences emerging in the value-claiming stage of the negotiation. Where one of the groups reached a more balanced, optimized negotiated outcome using more interest-based statements to claim value (Group 2), another group also reached a more balanced optimized negotiated outcome using more position-

based statements and a competitive negotiation approach to claim value (Group 3). Thus, these results are consistent with the Weir et al analysis and do not support my hypothesis that groups that adopt an integrative negotiation approach are more likely to reach "wiser" outcomes, as compared to groups that adopt a competitive approach (Weir et al., 2020).

Further, the context of facilitation could be reviewed. Considering all variables, it is possible that some negotiating groups could discuss these scenarios on their own, as well as run the model and implement that presence of scientific information. Yet the findings also provide support for a recommendation to have a facilitator participate in the negotiations, specifically a neutral party who can focus on prompting the participants to consider all the variables together. As in the Weir et al. paper, I find a lack of evidence to support the hypothesis that integrative discourse creates more value for the group than distributive language does (Weir et al., 2020). Also consistent with Weir et al is the role of facilitation in the overall outcome where positive effects of manipulation, including exposing participants to negotiation strategies and prompting discussion of a broader range of topics, may have an impact on the structure as a whole.

The broader context of this study suggests there may be some benefit for real-world science-based negotiations. In both regional and international settings, when diverse stakeholders seek the best outcome for everyone involved, this type of negotiating structure could be used as a method for gaining insight into participant preferences and likely choices prior to an actual decision-making scenario when there are potentially high-stakes outcomes involved that affect many parties. The multi-party and multi-issue SRPS with a focus on water resources and dam management could be an effective method for studying the implications of real-world conflict resolution.

APPENDICES

Table 7: Final Negotiated Outcomes (all groups)

Group 1: Decision Decision #1: Dam A – Repair; Dam B - Remove Decision #2: Option 1, hold public hearings, etc.; Stakeholder engagement Decision #3: Payment from Rivers-R-Us, Hydro Energy, WRD, Federal, HPAS - $2.7 to $3.7 million The final decision was to repair Dam A; remove Dam B; put in a fish lift at Dam 1 and then beyond that Dams 1, 2, and 3 were left as is. This outcome led to a kind of bifurcated process where there was an open and public collaborative process on dams A and B and then a stakeholder process that proceeded with the licensing process that Hydro Energy was going to employ. This negotiating group did not get to discuss how much it was going to cost exactly but did converse about how the necessary funding would be approximately $2.7 to $3.7 million and all groups that had money were willing to support it. Rivers-R-Us, Hydro Energy, and the town all agreed to put a warrant on it. The Federal supported a partial amount of money because one dam is removed. HPAS contributed money for a museum at Dam A, which is a history museum of water power.
Group 2: Decision Decision #1: Dam A – Repair, Hydro, and Nature-like fish passage; Dam B – Hydro and Nature-like fish passage; Dam 3 – Remove; Dam 1 – Pool and Weir, Denil Decision #2: Option 2, collaborative group with socioeconomic study and historic elements Decision #3: Federal - $2 million; Rivers-R-Us - $1 million; State - $500,000; Hydro Energy – $1 million The final decision was to add a Denil fish ladder to Dam 1; repair Dam A and add hydro as well as nature nature-like fish passage; Dam B also add hydro and nature-like fish passage; remove Dam 3. The work plan would be carried out with a collaborative group that would conduct a socio-economic study. There would also be a mandate for some historic elements to be incorporated with the dams, including some interpretive signage. Federal $2 million. River-R-Us, $1 million. Water Resources, $500,000. Hydro, $1 million.
Group 3: Decision

Decision #1: Dam A – Repair, Nature-like fish passage; Dam B – Remove; Dam 1 – Pool and Weir, Denil; Total = $3.5 million
Decision #3: Federal - $2 million; Rivers-R-Us - $1 million; State - $500,000

The final decision was to add Denil to Dam 1; Dam 2 do nothing. Dam 3 to add a Denil; repair and put a nature-like fish installation on Dam A; removed Dam B. The total cost is $3.5 million. The federal government agreed to put in $1.5 to $2.5 million.

Group 4: Decision

Decision #1: Dam A – Repair, Hydro, and Nature-like fish passage; Dam 1: Pool and Weir, Denil
Decision #3: Federal -$1 million; Dam A Hydro and Nature-like fish passage; WRD - $500,000 -> FD; Rivers-R-Us - $500,000 -> Denil and Hydro Energy - $500,000 -> Dam

The final decision was to repair Dam A and add a nature-like fish passage; add the Denil fishway at Dam 1. There was a collaborative approach and a shorter timeline. The town led with scientific expertise and involvement and conversations about funding. The federal government contributed up to $1 million, WRD $500,000, and Rivers-R-Us $500,000.

IRB Approval

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FWA:	00003132
IRB:	00000599
DATE:	July 24, 2020
TO:	Todd Guilfoos, PhD
FROM:	University of Rhode Island IRB
STUDY TITLE:	Strengthening the Scientific Basis for Decision Making about Dams
IRB REFERENCE #:	778925-49
LOCAL REFERENCE #:	HU1516-003
SUBMISSION TYPE:	Continuing Review/Progress Report
ACTION:	APPROVED
EFFECTIVE DATE:	July 24, 2020
EXPIRATION DATE:	July 23, 2021
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # 7

The above referenced human subjects research project has been APPROVED by the University of Rhode Island Institutional Review Board (URI IRB). This submission has received Expedited Review Review based on the applicable federal regulation 45 CFR 46 and 21 CFR 50 & 56. All research must be conducted in accordance with this approved submission.

Your project is now in compliance. Your current consent forms have not been stamped by the IRB. If you plan to resume face-to-face research you must submit a new amendment package that includes:

- **Amendment Form - Changes in Research that explains changes and includes which COVID-19 Research phase you are requiring to be approved for (Refer to Human Subject Research COVID-19 Emergency Procedures Guidance)**
- **Completed and signed IRB COVID-19 Safety Plan Template**
- **All consent forms with any changes made, include a track change and clean version and include with the signature a checkbox with the statement, I have read the provided COVID-19 Research Participant information.**
- **Any other documents that have been changed e.g. Advertisement/Recruitment need a clean and track change version**

INFORMED CONSENT
The URI IRB requires the use of IRB STAMPED consent/assent documents only. Stamped documents are located on IRBNet under Board Documents. Federal regulations require each participant receive a copy of the signed consent document.

MODIFICATIONS AND AMENDMENTS
Changes to the protocol or its related stamped consent/assent documents must be approved by the URI IRB before implementation.

RECORDKEEPING
Federal regulations require all research records must be retained for a minimum of five years after the project ends.

PROTOCOL EXPIRATION
Based on the risks, this project requires Continuing Review by this office by **July 23, 2021**. Please use the CONTINUING REVIEW FORM for this procedure.

REPORTING
Unanticipated problems involving risk to subjects or others, adverse events, and other problems must be reported to the IRB using the **Appendix S - Event Reporting** form. Additionally, all FDA and sponsor reporting requirements must be followed.

URI IRB RESEARCH POLICIES
All individuals engaged in human subjects research are responsible for the compliance with all applicable URI IRB policies (http://web.uri.edu/researchecondev/office-of-research-integrity/human-subjects-protections/general-guidance/). The Principal Investigator of the study is ultimately responsible for assuring all study team members review and adhere to applicable policies for the conduct of human subjects research.

If you have any general questions, please contact us by email at researchintegrity@etal.uri.edu. For study related questions, please contact us via **project mail through IRBNet**. Please include your study title and reference number in all correspondence with this office.

Matthew J. Delmonico, PhD, MPH
IRB Chair

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