LEARNING AND BELIEF CHANGE IN A COLLABORATIVE POLICY SUBSYSTEM: MARINE AQUACULTURE IN THE UNITED STATES

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Abstract

of

LEARNING AND BELIEF CHANGE IN A COLLABORATIVE POLICY SUBSYSTEM: MARINE AQUACULTURE IN THE UNITED STATES

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Collaborative governance processes involving diverse stakeholders with conflicting beliefs are sometimes used to solve difficult environmental and natural resource policy issues. This thesis explores the factors and conditions that affect general learning and belief change in such settings. I use interview and survey data from nine U.S. marine aquaculture collaborative institutions to develop two regression models, one ordinary least squares and one binary logistic. The dual model approach allows me to explore if the factors that affect general learning are the same factors that affect belief change.

This analysis illustrates there are several factors with significant influence on general learning that can be influenced by the convening agency (perceptions of group trust, perceptions of effective facilitation, and the inclusion of aquaculture critics). Perhaps less encouraging to conveners, this analysis also demonstrates that the factors that affect general learning are not necessarily the same factors that affect belief change. Signifying their importance, only the perception of a policy stalemate and perception of effective facilitation had significant and strong influence across both learning and belief change.

_____, Committee Chair
William Leach, Ph.D.

_____
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Chapter 1

INTRODUCTION

Learning and belief change are often cited as one of the primary benefits of collaborative policymaking/governance (see for example: Ambruster, 2008; Bennett & Howlett, 1992; Council on Environmental Quality, 2007; Daniels & Walker, 2001; Sabatier & Jenkins-Smith, 1993). Learning and belief change are significant outcomes of collaborative processes, as they can be important precursors to policy change. The objective of this thesis is to advance our collective knowledge of collaboration by exploring the factors and conditions that lead to learning and belief change in a collaborative setting. I accomplish this objective by using data from nine marine aquaculture partnerships to test various components of complementary and competing theories from the collaborative literature (both academic and practitioner). Before moving towards these theories it is helpful to briefly explore collaborative governance in the United States.

Contemporary Collaborative Context

Collaboration is a form of governance that is increasingly being used throughout the United States to tackle issues that present complex technical, legal and political components in addition to transcending traditional jurisdictional boundaries of government agencies (Innes & Booher 2010). Collaborative governance has been increasingly used in natural resource and environmental issues, and much of the advances in collaborative techniques and theory have occurred in these fields over the last twenty years (Leach, personal communication, 2010).

Looking at water management as an example; Sabatier et al. (2005) point out that "a quiet revolution is occurring in water management institutions in the United States" (p. 3). The authors observe that the traditional top-down technocratic agency approach to water management has come under a great deal of criticism as water issues have become both more complex and more contentious. In their words, "...a new approach to water management has emerged. It has explicitly focused on all sources of a pollutant within the watershed as a whole rather than on types of sources and is not confined to the arbitrary political boundaries represented by states and counties" (p. 5). This new approach is highly collaborative and includes multiple affected stakeholders in face-to-face negotiations utilizing agreed upon decision rules (p. 5).

Advocates of collaborative governance point out that collaboration has many advantages over more traditional approaches. These advantages include increased participation by affected parties, reduced time, lower monetary cost, better solutions, capacity building to handle future disputes, and improved overall outcomes (McKinney & Field, 2008, p. 419). The Center for Collaborative Policy (CCP)[1] operates on the principal that decisions resulting from collaborative governance cost less money and time because such decisions are easier to implement and are likely subject to fewer legal challenges. Two examples of successful collaboratives demonstrating these characteristics are the Catron County Collaborative in New Mexico and The Applegate Partnership of Oregon. The Catron Collaborative successfully allowed for the return of

[1] Founded in 1990 at California State University, Sacramento, the mission of the CCP is to build the capacity of public agencies, stakeholder groups, and the public to use collaborative strategies to improve policy outcomes (Center for Collaborative Policy, 2009a).

grazing and land restoration projects after ten years of legal fighting in the courtroom. The Applegate Partnership was able to develop collaboration between the community and government agencies resulting in better management of an almost 500,000 acre watershed containing both public and private lands (Firehock, 2010, p. 7).

In addition to localized, place-specific collaboratives, the collaborative process is also being applied to larger issues and initiatives such as those at the state level. Sutkus (2007) discusses the call for larger scale collaboration that emerged in the wake of Hurricane Katrina and the terrorist attack on 9/11. Many states are aggressively pursuing collaborative approaches to coordinate systems and people to accomplish the goals of public safety. One example of this is the 2005 collaborative to develop communications modernization and interoperability within the state of California. Despite almost two prior years of stagnation, within 6 months a collaborative process brought together thirteen state agencies and developed a strategic plan for state agency communications modernization and interoperability (Sutkus, 2007, p. 4).

The federal government is also taking steps to promote the idea of collaborative governance to navigate natural resource issues, as evident by the Council on Environmental Quality's *Collaboration in NEPA: A Handbook for NEPA Practitioners* (2007). The handbook is intended to introduce federal NEPA practitioners to the idea of collaboration, give an overview of the principals and steps in conducting a collaborative process, discuss the benefits available via collaboration, and provide pertinent examples of collaboration.

Parameters of Collaboration

The precise parameters of collaboration are wide and varied as there are many different manifestations of the concept throughout the United States. As Calanni et al. (2010) point out, academics have generally labeled theses manifestations in the following ways: watershed partnerships, collaborative environmental management, collaborative institutions, integrated environmental management, collaborative public management, ecosystem-based management, and collaborative resource management institutions. The marine aquaculture partnerships under review in this thesis mark one of the most recent manifestations of collaboration.

In general, collaborative governance groups have a few fundamental foundations in common with each other. From the most general perspective, "…collaborative policy making is a process whereby one or more public agencies craft a solution to a policy issue using consensus-driven dialogue with diverse parties who will be affected by the solution or who can help to implement it" (CCP Site). A similar definition from Firehock (2010) summarizes collaboratives as diverse groups of individuals working together locally to address a complex problem that cannot be addressed unilaterally and is tied to a specific geographic place (p. 8). Membership within collaboratives typically includes representatives from industry, government, non-governmental organizations, academics, and the general public – all brought together to find solutions to complex problems (Ansell & Gash, 2008). Table 1 summarizes definitions of collaboration as specified by various authors, organizations and agencies.

Table 1: Selected Definitions of Collaborative Governance

Source	Definition
(Ambruster, 2008); Collaborative Versus Technocratic Policymaking: California's Statewide Water Plan.	"Collaboration or consensus-building is usually defined as a practice in which parties with different points of view meet in an effort to build consensus toward agreement in a conflict, or vis-à-vis policy decision-making. The process may or may not involve third party facilitation or mediation. Collaborative decision-making is occurring in many different forms today, from negotiated rulemaking, in which regulators and affected parties engage in consensus based negotiations over proposed regulations, to multiparty, multi-agency institutions created to work towards resolution of long standing policy conflicts over complex, intractable issues."
Council on Environmental Quality; NEPA Collaboration Handbook (2007).	"Collaboration applies in many contexts and can include a broad range of activities; however, there is no set definition. This handbook focuses on collaboration in the context of NEPA where an agency engages other governmental entities and/or a balanced set of affected and interested parties in seeking agreements at one or more stages of the NEPA process by cultivating shared vision, trust, and communication."
Community-Based Collaboratives Research Consortium; Community-Based Collaboration (2010).	"Convened voluntarily from within the local community to focus on resource management issues or planning involving public lands or publicly owned or regulated resources whose management impacts the physical, environmental and/or economic health of the local community. Brought together by a shared desire to influence the protection and use of natural resources through recommendations or direct actions that will impact the management of the resource. Membership that includes a broad array of interests, some of which may be in conflict. A decision-making process that requires participation by local stakeholders."
Center for Collaborative Policy	"Collaborative policy making is a process whereby one or more public agencies craft a solution to a policy issue using consensus-driven dialogue with diverse parties who will be affected by the solution or who can help to implement it."

In the next chapter of this thesis I provide context for the subject matter of this analysis, marine aquaculture in the United States. In Chapter three I review the collaborative literature as it relates to issues of learning and belief change, including bodies of work both from the academic and practitioner realms. Chapter four describes the methodology I employ and includes a discussion of how I operationalize learning. Chapters five and six present the results of my analysis and tie everything together with a discussion of how the results further our understanding of learning in collaborative settings.

Chapter 2

BACKGROUND

The controversies and complexities of marine aquaculture in the United States provide an excellent opportunity to study the elements of contemporary collaborative processes. This section details the challenges facing the United States in the production of domestic aquaculture, the current regulatory framework of marine aquaculture, and the debate over increasing domestic marine aquaculture activities.

The National Oceanic and Atmospheric Administration (NOAA), an agency housed within the U.S. Department of Commerce, oversees aquaculture production and operations in the United States. The U.S. Department of Commerce (1999), defines aquaculture as "the propagation and rearing of aquatic organisms in controlled or selected aquatic environments for any commercial, recreational, or public purposes." NOAA (2010) is currently revising their comprehensive national policy for marine aquaculture, but existing goals include creating employment/business opportunities in coastal communities, providing safe and sustainable seafood, and maintaining healthy marine populations, species, ecosystems and coastal communities.

NOAA and the U.S. aquaculture industry operate within the context of increasing global demand for seafood. Recent estimates suggest that the global human population will increase by almost 40 percent over the next 40 years – a growth spike that will lead to increased demand on all of earth's resources (Sea Grant, 2008, p. 5). The supply side statistics are stark – over 77 percent of global wild fisheries and 45 percent of U.S. wild fisheries are fully exploited or over-exploited (2008, p. 5). Aquaculture currently

provides half of the world's seafood supply and production has been growing annually at about nine percent (Marine Aquaculture Task Force, 2007, p. 13). With more and more wild fisheries being fully exploited and overfished, the United Nations has declared that most of the future increases in seafood production must come from aquaculture (NOAA, 2010).

Although aquaculture supplies half of the world's seafood, aquaculture from the United States represents only one to one and a half percent of global production (Marine Aquaculture Task Force, 2007; Sea Grant, 2008). China produces the largest share of global aquaculture production with almost 70 percent, while India, the Philippines, Indonesia, Japan, Vietnam, and Thailand all produce over two percent of global production (2007, p. 14). In terms of weight, China produced over 41 million megatons of aquaculture in 2004, Japan produced 1.3 million megatons, and the U.S. produced only 0.6 million megatons (2007, p. 14). Domestically the United States imports over 84 percent of the seafood it consumes, with about half of that consumption being produced from global aquaculture. The lack of total production in the United States (only $4 billion in seafood exports) combined with the high demand as demonstrated through importation (at a cost of $14 billion) has resulted in an annual seafood trade deficit of over $9 billion (NOAA, 2010). This has led NOAA to declare a goal of dramatically increasing the annual value of U.S. aquaculture production – to $5 billion by 2025 (Naylor & Burke, 2005, p. 205). One of the latest estimates, from the National Marine Fisheries Service Office of Science and Technology, pegged the value of annual domestic aquaculture production at $1.2 billion (NOAA, 2009).

The challenges facing the U.S. production of aquaculture are numerous, complex, and legitimate: a lack of supportive regulatory frameworks, lack of trained personnel, lack of capital investments, environmental concerns, high labor costs, and a lack of available high quality sites due to competing uses (Goldburg, Elliot, & Naylor, 2001; Sea Grant, 2008). As Calanni et al. (2010) suggests, one would think that given the trade deficit there would be a supportive regulatory climate forthcoming for the aquaculture industry. The reality is that aquaculture producers must navigate a complex set of federal and state guidelines. A high-profile example of this is the recent demonstration fish farm built by Hubbs-Sea World Research Institute in Mexico. The demonstration farm was originally to have been built off the California coast, but the presence of a multitude of federal agencies made the process so difficult that the nonprofit eventually gave up and headed to Mexico (Gunther, 2007). As Donald Kent, president of Hubbs states regarding the regulatory framework, "...you have a process with nobody to lead it…We're becoming a nation of importers, when we could be developing our own industry that we can control" (Gunther, 2007). Making matters more confusing, all commercial marine aquaculture in the U.S. currently takes place in state waters and falls under the jurisdiction of state regulations in addition to federal regulations (Marine Aquaculture Task Force, 2007). Table 2 displays the complexity of the federal legal framework regulating marine aquaculture. Important to note is that almost none of these statutes were designed with marine aquaculture in mind, instead they touch on items affecting marine aquaculture (2007, p. 24).

Table 2: U.S. Federal Regulatory Framework

Law	Agency(s)
National Aquaculture Act	U.S. Department of Agriculture
Clean Water Act	Environmental Protection Agency U.S. Army Corps of Engineers
Federal Insecticide, Fungicide, and Rodenticide Act	Environmental Protection Agency
Rivers and Harbor Act of 1899	U.S. Army Corps of Engineers
Marine Protection, Research and Sanctuaries Act	U.S. Army Corps of Engineers
The Migratory Bird Treaty Act	U.S. Fish and Wildlife Service
Endangered Species Act	National Oceanic and Atmospheric Administration U.S. Fish and Wildlife Service
Marine Mammal Protection Act	National Oceanic and Atmospheric Administration U.S. Fish and Wildlife Service
Magnuson-Stevens Fishery Conservation and Management Act	National Oceanic and Atmospheric Administration
Food, Drug and Cosmetic Act	Minerals Management Service, Department of the Interior
Coastal Zone Management Act of 1972	National Oceanic and Atmospheric Administration

Source: (Goldburg et al., 2001; Marine Aquaculture Task Force, 2007)

The challenges arising from a complex regulatory framework are supplemented by legitimate ecological challenges as opponents and critics point to several negative impacts including effluent discharge, farmed fish escapes, disease and parasite transmission, and habitat modification (Goldburg et al., 2001; Naylor et al., 2005; Naylor & Burke, 2005; Naylor et al., 2000; Sea Grant, 2008). The claim that marine aquaculture can help replenish natural stocks of wild fisheries has come under dispute – as Naylor et al. (2000) point out, "…the diversity of production systems leads to an underlying paradox: aquaculture is a possible solution, but also a contributing factor, to the collapse

of fisheries stocks worldwide" (p. 1017). This is due in part to the large fish meal and fish oil required to produced farmed fish – virtually all farm operations for carnivorous diadromous fish and marine finfish actually serve to reduce rather than increase the overall fish stock (Naylor & Burke, 2005, p. 194). An example of this is that the ratio of wild fish used to create farmed salmon is 2.44 (meaning an average of 2.44 pounds of wild fish is used to create one pound of farmed salmon) (Goldburg et al., 2001, p. 11). Ecological issues are only a part of the story for marine aquaculture production struggles – establishing operation sites also means competing with local fisherman and coastal landowners (2001, p. 17). Table 3 presents a summary of the ecological impact challenges that U.S. marine aquaculture faces.

Table 3: Summary of Selected Marine Aquaculture Ecological Impacts

Ecological Impact	Impact Description
Effluent discharge / Chemical pollution	Aquaculture netpen operations can release untreated nutrients, chemicals, and pharmaceuticals into marine ecosystems (Naylor & Burke, 2005). This discharge "contributes to nutrient pollution near open net pens, particularly in shallow or confined water bodies or in concentrated production areas. In some cases, nitrogen wastes exceed the assimilative capacity of the local marine ecosystem and lead to degenerated water quality that can be toxic to fish and shellfish" (Naylor & Burke, 2005).
Farmed fish escapes	There are concerns over the extent that escapees survive in the wild and compete with wild fish over food and other resources. Issues of interbreeding are also a concern with escapees as this could alter the genetic makeup of the wild population (Naylor, et al., 2005). As Naylor et al point out, "…millions of Atlantic salmon have escaped on the western coasts of North America and South America. Atlantic salmon have been found in more than 80 rivers in British Columbia alone, and they are reproducing in some locations" (2005).

Disease/Parasite transmission	Aquaculture operations can introduce diseases and/or parasites to wild fish stocks and can even amplify the diseases already present (Goldburg et al., 2001). An example of this occurred in the early 1900s – Goldburg et al discuss that "the Japanese oyster drill and a predatory flatworm were introduced to the West Coast with the Pacific oyster, and at that time they contributed to the decline of native oyster stocks" (2001).
Habitat modification	Marine aquaculture operations in the United States use 64,000 acres of salt water (Goldburg et al., 2001). The clustering of these operations can result in the obstruction of wild animals' natural resources. Clustering also serves to create "large aggregations of fish that are a lure to predators. Birds, seals, and other predators often feed at aquaculture sites, where they can become entangled in netpens and suffocate" (Goldburg et al., 2001).

Although there is a demonstrated need for increased aquaculture production in the United States, the combination of legitimate and multifaceted challenges dictates a special approach to progress. The most recent approach has been the creation of several aquaculture partnerships. Some of these collaboratives formed spontaneously while others were created by state law. The issues they address range from the big picture to the technical details of aquaculture operations (see Appendix C for a description of the nine partnerships studied in this thesis).

Chapter 3

LITERATURE REVIEW

Collaborative efforts are focused on reaching solutions – in many cases this means getting people to learn by reframing what they understand about causes and outcomes. This chapter reviews academic and practitioner-based literature regarding the factors and conditions that affect learning in a collaborative setting. The first section of this review describes how various authors have defined learning within a collaborative setting. The next two sections look at what the literature says regarding aspects of the collaborative process and participant traits and perceptions that affect learning. An exploration of these components will provide a foundation and framework for analyzing the factors and conditions that affect learning. I conclude this review with a summary of these factors and a look at areas of contention and missing links.

Theoretical Perspectives and Definitions of Learning

The definition of learning is quite vague throughout the collaborative governance literature. Although many authors discuss learning as a desired function or component of collaborative processes, few explicitly take the time to give more than a perfunctory definition of the concept. Bennett and Howlett (1992) point out that vagueness and differences between definitions of learning have made it quite difficult to measure learning and make meaningful comparisons between studies (p. 276).

Perhaps somewhat ironically, it is the most abstract and academically based collaborative literature that has the most explicit definition of learning. The Advocacy

Coalition Framework[2] devised by Sabatier and Jenkins-Smith (1993, p. 42) defines its version of learning, "policy-oriented learning", as follows:

> Policy-oriented learning involves relatively enduring alterations of thought or behavioral intentions that result from experience and which are concerned with the attainment or revision of the precepts of the belief system of individuals or of collectivities (such as advocacy coalitions).

Sabatier's definition of policy-oriented learning within his ACF makes reference to the revision of belief systems, a key component of the ACF. The ACF structures individuals' belief systems into a three-level hierarchical foundation. The first belief level is composed of deep core beliefs that are very resistant to change – these are, "...the broadest, most stable, and predominately normative" (Weible & Sabatier, 2009, p. 196). The next level is comprised of policy core beliefs, those beliefs that "…are of moderate scope and span the substantive and geographic breadth of a policy subsystem" (2009, p. 197). Policy core beliefs are divided into two kinds: normative policy core beliefs and empirical policy core beliefs. Normative policy core beliefs (e.g. an individual's preference for industrial development in Alaska's wildlife reserve versus environmental protection) are unlikely to change, while empirical beliefs (relating to both the cause and degree of a problem such as wildlife diminishment in the Alaskan wildlife reserve) are more likely to change. Lastly, secondary beliefs are, "…more substantively and geographically narrow in scope, more empirically based, and only related to a subset of the policy subsystem" (2009, p. 197). Secondary beliefs (e.g. a specific policy proposal

[2] Introduced in 1988 as a symposium issue for Policy Sciences, the Advocacy Coalition Framework is a policy process framework developed with the intention of breaking down the complexity of public policy. The ACF integrates many stages of the policy cycle and includes scientific and technical information as core elements of its theories (Weible, Sabatier, & McQueen, 2009).

regarding a specific portion of a policy subsystem) are the beliefs most likely to undergo the revision referenced in Sabatier's definition of learning.

Daniels and Walker (2001) discuss their notions of learning as part of their Collaborative Learning[3] approach to environmental conflict. Daniels and Walker do not provide a succinct definition of learning, but instead focus on the importance of comprehending learning as "a process, rather than in terms of outcomes" (p. 88). In staying with the process over outcomes framework, Daniels and Walker draw heavily from Kolb's (1984) model of experiential learning. Daniels and Walker (2001) discuss that learning is motivated by conflicts, is a continuous process based in experience, and is a comprehensive process of adaptation to the world (p. 88). However, experience alone is not enough for learning – something must be done with that experience (Kolb, 1984, p. 42). The two authors (2001, p. 88) somewhat synchronize with Sabatier's ACF as they discuss learning in terms of an individual's belief system:

> Experiential learning is both grounded and dynamic. It is grounded because it begins and ends with one's understanding and experiences of the world. It is dynamic because it involves change in the learner's beliefs and understanding of the world but also can generate activity that can alter the learner's environment.

Daniels and Walker conclude their discussion of learning by stating that learning is a key foundational component of a collaborative process. They argue that learning is natural and pervasive (perhaps justifying the lack of an explicit definition), but is not in all cases easy or omnipresent and the process must be designed purposefully (p. 95).

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[3] Developed in 1996 as a learning-based approach to public participation, the CL framework pulls from soft systems methodology, alternative dispute resolution, and learning theory. CL was designed to foster an atmosphere of learning, encourage systematic thinking, discourage competitive behavior, and focus on practical change (Blatner, Carroll, Daniels, & Walker, 2001).

Other authors are even less clear in defining exactly what learning is and instead focus on nuanced versions of learning in the context of the group setting. Innes and Booher (2003) discuss that the learning occurring in a productive group setting can "…be about facts, about what others think, or about how scientists see a problem" (p. 44). Still others discuss learning in ACF-like terms, such as Fenger and Klok (2001), who define learning as, "…convergent change of beliefs" (p. 164). Another author's review of public policy processes found that change in collective beliefs, accompanied by "new collective behavior, policy, or strategies, is one way to operationalize the product of collective learning" (Anonymous, 2010, p.3).

Aspects of the Collaborative Process that Affect Learning

In this section, I explore partnership level conditions and factors that affect the learning process within a collaborative setting. Partnership level means those conditions and factors that affect the dynamics of the entire partnership, as opposed to only an individual. Such conditions include the level of conflict in the partnership, the level of accepted science regarding the partnership's subject matter, the level of external resources available to partnership members, the partnership's receptiveness to local knowledge, and the diversity/appropriateness of participants selected for the partnership.

Level of Conflict

The existing level of topical conflict in a collaborative process has implications for the success or failure of that collaborative. A practitioner organization, The Center

for Collaborative Policy (CCP)[4], cites low conflict levels as the number one condition favorable to initiate a collaborative policy. The CCP states that a collaborative is more likely to be successful if, "…issues do not focus on constitutional rights or very basic societal values" (2010a). Essentially a collaborative that focuses on fundamental rights or issues will be less likely to find areas of agreement or trade off than does a process that focuses on specific technical and empirical issues.

Sabatier's ACF also discusses conflict levels and ties it back to the discussion of hierarchical belief systems. Similar to the CCP's discussion of constitutional rights versus technical issues, Sabatier (1988) states that when two sides attempt to debate core beliefs a "dialogue of the deaf" will likely occur (p. 155). This occurs because the building of core beliefs leads to cognitive dissonance and selective perception. As Sabatier puts it, the creation of core beliefs means that "…powerful egodefense, peer-group, and organizational forces create considerable resistance to change even in the face of countervailing empirical evidence or internal inconsistencies" (p. 147). The ACF (1988, p. 155) has based a specific hypothesis around this notion:

> Policy-oriented learning across belief systems is most likely when there is an intermediate level of informed conflict between the two. This requires: a) each have the technical resources to engage in such a debate; and that b) the conflict be between secondary aspects of one belief system and core elements of the other or, alternatively, between important secondary aspects of the two belief systems.

Conflict levels within the ACF framework represent a balancing act of sorts. While a debate around subjects too close to core beliefs will be counter-productive, a debate

[4] Founded in 1990 at California State University, Sacramento, the mission of the CCP is to build the capacity of public agencies, stakeholder groups, and the public to use collaborative strategies to improve policy outcomes (Center for Collaborative Policy, 2009a).

around equally unimportant issues will not mobilize the resources required for a productive debate (1988, p. 155).

Level of Accepted Science

There are different perspectives regarding how science plays into the collaborative and learning process. One of the hypotheses of the ACF states that, "problems for which accepted quantitative data and theory exist are more conducive to policy-oriented learning across belief systems than those in which data and theory are generally qualitative, quite subjective, or altogether lacking" (Weible et al., 2009, p. 129). Sabatier (1988) points out that this hypothesis speaks to the tractability of an issue, and gives the example that more policy-oriented learning should be expected in discussing air pollution versus mental health – this is because we have developed a good understanding of air pollution over the last few decades (p. 157). Bolstering this argument, Meijerink (2005) tests the ACF and finds that Dutch coastal flooding policy debates were largely intractable during the late 1960s to early 1970s due in part to a lack of shared knowledge around coastal ecological issues (p. 1070).

The ACF fleshes out this hypothesis by arguing that problems related to natural systems are more likely to foster learning than problems related to social or political systems (Weible et al., 2009, p. 129). Natural systems are more likely to have readily available and widely accepted scientific information than social arguments such as the right to life. A slightly different perspective from the Collaborative Learning (CL) framework suggests that all systems are ultimately interrelated and therefore the

distinction between natural systems and social systems is a false construct that oversimplifies (Daniels & Walker, 2001).

Yet another perspective, born out of joint fact-finding (JFF)[5], aligns with both the ACF, and the CL framework. Ozawa (2006) hints that many discussions that may appear to be scientific (and therefore based in the natural system) are ultimately laced (or become laced) with intractable social values. Ozawa also points out that science is abused, as "…antagonists often insist on wielding science as a shield, a weapon, or a tool of persuasion" (p. 198). This misuse of science can result in conflicts sinking into intractability. The proposed Yucca Mountain nuclear waste site provides an excellent example of this. Ozawa writes that both sides of the debate (the Department of Energy and the state of Nevada / environmentalists) used "sound science" or "best science" to argue why the site was either safe or unsafe for nuclear waste storage (pp. 198-199).

Resources

Collaborative processes can be long, intensive, and costly – the CCP (2010a, 2010b) lists adequate resources (in terms of funding) as one of the key conditions required for both initiating and sustaining a collaborative process. For example, the CCP's (2007) *North Bay Selenium Stakeholder Process Assessment* calls into question the viability of a North Bay selenium collaborative process: the CCP found that "for some stakeholders, resource limitations will be too great to ignore and will impede their participation" (p. 18). This could lead to representation issues that compromise learning,

[5] JFF has evolved over the last ten to fifteen years as a process or series of best practices aimed at ensuring appropriate balance of science and politics in environmental decision making at the federal, state, and local levels. JFF involves the creation of shared learning to ensure that decisions are made using the best-quality science rather than "science by committee" (Karl, Susskind, & Wallace, 2007).

as a lack of participation "could call into question the legitimacy of the process if it is obvious that equitable representation of interests is not being achieved" (2007, p. 18). Other sources of collaborative literature indirectly address the resource and funding issue. Implicit in both the JFF and CL literature is the expectation that there would be some level of funding required to undertake collaborative activities.

Local Knowledge

Local knowledge is knowledge that comes from non-expert participants or sources, it is knowledge that has been developed by the people closest to the system in question and comes from experience (Amengual, 2004). The decision to integrate local knowledge into a collaborative process can come from two angles: either by including stakeholders that themselves have local knowledge or by allowing local knowledge to be introduced alongside other more scientifically based information.

Amengaul (2004) points out that local knowledge adds richness to the conversation in four different ways: (1) local knowledge increases the scope of the investigation and brings new things to light, (2) local knowledge can add information to existing expert analysis, (3) local knowledge brings specificity that may be lacking in expert generalizations, and (4) local knowledge can look at a system from different perspectives than the expert quantitative and reductionist methods (pp. 3-4). Corburn (2002) provides an excellent example of local knowledge integration as he describes an EPA health risk assessment in Brooklyn, New York. Community stakeholders (local knowledge sources) were not included in developing the methodology of the health assessment. Instead, community members went to the sole public hearing on the topic

and pointed out that the EPA's proposed methodology did not include an assessment of toxic fish from the East River. The experts involved in developing the health assessment had failed to realize that residents ate fish from the East River. In this instance local knowledge served to greatly increase the effectiveness and accuracy of the health assessment.

Participants

Perhaps the most critical and fundamental decision in designing a collaborative process is selecting the stakeholders that will participate. As Leach (2010) discusses, "…the importance of a holistic perspective marked by inclusive and representative participation is an almost universally cited finding from research on community-based collaboratives" (p.56). This has implications for learning as the wrong balance of participants will not provide the range of knowledge necessary to address complex problems (2010). In most instances the number of participants that can be involved is very limited due to any number of reasons from a lack of funding to a lack of a thoughtful needs assessment.

The CCP (2010a, 2010b) lists participant selection issues in three conditions favorable to initiate a collaborative process and two conditions needed to sustain a collaborative policy process. The CCP states clearly that every effort should be made to bring in affected stakeholders as this speaks to the legitimacy and inclusiveness of a collaborative project (2010b). Legitimacy comes in part because potential deal breakers will be at the table – those stakeholders that could undo the efforts of the collaborative at some point down the road in another venue. Additionally, it is not enough for each

stakeholder group to be merely represented – each stakeholder group needs to be represented by a "legitimate spokesperson" (2010a). The definition of a legitimate spokesperson is rather complex and demanding (Center for Collaborative Policy, 2005):

> The spokesperson needs to be recognized as a true representative. The spokesperson needs to understand how to communicate and support enlightened self-interest. The spokesperson must have systems in place, or be able to support the implementation of systems, to authentically communicate with their constituents / organization. The representative must also hold sufficient skills to advocate for collaboratively generated options.

The JFF framework also provides direction regarding collaborative participants – a major part of the second phase of the JFF process is to "generate agreement on stakeholder representatives" (Consensus Building Institute, 2002). A review of three successful JFF case studies found that one of the common threads among successful collaboratives was the presence of "relevant stakeholders" (Karl et al., 2007, p. 29). Another JFF analysis found that a shortcoming of more traditional processes (e.g. Blue Ribbon Panels and adversary science proceedings) can be the lack of access for non-expert stakeholders (McCreary et al., 2001). The authors of the analysis found that, "…when stakeholders – grass-roots interests and other resource users with a stake in a policy decision – are denied access to the deliberations of an expert panel, the panel may overlook valuable information or ask the wrong questions" (p.4). This meshes well with the CCP's reasoning – a focus only on experts will undoubtedly look passed potential deal breakers and cause future stumbling blocks.

Participant Traits and Perceptions Affecting Learning

This section focuses on the traits and perceptions of the individual participants that may have some effect on the learning that occurs in a collaborative setting. The

factors I review in this section include hurting stalemate, facilitation, duration, and interpersonal trust.

Hurting Stalemate

Academic and practitioner literature both touch on the importance of a hurting stalemate that leads to interdependence among stakeholders. Interdependence helps to level the playing field and reduce the opportunity for one party to unilaterally make decisions. The concept of a hurting stalemate comes from alternative dispute resolution (ADR)[6] literature and essentially means that the status quo for a particular issue has become unacceptable for all stakeholders. If any one stakeholder is content with the status quo, the hurting stalemate is not mutual and a discussions may not be fruitful (Sabatier & Weible, 2007, p. 206).

Zartman (2001) describes this condition as a moment of ripeness – a point in time when "…unilateral means of achieving a satisfactory result are blocked and the parties feel that they are in an uncomfortable and costly predicament" (p. 8). Zartman (1991) goes further and states that this mutual stalemate is often still not enough without the presence of an impending catastrophe that serves as a deadline for resolution (p. 16). Although Zartman is discussing international conflict resolution, his theories are relevant to collaborative governance and have been built into the ACF framework among others.

As stated above, the ACF has integrated the notion of a hurting stalemate along with other ideas from the ADR literature. Sabatier and Weible (2007) list a hurting

[6] ADR has grown quickly in the United States since the political and civil conflicts of the 1960s as a method of dispute resolution where conflicting parties are assisted by a professional third party to reach consensual agreement (Spangler, 2003).

stalemate as one of the chief prescriptions for negotiating and implementing agreements (p. 206). Unfortunately, the ACF does not flesh out the precise parameters of a hurting stalemate and leaves most of the description to Zartman's work.

Authors such as Fenger and Klok (2001) have gone further and contributed additions to the ACF with their discussions of bifurcated interdependency. Fenger and Klok (2001) split interdependency into two distinct categories: competitive interdependency and symbiotic interdependency. The authors argue that competitive interdependency occurs when two stakeholders are in need of the exact same scarce resource, while symbiotic interdependency occurs when one stakeholder's resources can be exchanged with another stakeholder's resources so that both may achieve their aims (pp. 162-163). The extension of this argument is that symbiotic interdependencies represent a condition more favorable for cooperation between groups. In fact, Fenger and Klok argue that divergent beliefs may be forced to converge given symbiotic interdependencies, a process they describe as 'learning' under the ACF.

From a practitioner standpoint, the CCP cites hurting stalemate and interdependence among stakeholders as a crucial condition for success. In fact, this concept is captured in at least four of the CCP's conditions favorable to initiate a collaborative process. These conditions include: No party has assurance of a much better deal elsewhere, parties anticipate future dealings with each other, relative balance of power among the parties, and external pressures to reach agreement (2010a). These conditions are assessed as part of the CCP's needs assessment process prior to most collaboratives they oversee. For example, the CCP's (2005) *Lower Yolo Bypass*

Stakeholder Process Needs Assessment reports that, "…there is a balance of influence among Lower Bypass stakeholders", and that, "…participants expressed no expectation that conditions will improve on their own and in fact, they are certain that conditions will deteriorate. Neither is there any collective sense that a better outcome can be achieved through some other approach" (pp. 52-53). Some other approach in this context can refer to some other venue – stakeholders are much more likely to negotiate in good faith if they lack other venues to unilaterally get results (Sabatier, Leach, Lubell, & Pelkey, 2005).

Facilitation

The choice of who facilitates a collaborative process is a key decision that could have implications regarding the amount of learning that occurs. Facilitation refers to the individual(s) responsible for running the meetings, guiding the discussions, fostering learning, and finding areas of potential agreement. A major topic in the literature is whether or not a facilitator should be from an external and neutral third party (a non-stakeholder) – there is a difference of opinion among experts on this matter. More agreement is found regarding the desired characteristics of the facilitator: the facilitator should be skilled, respected and knowledgeable of the situation from the viewpoint of each of the stakeholders (Daniels & Walker, 2001; Innes & Booher, 2003; Karl et al., 2007).

The ACF pulls from the ADR literature and describes the facilitator as a mediator who must be both skilled and neutral (Sabatier & Weible, 2007, p. 206). Proponents of the JFF point out that a "professional neutral" must be responsible for "neutral process management" (Karl et al., 2007). Another JFF proponent points out that it is a neutral

facilitator who is able to "help joint fact-finding participants agree on key research questions, acceptable study methods, and credible scientists and analysts" (Peyser, 2006). In a discussion of the success of the Northern Oxford County Coalition collaborative process, Karl et al. (2007) point out that a professional facilitation team from the Consensus Building Institute was able to implement several tenets of successful JFF, including: conducting a conflict assessment, drafting meeting protocols, helping to select an outside expert and managing expectations.

While the ACF and JFF do not spend much time describing facilitation in detail, the CL framework goes somewhat further. Daniels and Walker (2001) point out that although the facilitator should be impartial, "…facilitation can be provided by members of the convening party, facilitators obtained locally, or professional facilitators who may be outside the local community" (p. 177). Going beyond the suggestion of choosing a facilitator from the convening agency, the CL framework also allows for the facilitator to be a member of a stakeholder group (p. 166). The key determinants in selecting a facilitator, according to the CL framework, are impartiality, fairness, and credibility. Credibility in this context means that the facilitator is able to understand things from a stakeholder's point of view.

The CCP seemingly takes the facilitation issue on a case-by-case basis. For example, the CCP's (2007) North Bay Selenium needs assessment recommends that a "neutral third-party with expertise in stakeholder group processes, total maximum daily loads, and associated environmental compliance topics" facilitate the process (p. 21). Another CCP (2005) needs assessment of the Lower Yolo Bypass recommends that "the

Yolo Basin Foundation convene and sponsor the collaborative process…the Foundation has an excellent reputation with regional stakeholders and is collectively perceived as a neutral organization" (p. 58).

Going against the grain somewhat, one analysis finds that the facilitation issue may be overanalyzed, especially for collaboratives with limited funding (Leach & Sabatier, 2003). Sabatier et al. (2005) point out that the literature is definitely not of one voice regarding the necessity that facilitators need to be non-stakeholder neutrals. A similar finding from a review of JFF collaborative processes (running counter to the JFF Northern Oxford case study) found that neutral auspices "has not proved necessary in most of our work" (McCreary, Gamman, & Brooks, 2001). The authors conclude that the potential presence of a neutral facilitator can provide reassurance to stakeholders that negotiations will indeed be credible to the point where the neutral ends up not being needed.

Several authors insist it is not enough for the facilitator to be knowledgeable, neutral, and respected –the facilitator should also be trained and skilled (Daniels & Walker, 2001; Innes & Booher, 2003; Karl et al., 2007). In this context being skilled means being able to connect the dots and find areas of mutual gain. It also means having the ability to push experts on both sides of the issue to back up their claims (Leach, 2010). Innes and Booher (2003) point out that facilitators play a pivotal role in helping the group effectively communicate. With a skilled facilitator, each participant can speak sincerely, make comprehensible statements, and make accurate statements (p. 38). The skilled facilitator achieves this in part by "asking for clarification or examples, tries

experimental rephrasing of ambiguous statements and asks for elaboration as needed" (p. 38). Interestingly, the requirement of a skilled facilitator may run counter to the requirement of a neutral third party with knowledge of the stakeholders' issues – many organizations have skilled facilitators, but the more localized an issue becomes (as is the case with many environmental issues) the more difficult it may become to find a facilitator with all the desired traits.

Duration

The literature suggests that the precise goal and timeline (or lack thereof) of a collaborative process can have consequences for learning. In the extreme, the ACF suggests that core belief change (learning in the context of this paper) can take a period of ten years or more – seriously casting doubt on the chances for collaborative success in the short term (Sabatier & Weible, 2007, p. 192). The ACF argues that such a period of time is required for coalition stakeholders to change their beliefs via "the gradual accumulation of information, such as scientific study, policy analysis, and experiences of various local stakeholders (Weible, 2007, p. 101). Somewhat countering the ten year timeline, the JFF literature points out that substantial progress can be made over a much shorter timeline – in fact many of the successful JFF case studies took place over a matter of a year or so (Amengual, 2004; Karl et al., 2007; McCreary et al., 2001). A separate review of watershed collaboratives found that approximately six meetings throughout the course of a year is the minimum time commitment required to address technical issues (Sabatier et al., 2005).

Interpersonal Trust

Interpersonal trust is an important factor in determining the amount of learning that occurs and the overall success of the collaborative. As the CL framework explicitly states, "…some reasonable level of trust is critical to collaboration" (2001, p. 180). Other authors use the analogy of a legislature to display the importance of trust – good working relationships can pass legislation through the gauntlet of veto points, while distrust can cause gridlock and hurt the wellbeing of all (Leach & Sabatier, 2005).

Leach and Sabatier (2005) connect some of the earlier concepts from Sabatier's ACF with interpersonal trust. The authors point out that the ACF belief hierarchy plays a role in interpersonal trust as "the framework suggests that individuals assess trustworthiness by comparing their own core beliefs to those of other parties" (p.67). A lack of alignment between individuals' core beliefs can therefore lead to cognitive dissonance and act as a filter that interferes with learning. Leach and Sabatier (2005) point out the ACF's tenet that this dissonance can only be overcome in analytically tractable disputes that are mediated by a neutral facilitator. This is very much in line with a belief of the CL framework, in which Daniels and Walker (2001) point out that a skilled facilitator is able to make trust an overt issue and build trust among parties (p. 180). Leach and Sabatier also circle back around to the hurting stalemate concept – suggesting that a mutual stalemate can aid trust by boosting each side's confidence that the other side will respect the process.

Perhaps casting some doubt over the effectiveness of a skilled facilitator in developing trust, Leach and Sabatier (2005) caution that core beliefs are very difficult to

change in the short term, "…the best that a mediator or facilitator can do is call attention to their importance and hope that participants will muster their most productive attitudes" (p. 45). An empirical study found that future interaction was a key variable in interpersonal trust levels. The authors recommend that facilitators build on this finding by making it clear to participants that the process will last well into the future and thus make participants understand the importance of current interactions (Leach & Sabatier, 2005). Finally, the authors bolster the claims of JFF proponents (Ehrmann & Stinson, 1999, p. 7) that shared information gathering early in the process can help participants have a common view of the seriousness of the problems they are discussing.

Conclusion

There are myriad factors that affect the learning process within a collaborative setting. This review has highlighted several of the most pronounced factors drawn from the practitioner and academic literature. While some areas have been explored in detail, others represent gaps that need to be filled before collaborative processes can be further informed and improved. This section briefly summarizes the various factors illuminated throughout this review and highlights the gaps or points of contention this thesis is poised to address.

In table 4 I summarize the factors from this literature review that relate to learning and extract a hypothesis based on each factor that is rooted in the literature. I then list the academic or practitioner theories which relate to each of these factors and subsequently name empirical studies that have studied each particular factor. Each learning related factor is ultimately classified into one of three categories: *uncontested*

factors - those factors that are present in at least one empirical study with little or no debate about the effects of the factor; *contested or competing* factors – those factors which are highlighted as more important in some theories than others and/or are important in some empirical studies but not in others; and finally research *gaps* – those factors that are highlighted in some theories (and not contested) but have little or no empirical grounding. For the purposes of this paper I consider both qualitative and quantitative empirical studies to be valid.[7]

Table 4: Summary of Factors Affecting Learning

Learning Related Factor	Extracted hypothesis	Related Theories	Empirical Grounding	Classification
Level of conflict	Lower levels of conflict result in increased collaborative learning and success.	CCP, ACF	Meijerink, S. (2005)	Uncontested
Local knowledge	Incorporating local knowledge offers additional opportunities for learning.	JFF	Corburn, J. (2002).	Uncontested
Participants	Having the correct mix of participant stakeholders increases potential for learning.	CCP, JFF	Karl, H. A., Susskind, L. E., & Wallace, K. H. (2007).	Uncontested
Interpersonal trust	Increased levels of interpersonal trust lead to an improved environment for learning.	CL, ACF	Leach, W. D. & Sabatier, P. A. (2005).	Uncontested

[7] An example of this tables use is as follows: mutually hurting stalemate is listed in several theories as having influence over collaborative institutions (ADR, ACF, CCP), and yet there are very few empirical studies that analyze the actual effects of such stalemates.

Level of accepted science	Higher levels of accepted topical science results in increased potential for learning.	ACF (JFF and CL somewhat contest)	Meijerink, S. (2005); Ozawa, C. P. (2006).	Contested or competing
Facilitation	A skilled and neutral third party facilitator will be better able to facilitate learning.	ACF, ADR, JFF, CL (CCP, JFF and others somewhat contest)	Blatner, K.A., Carroll, M.S, Daniels, S.E., & Walker, G.B. (2001); McCreary, S., Gamman, J., & Brooks, B. (2001); Leach, W. D. & Sabatier, P. A. (2005).	Contested or competing
Duration	Collaborative processes take a long period of time for learning to occur.	ACF (JFF somewhat competes)	Although competing, this is somewhat of a research gap.	Contested or competing
Hurting stalemate	The presence of a hurting stalemate leads to interdependence and increased potential for learning.	ADR, Ripeness Theory, ACF, CCP		Gap
Resources	Collaboratives with more resources will be more successful.	CCP, ACF		Gap

Reviewing the literature in this manner illustrates that although many hypotheses are supported by empirical studies, there are others that are either contested or lack empirical research. No single theoretical framework seems to have an empirical stranglehold in its beliefs, although the hypotheses of Sabatier's ACF have perhaps been explored more than any other.

Chapter 4

METHODOLOGY

I break this chapter into three sections: the first section explains the process for collecting the data, the second section explains how the independent and dependent variables are measured, and the third section specifies the two statistical models utilized to analyze the data.

Data Collection

The data for this study come from a broader aquaculture project funded by a grant from the National Science Foundation[8]. The research team includes Dr. Chris Weible, Jon Calanni, and Sabba Siddiki from The University of Colorado, Denver, and Dr. Bill Leach and myself from California State University, Sacramento. The study's objectives are five-fold: explain the effectiveness of aquaculture partnerships measured in terms of their influence on (i) social capital, (ii) learning and consensus on scientific and policy issues, (iii) formal policy agreements, (iv) policy adoption by higher authorities, and (v) projected socioeconomic and ecological outcomes (University of Colorado Denver: School of Public Affairs, 2009). For the purposes of this study, aquaculture partnerships are the collaborative settings referenced throughout this paper. Specifically, they are groups that include both governmental and non-governmental representatives that collaborate on policy and/or research to further the development and/or regulation of aquaculture in the United States. Individuals within these aquaculture partnerships are the level of measurement for this study.

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[8] National Science Foundation Grant # 0721067

To identify and select marine aquaculture partnerships for the study, we (the aforementioned research team) searched the Internet for viable partnership candidates in the fall of 2009. Additionally, we identified and interviewed 21 individuals knowledgeable of aquaculture science and policy to aid in the search process. We also formed an eight-person advisory committee to aid in developing our partnership list and to develop the interview protocol and survey instrument that we ultimately would administer to individuals from each partnership.

We identified nine marine aquaculture partnerships throughout the United States that we believe to be active (or recently active). We excluded partnerships operating in Hawaii and Alaska for monetary purposes.[9] Table 5 identifies the nine partnerships that we included in our study (see Appendix C for a more detailed description of the partnerships).

Table 5: The Partnerships

Partnership Name	Geographic Location	Surveyed Respondents
Pacific Aquaculture Caucus	West Coast	27
California Aquaculture Development Committee	West Coast	18
Washington State Shellfish Aquaculture Regulatory Committee	West Coast	15
Florida Net Pen Working Group	East Coast	12
Maine Aquaculture Advisory Council	East Coast	6
Maine Fish Health Technical Committee	East Coast	9
Maryland Aquaculture Coordinating Council	East Coast	10
New Jersey Aquaculture Advisory Council	East Coast	15
Rhode Island Aquaculture Working Group	East Coast	17

[9] A tenth partnership, the Gulf Coast Aquaculture Consortium, was identified but omitted due to the British Petroleum oil spill disaster in the Gulf. Data collected from this partnership would have likely been atypical and not comparable to our other data due to the scope of the disaster.

After collecting contact information for partnership participants (from either the partnership coordinator or the partnership website), we interviewed five to seven participants from each. We conducted 60 interviews, the majority of which were in-person, and transcribed the recordings of each for purposes of coding and analysis. Each interview was coded by at least two members of the research team in order to achieve inter-coder reliability. After conducting interviews, we sent our survey to all current or former participants as identified by the main contact person for each partnership. This resulted in 129 survey responses, with an overall response rate of 68 percent. The range of response rates for each partnership ranged from 59 percent to 90 percent. The smallest of the partnerships had five respondents while the largest had 27 respondents.

Dependent Variables

This study employs identical explanatory variables to explore two distinct dependent variables – both of which are different measures of individual learning within the collaborative.

General Learning

To compute my first dependent variable, general learning, I created a scale from four Likert scale survey questions (Chronbachs alpha = 0.864). The questions were on a scale from strongly disagree (-2) to strongly agree (+2) and included: (1) “The partnership has given me a better understanding of other stakeholder’s perspectives”, (2) “The partnership has given me a better understanding of aquaculture science”, (3) “The partnership has given me a better understanding of aquaculture policy, law, or regulations”, and (4) “The partnership has given me a better understanding of aquaculture

economics or business." Collectively, these survey items represent an indication of the level of overall general learning an individual has undergone as a result of participating in the partnership.

Belief Change

To compute my second dependent variable, learning expressed as belief change (hereafter simply 'belief change'), I combined responses from two survey questions to create a dichotomous dependent variable: (1) "At least partially through your participating in this partnership, have you changed your professional opinion on any scientific or technical issues related to marine aquaculture," and (2) "At least partially through your participation in this partnership, have you changed your opinion on any significant policy issues related to marine aquaculture." This value could be either zero (if the respondent did not change their opinion on either prompt) or one (if the respondent changed opinion on either prompt). Theoretically, belief change represents a somewhat higher and perhaps more important threshold of learning than general learning. Belief change, or change of opinion on an issue, is theoretically more likely to translate into real position shifts. Important to note is that this measure of belief change casts a wide net to include learning that occurred solely within the partnership as well as learning that was catalyzed by the partnership in conjunction with other experiences or events. Some respondents may have answered the question with the partnership as a secondary cause of the belief change rather than the primary cause.

Explanatory Variables

The survey contains several basic questions, easily coded into dummy variables, which explain fundamental characteristics of respondents. Dummy variables garnered from these questions include identification of professional affiliation (government versus non-government) and gender. Other basic questions utilized as variables include the age of a participant (a midpoint on a range of age options on the survey) and the number of years that the participant has taken part in the partnership.

I operationalized the concept of mutually hurting stalemate (a measure of stakeholder interdependence) by creating an index variable from two Likert scale questions on our survey: (1) "It is essential to find solutions that are satisfactory to all members of the partnership", and (2) "If the partnership reached an impasse and disbanded, progress on aquaculture issues would be delayed for several years."[10] This variable, like most Likert scale items on the survey, has values from -2 (strongly disagree) to +2 (strongly agree). I supplement the hurting stalemate concept with a best alternative to negotiated agreement (BATNA) variable by looking at individual responses to the following survey question: "If the partnership fails to adopt workable solutions, my concerns could probably be satisfied by appealing directly to the legislature, courts, or individual agencies."

Two questions from the survey instrument were collapsed together to create an index variable representing each partnership's mean receptiveness to local knowledge, as opposed to solely being receptive towards traditional science: (1) "The process of science

[10] Several Likert scale questions from the survey were reversed to create directional consistency for the purposes of creating index and scale variables.

is the only valid and reliable way to understand nature," and (2) "The experience and/or intuition of non-scientists can provide an understanding of nature as valid as that of science." I calculated the mean response to this index for each participant and assigned an average individual response for each partnership. The rationale for the partnership level variable is that if the partnership overall has a low level of receptiveness to local knowledge, such knowledge may never find its way into the discussion.

An additional two questions from the survey relating to trust and honesty were combined to create an individual trust scale variable (Cronbach's Alpha = 0.815). These questions asked participants to indicate what number of the partnership participants were (1) "Honest, forthright, and true to their word," and (2) "Trustworthy." Respondents could choose to indicate none (a value of 0), few, half, most, or all (a value of 5). The resulting variable measures each individual's perception of trust within the partnership.

In order to measure the level of conflict present in each partnership, I created another scale variable that collapsed several core belief survey questions (Cronbach's Alpha = 0.693) and calculated the variance of responses within each partnership – a greater variance equates to a higher mismatch of core beliefs and therefore higher expected conflict levels within the partnership. Examples of these questions include: "Plants and animals exist primarily for use by people," "The balance of nature is very delicate and easily upset by humans," "We are approaching the limit of the number of people the Earth can support," etc.

Also relating to conflict, respondents were asked to indicate their agreement with the statement, "There is at least one participant who mediates conflict and is respected by

the other partnership members." This question was combined with two other questions to create a scale variable (Cronbach's Alpha = 0.683) measuring an individual's perception of effective facilitation within the partnerships. The two other questions were: (1) "The partnership process treats all parties fairly and consistently," and (2) "The partnership discussions are civil, and marked by mutual recognition and respect." My expectation is that an effective and skilled facilitator (as defined in the literature) would be able to create this sort of atmosphere.

Two variables measuring the diversity of stakeholders represented in each partnership include an individual-level perception variable and a partnership-level dummy variable. The individual perception variable comes from responses to the survey question, "Some critical interests are not effectively represented in the partnership." The partnership dummy variable simply indicates whether there were aquaculture critics present in the partnership (defined as environmental stakeholders). We identified aquaculture critics through stakeholder interviews and survey responses.

Another partnership-level variable is the level of accepted/good science in a partnership, operationalized by calculating the mean response for each partnership for the following survey question: "Indicate the seriousness of the perceived problem that there is a lack of good science to make sound decisions regarding the siting and operation of aquaculture facilities (from not a problem at all to a very serious problem)."

The final partnership-level variable is the level of resources available to an individual stakeholder's organization (external to the partnership). Regarding organizational resources, we asked survey respondents to rate the capacity of their

organization to mobilize several resources: financial, scientific and technical, supportive constituents, supportive elected officials, supportive government officials, and supportive non-governmental leaders in the aquaculture industry. I took the mean of these responses (Cronbach's Alpha = 0.793) for each partnership to look at the average level of individual resources per group.

Table 6: Summary of Variables

Dependent Variables	**Description**[11]
General Learning	Scale dependent variable, ordinal; mean response to four survey questions relating to learning with values ranging from strongly disagree (-2) to strongly agree (+2). *(Chronbach's Alpha = 0.864)*
Belief Change	Dummy dependent variable; 1= the respondent changed his or her opinion on either a policy or scientific issue relating to marine aquaculture through participation in the partnership.
Individual-level Demographics	**Description**[12]
Years Participated	Continuous variable indicating the number of years the respondent has participated in the partnership.
Age	Value indicates the midpoint of several age brackets (20-29, 30-39, 40-49, etc.)
Government	Dummy variable; 1= respondent represented a government organization, 0= the respondent did not represent a government organization.
Female	Dummy variable; 1= respondent is a female, 0= the respondent is a male.

[11] The associated survey questions used to create scale and index variables are not duplicated in this table. Please refer to the explanatory variables section in this chapter for the component questions of scales and indexes.
[12] Ibid

Individual-level Perceptions	Description[13]
Stalemate Perception	Index variable, ordinal; mean value per participant of two survey questions relating to mutual stalemate with values ranging from strongly disagree (-2) to strongly agree (+2).
Best Alternative to a Negotiated Agreement	Ordinal variable, individual response to survey question asking if alternate venues can satisfy the participant's concerns.
Trust Perception	Scale variable, ordinal; mean value per participant of two survey questions relating to trust with values ranging from none (0) to all (5). *(Cronbach's Alpha = 0.815)*
Facilitation Perception	Index variable, ordinal; mean response to three survey questions relating to the partnership's facilitation with values ranging from strongly disagree (-2) to strongly agree (+2). *(Chronbach's Alpha = 0.683)*
Critical Parties Absent Perception	Ordinal variable, individual responses to a survey question asking if critical interests are missing from partnership proceedings.
Partnership-level Factors	**Description[14]**
External Resources	Scale variable, ordinal; mean value of responses per partnership regarding stakeholders' organizational resources and their capacity to mobilize them. Values from no capacity (0) to complete capacity (5). *(Cronbach's Alpha = 0.793)*
Perception of Problematic Science	Ordinal variable, mean value of responses per partnership regarding the quality level of aquaculture science. Values from not a problem (1) to very serious problem (4).
Includes Aqua Critics	Dummy variable; 1= environmental stakeholders were present in the partnership, 0 = environmental stakeholder were not present in the partnership.
Local Knowledge Receptiveness	Index variable, ordinal; mean value per partnership for the variable above. Values ranging from strongly disagree (-2) to strongly agree (+2).
Level of Conflict	Variable represents the variance in each partnership as measured by responses to 4 core belief questions.

[13] Ibid
[14] Ibid

Regression Models

After cleaning and preparing the data to create my dependent and independent variables, I am left with a model that attempts to explain the factors and conditions that lead to learning in a collaborative setting (operationalized as two dependent variables; general learning and belief change). This model is composed of three broad causal factors including demographics, individual-level perceptions, and partnership-level factors and conditions. Represented as an equation, the model is as follows:

> **General Learning** (dependent variable 1) or **Belief Change** (dependent variable 2) = *f* (individual-level demographics, individual-level perceptions, and partnership-level factors and conditions).
>
> **Individual-level demographics** = (government/non-government representative, number of years participated, age midpoint, and female).
>
> **Individual-level perceptions** = (mutually hurting stalemate perception, effective facilitation scale, individual trust perception, perception of critical parties missing, and BATNA perception).
>
> **Partnership-level factors and conditions** = (total resources mean, level of science mean, inclusion of aquaculture critics, local knowledge receptiveness mean, and level of conflict).

This study employs two regression models to analyze the two dependent variables that measure learning. The first model, measuring overall learning, employs ordinary least-squares regression analysis with Hubert White clustered robust standard errors. Because my second dependent variable, learning as belief change, is a dichotomous

variable, my second model uses binomial logit analysis. This form of regression ensures that predicted values will be between 0 and 1. The following chapter presents results from the two regression models and enumerates the many challenges faced in analyzing my dataset.

Chapter 5

RESULTS

This chapter presents (a) demographic statistics regarding the survey respondents, (b) descriptive information about the two dependent variables – general learning and belief change, and (c) the results of ordinary least squares (OLS) regression and logistic regression models that test hypotheses about how learning and belief change occur in collaborative policy settings. I withhold major analysis (including implications and recommendations) until the discussion chapter.

Respondent Demographics

Most of the respondents in this study were male and between the ages of 50 to 59 years of age; our female respondents tended to be younger (Figures 1 and 2).

Figure 1: Respondent Age

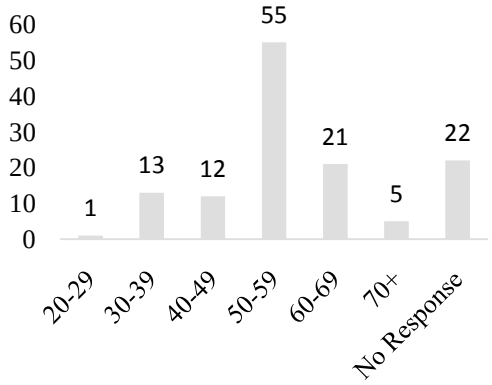
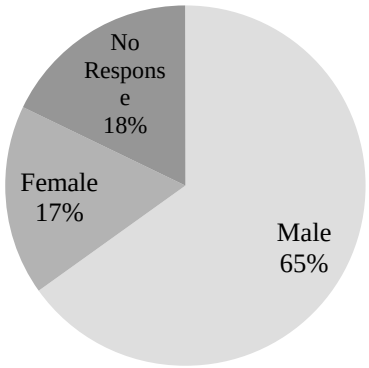
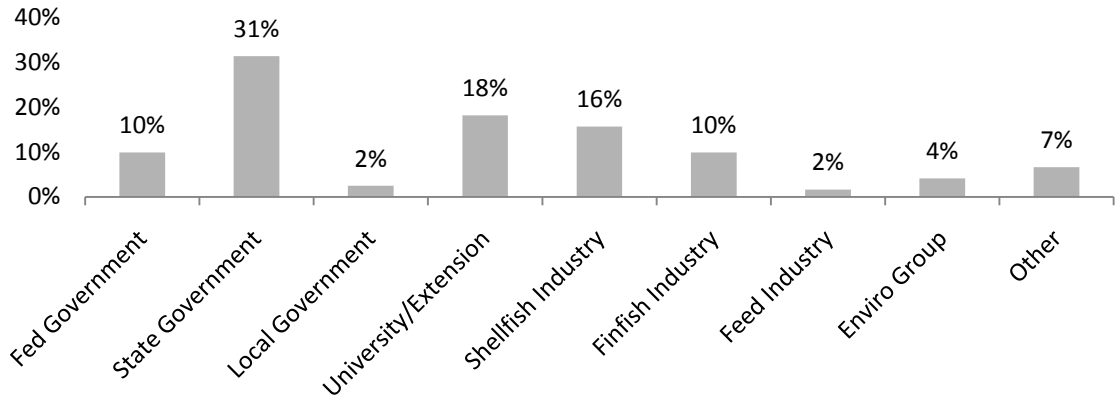


Figure 2: Respondent Sex



Close to 42 percent of respondents were affiliated with some level of government, with most government respondents coming from state government (Figure 3).

Figure 3: Respondent Affiliation



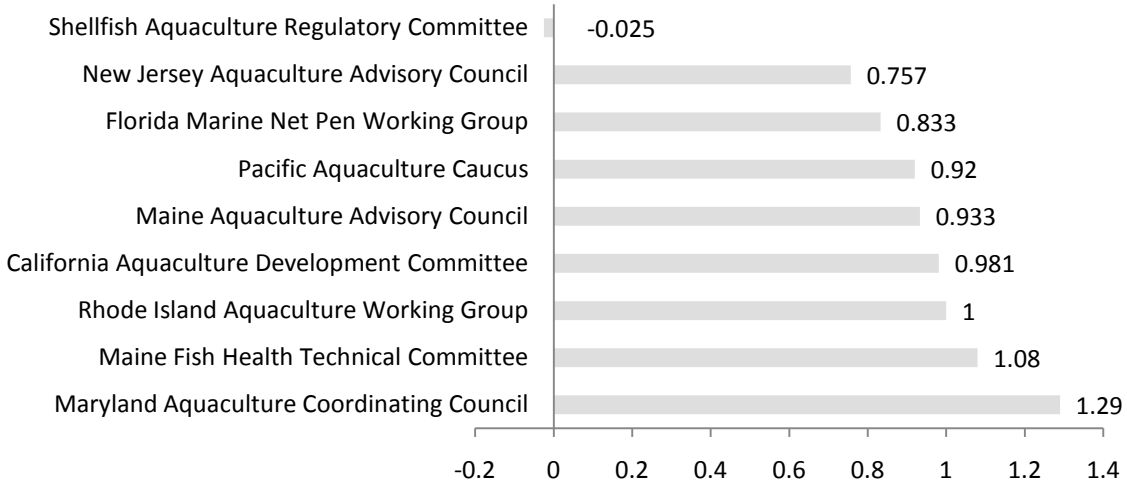
Selected Explanatory Variables

In this section, I present three graphs that depict how key explanatory factors vary across the nine partnerships. The rankings of the partnerships are similar for all three factors, and also resemble the ranking of the partnerships in terms of the dependent variables – general learning and belief change. The juxtaposition of these graphs suggests the possibility of causal relationships among the variables, which are reinforced in the subsequent multivariate analysis that uses individual stakeholders as the unit of analysis.

Facilitation

Figure 4 displays the average perception of effective facilitation for each partnership. Interviews from SARC stakeholders reinforce the particularly hostile and contentious atmosphere reflected in this chart. One-way ANOVA tests reveal that there are significant differences between the partnership means ($p<.001$).

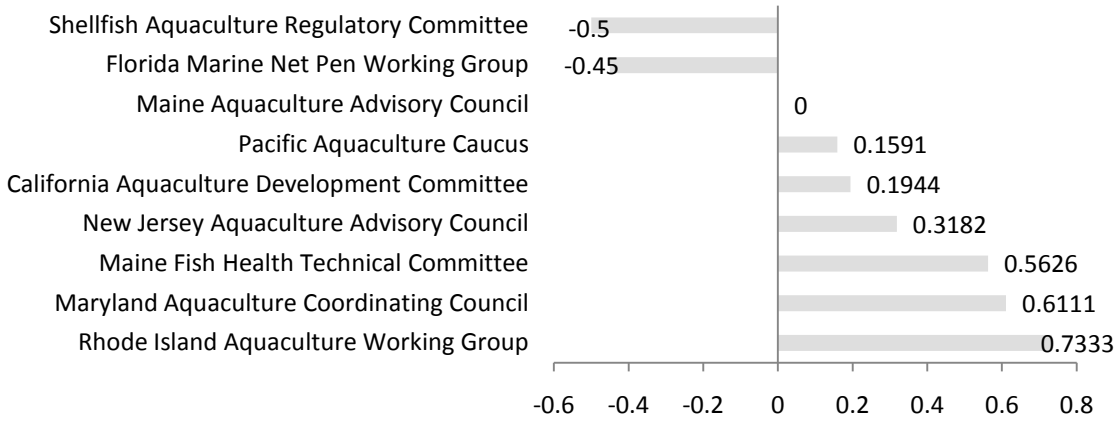
Figure 4: Mean Effective Facilitation Perception by Partnership



Hurting Stalemate

As figure 5 shows, SARC and the Florida Net Pen Working Group again find themselves at the lower end of the distribution with much a much lower mean perception of hurting stalemate among participants. Three other groups form a bracket at the other end of the range, at least 0.25 points above the next set of three groups. Differences between groups were statistically significant ($p<.05$).

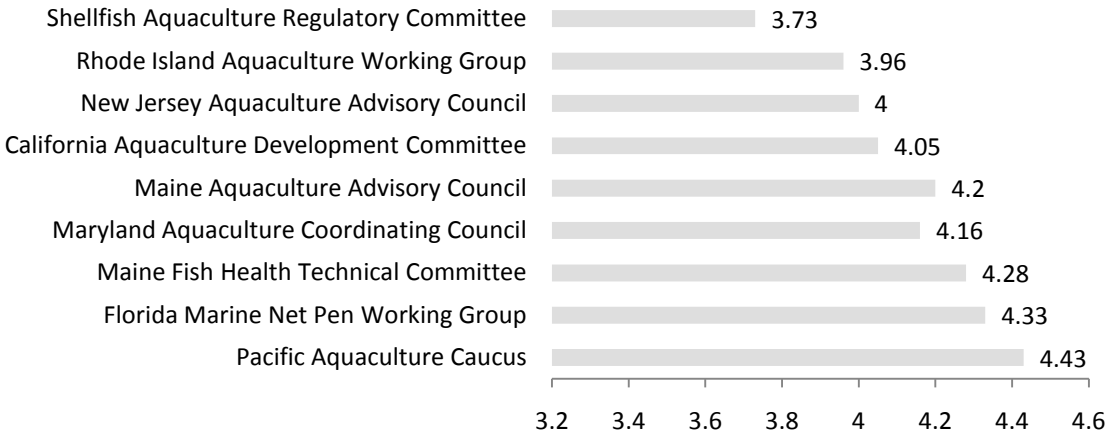
Figure 5: Mean Hurting Stalemate Perception by Partnership



Interpersonal Trust

Figure 6 shows that there were relatively high levels of trust across each aquaculture partnership, but there were still significant differences between the partnerships (ANOVA, $p<.05$), with SARC again at the low end of the observed range.

Figure 6: Mean Trust Perception by Partnership



Dependent Variables

General Learning

Figure 7 is a histogram that summarizes the distribution of general learning scores across all respondents. On a scale where zero means "neither agree nor disagree" and +2 means "strongly agree," the mean score of +0.81 suggests that, on average, stakeholders "agree" that the partnership has given them a better understanding of (a) other stakeholder's perspectives, (b) aquaculture science, (c) aquaculture policy, law, or regulations, and (d) aquaculture economics or business.

Figure 7: General Learning Distribution

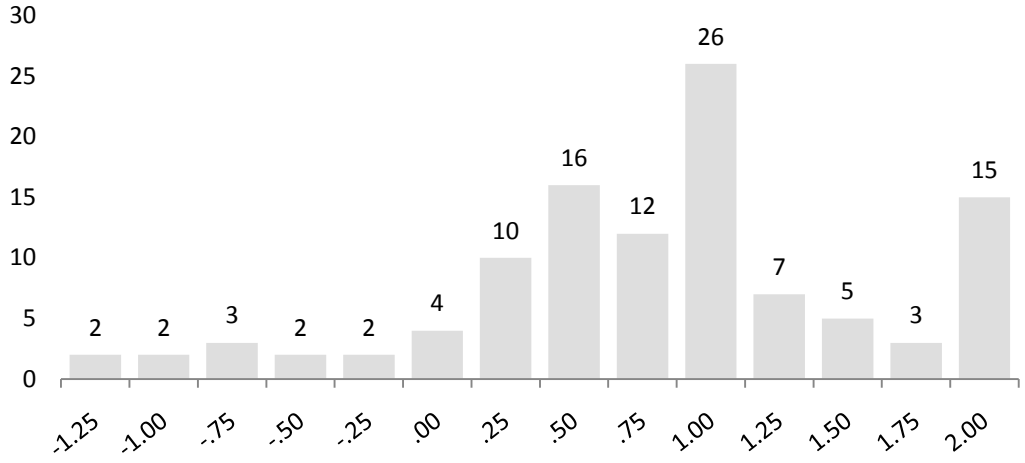


Figure 8 compares the degree of general learning that occurred among various categories of respondents. For example, government stakeholders and female stakeholders had higher mean responses on the general learning scale than males and non-governmental stakeholders respectively.[15] Those respondents that were in partnerships that included aquaculture critics (environmental stakeholders) had a mean response of 0.84 on the general learning scale versus 0.76 for respondents finding themselves in partnerships without aquaculture critics. However, none of the differences shown in Figure 8 are statistically significant. (one-way ANOVA).

[15] The scale for the general learning scale goes from -2 (corresponding to strongly disagree) to +2 (corresponding to strongly agree). Therefore a mean of 0.96 (as is the case with females) can be interpreted as a mean response very close to "agree".

Figure 8: General Learning Comparison by Characteristic

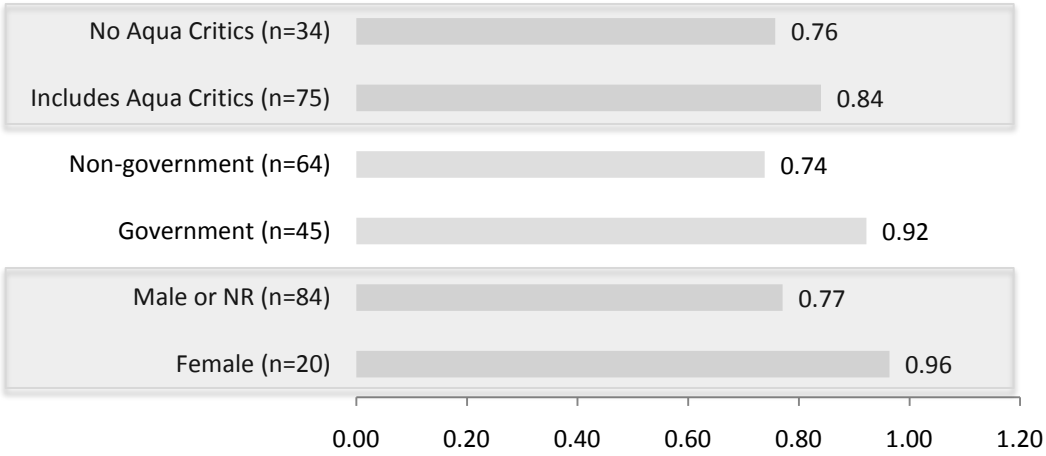
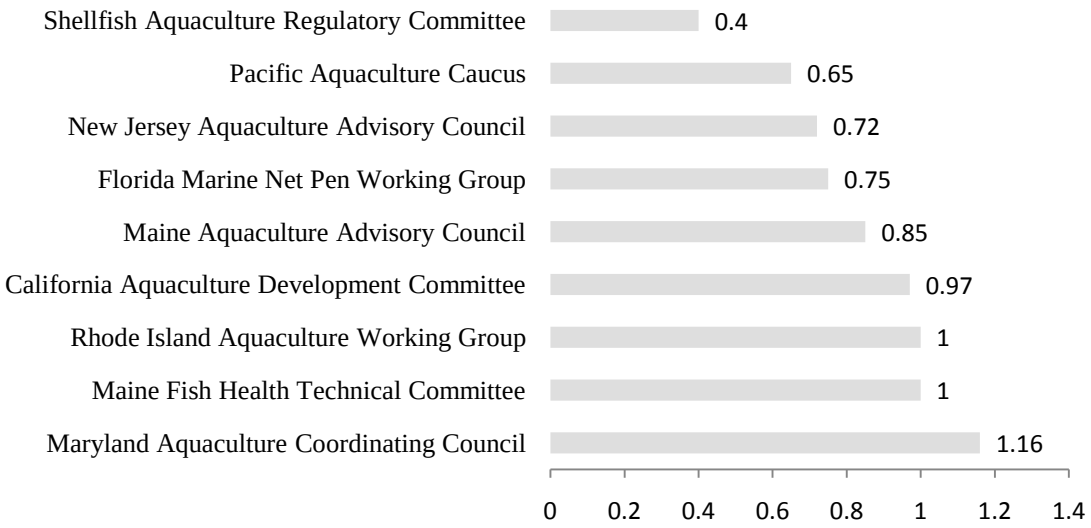


Figure 9 simply displays the mean amount of general learning for each partnership. Respondents from the Maryland Aquaculture Coordinating Council had the highest mean response along the general learning scale while the Washington-based Shellfish Aquaculture Regulatory Committee had the lowest mean response. One-way ANOVA indicates that the latter partnership is significantly different than at least one of the other partnerships on this measure of learning. The three groups with the most general learning are also the same three groups with the highest mean perceptions of a hurting stalemate.

Figure 9: General Learning by Partnership



Belief Change

Figure 10 displays the overall distribution of responses to the belief change questions. Namely 61 of 110 (55%) respondents reported that *due at least in part to their participation in the partnership,* they had changed their professional opinion on at least one science issue or policy issue related to marine aquaculture. The remaining 45% of respondents reported no such belief change.

Figure 10: Belief Change Distribution

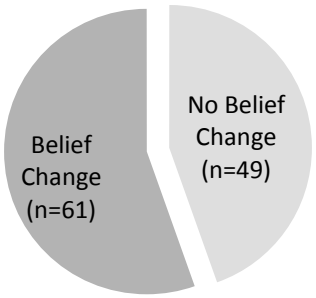


Figure 11 compares the degree of belief change that occurred among various respondent groups. The patterns are very similar to those for general learning. Among respondents involved in partnerships that included aquaculture critics, 57 percent reported belief change compared to 53 percent of respondents from partnerships that did not include critics. Similarly, higher percentages of government stakeholders and female stakeholders reported belief change than did their counterparts.[16] Also similarly to general learning, one-way ANOVA failed to reveal significant differences between these groups.

Figure 11: Percent of Respondents Reporting Belief Change by Characteristic

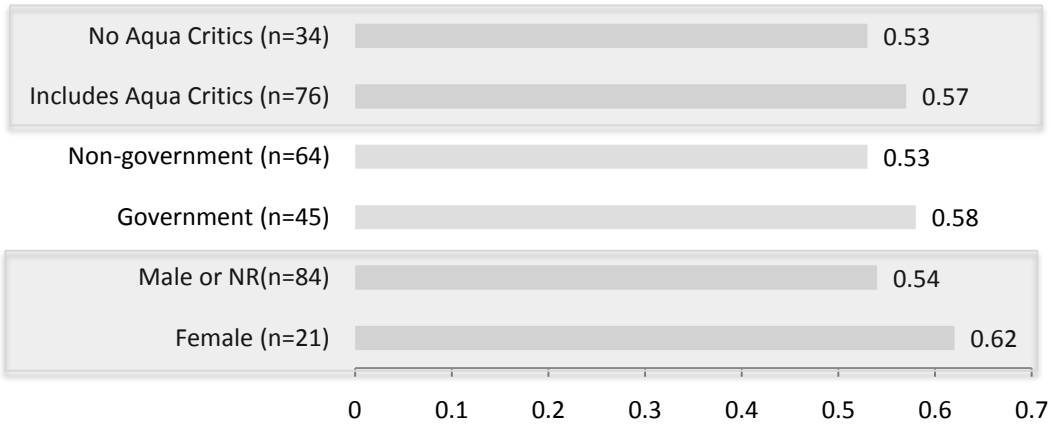
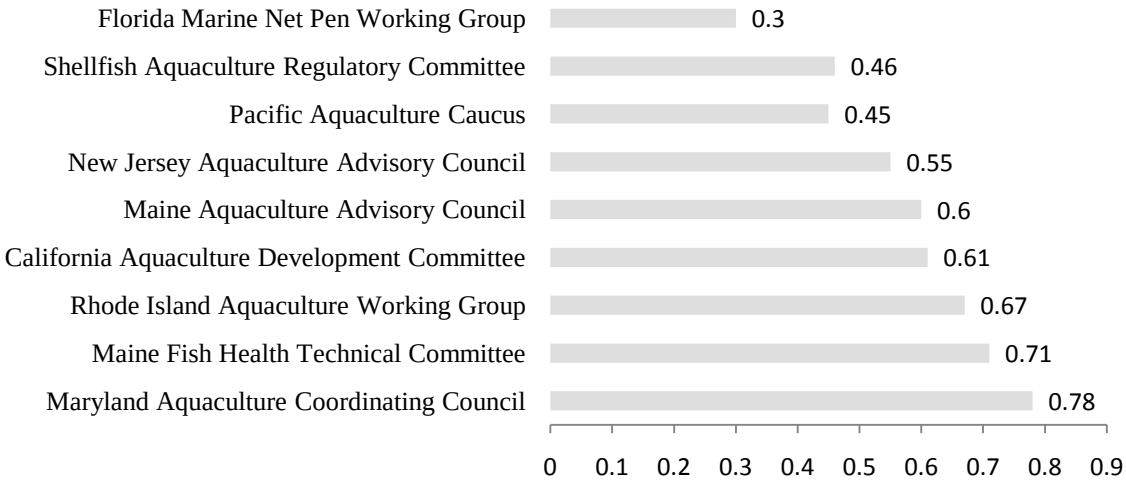


Figure 12 compares rates of belief change by partnership. As with general learning, Maryland comes out on top, with the highest percentage of respondents reporting belief change. Interestingly, The Florida Marine Net Pen Working Group drops three places from their position in the general learning ranking to displace the Shellfish

[16] The belief change variable is a dummy variable with responses either being 0 (no belief change) to 1 (belief change).

Aquaculture Regulatory Committee as the partnership with the lowest reported level of belief change. The remainder of the ordering is identical to the general learning ordering. These results indicate that, for the most part, the two learning variables are fairly closely correlated with one another across partnerships.

Figure 12: Percent of Respondents Reporting Belief Change by Partnership



Regression Analysis of General Learning and Belief Change

As outlined in the preceding chapter, my initial intent was to look at both individual level variables along with partnership level variables. The framework for such models was adapted from a similar study of watershed partnerships (Leach and Sabatier 2005). Due in part to the low number of marine aquaculture partnerships in this study (n=9), I ran into severe issues which ultimately resulted in flawed OLS and logistic regression models. Table 7 presents the initial OLS linear regression results with general learning as the dependent variable. Note that it was important to use Huber White robust standard errors clustered by partnership. This was necessary because each survey

observation may not be independent of the other, violating a key regression assumption. Observations contained within the same partnership may have an effect on each other and negate observation independence (Greene, 1998).

Table 7: Unrestricted OLS Linear Regression Model of General Learning

Explanatory Variables	**Coefficient B**	**VIF**
Trust perception	0.523**	1.433
	(0.147)	
Facilitation perception	0.374*	1.872
	(0.158)	
Belief conflict[a]	-1.005*	3.261
	(0.360)	
External resources mean[a]	-0.801	6.366
	(0.589)	
Includes aqua critics[a]	0.301	2.569
	(0.152)	
Years participated	-0.001	1.764
	(0.016)	
Age	0.002	1.776
	(0.013)	
Government	0.466**	1.500
	(0.119)	
Local knowledge[a]	0.369	2.951
	(0.243)	
Problematic science[a]	0.077	3.057
	(0.151)	
Critical parties absent perception	0.071	1.348
	(0.069)	
BATNA	-0.042	1.274
	(0.040)	
New stalemate	0.291*	1.512
	(0.102)	
Female	0.325	1.405
	(0.166)	
Constant	0.663	
	1.782	
Adj. R^2	0.501	N = 74

Note: OLS regression with unstandardized coefficients, and in parenthesis, Huber White robust standard errors with clustering on a variable identifying each respondent's partnership. *p<0.05, **p<0.01.

[a] Variables that are constant for all respondents within a partnership, but vary across partnerships.

The uncorrected results present collinearity issues because relatively high variance inflation factors (VIF) are present in five of the variables (*problematic science part, local knowledge part, includes aqua critics, external resources mean, and belief conflict*). The VIF statistic measures the degree to which the explanatory variable is explained by all other explanatory variables. Generally, VIF statistics should not be higher than three to five for any given variable (Studenmund, 2006). Spearman correlation coefficients[17] between variables also display numerous red flags (see Appendix A for correlation table). Variables that are correlated with each other by 0.8 or more may be measuring the same concept and can thus interfere with each other (Studenmund, 2006). Specific variables displaying high correlation coefficients include *problematic science part, local knowledge part, includes aqua critics, external resources mean, and belief conflict*. These Collinearity issues can mask the significance of important variables and disrupt the clarity of the model.

The unfortunate pattern amongst these problematic variables is that they are almost entirely partnership level variables. The low number of overall partnerships in this dataset is heavily contributing to a flawed model. The same issue has also contributed to a flawed logistic regression model. Table 8 displays the initial results of my logistic regression with belief change as the dependent variable.

[17] Spearman correlation coefficients indicate the degree that two variables move together. The spearman statistic is the preferred correlation statistic as the dependent variable is non-parametric.

Table 8: Unrestricted Logistic Regression Model of Belief Change

Explanatory Variables	Coefficient B	Odds Ratio
Trust perception	0.781	2.183
	(0.993)	
Facilitation perception	1.378	3.968
	(0.828)	
Belief conflict[a]	-7.817*	0.000
	(3.715)	
External resources mean[a]	-9.237*	0.000
	(4.355)	
Includes aqua critics[a]	2.879	17.794
	(1.495)	
Years participated	0.026	1.026
	(0.103)	
Age	0.019	1.019
	(0.044)	
Government	1.603	4.967
	(0.985)	
Local knowledge[a]	2.396	10.978
	(1.802)	
Problematic science[a]	2.743	15.532
	(2.034)	
Critical parties absent perception	0.373	1.452
	(0.415)	
BATNA	-0.072	0.931
	(0.533)	
New stalemate	2.211*	9.126
	(0.741)	
Female	2.685	14.663
	(1.377)	
Constant	15.590	5894590.266
	(10.672)	
Model Correctly Predicts	85.1%	N = 74

Note: Logistic regression with unstandardized coefficients, and in parenthesis, standard errors. *p<0.05, **p<0.01.

[a] Variables that are constant for all respondents within a partnership, but vary across partnerships.

The logistic regression results in Table 8 display some alarming issues concerning the odds ratios for two partnership level variables, belief conflict and external resources mean. The extremely low odds ratios for each hints at a flaw likely linked to the low

number of overall partnerships in this study. Additionally, the very nature of the partnership level variables on a scale with little variance means that a change of one unit will have massive effects on the odds ratio statistic.

Revised Regression Models

Given the unfortunate issues prevalent in the initial results I had to fundamentally alter both models and remove all but one of the partnership level variables (*aquaculture critics present).* I kept the aquaculture critics variable, as it is a dummy variable and will not generate collinearity to the same degree as the scale partnership level variables. I replaced the partnership level variables with individual level variables as follows: To replace the local knowledge partnership level variable I created a new individual level variable that measures the respondent's willingness to incorporate local knowledge. Similar to the prior partnership-level local knowledge variable, this new variable is comprised of two survey questions: (1) "The process of science is the only valid and reliable way to understand nature" and (2) "The experience and/or intuition of non-scientists can provide an understanding of nature as valid as that of science." In deleting the belief conflict variable, I created an individual level variable measuring the individual's level of anthropocentrism. Although this variable measures a somewhat different concept, it still illuminates the degree to which an individual's beliefs play a role in the learning process. The anthropocentrism scale variable (Chronbach's Alpha 0.71) is comprised of several survey question responses: "Plants and animals exist primarily for use by people," "The balance of nature is very delicate and easily upset by human activities," "The so-called "ecological crisis" facing humankind has been greatly

exaggerated," "We are approaching the limit of the number of people the Earth can support.". Also replaced was the level of accepted science partnership level variable; this was replaced by a variable that measures the individual's perception of aquaculture science levels.

Another variable that had to be removed from the models was *years participated* – unfortunately this variable had far too many missing responses (resulting in regression models operating with only about 60 percent of survey responses) and was thus far too expensive to keep in the models. Additionally, due to the tendency of female respondents to be relatively young and male respondents relatively old, I created a dummy variable indicating whether or not a respondent was a female younger than 50 years old. Taking this step resulted in a gain of one degree of freedom and helped to improve both regression models.

Table 9: Revised OLS Linear Regression Results of General Learning

Explanatory Variables	Coefficient B	VIF
Trust perception	0.285**	1.629
	(0.081)	
Facilitation perception	0.368**	1.617
	(0.095)	
Includes aqua critics[a]	0.159*	1.198
	(0.056)	
Government	0.235*	1.232
	(0.074)	
Stalemate perception	0.315**	1.288
	(0.064)	
Female under 50	0.419*	1.039
	(0.148)	
External resources	-0.088*	1.200
	(0.037)	
Local knowledge receptiveness	-0.032	1.087
	(0.059)	
Problematic science perception	0.148*	1.085
	(0.054)	
Anthropocentrism	-0.087	1.173
	(0.051)	
Constant	-1.177	
	(0.403)	
Adjust R2	0.561	N = 105

Note: OLS regression with unstandardized coefficients, and in parenthesis, Huber White robust standard errors with clustering on a variable identifying each respondent's partnership. *p<0.05, **p<0.01.
[a] Variables that are constant for all respondents within a partnership, but vary across partnerships.

Table 9 above presents a revised and improved OLS linear regression model with a higher adjusted R-squared,[18] lower VIF statistics, and over thirty additional observations. Spearman correlation coefficients are also much lower across the board and present no red flags (see Appendix B). Most noteworthy, this revised model gives a

[18] The R^2 statistic is a measure of goodness of fit. The higher the R2, the more the dependent variable is explained by the explanatory variables in the model. In this instance 61.6% of the variation in the dependent variable is explained by the twelve explanatory variables in the model.

clearer picture of important variables and has resulted in more significant variables. The initial OLS model resulted in 5 significant variables, while the revised model has resulted in 8 significant variables.

Significant variables include *trust perception, facilitation perception, includes aqua critics, government, stalemate perception, problematic science perception, female under 50,* and *problematic science perception*. The interpretation of the significant results is as follows: a one unit increase in an individual's perception of honest and trustworthy co-stakeholders (meaning one unit along the Likert survey scale) leads to a 0.29 increase along the general learning scale. A one unit increase in an individual's perception of effective facilitation leads to a 0.37 increase along the general learning scale. A partnership that includes environmental stakeholders leads to a 0.16 increase along the general learning scale. Unit increases in the perception of a hurting stalemate lead to a 0.32 unit increase along the general learning scale. Each unit shift in perception of low levels of quality aquaculture science leads to a 0.15 increase along the general learning scale. Unit increases in a stakeholder's perception of external resources lead to decreases of 0.09. Finally, from a demographic perspective, if the stakeholder comes from the government sector a 0.24 increase along the scale can be predicted, and if the stakeholder is a female under 50 years old, a 0.42 increase can be predicted.

Table 10: Revised Logistic Regression Model of Belief Change

Explanatory Variables	Coefficient B	Odds Ratio
Trust perception	0.221	1.248
	(0.681)	
Facilitation perception	1.194*	3.300
	(0.524)	
Includes aqua critics[a]	0.103	1.109
	(0.547)	
Government	0.550	1.734
	(0.535)	
Stalemate perception	1.003**	2.723
	(0.335)	
Female under 50	1.160	3.190
	(0.908)	
External resources	0.324	1.382
	(0.372)	
Local knowledge receptiveness	-0.185	0.830
	(0.274)	
Problematic science perception	0.430*	1.537
	(0.210)	
Anthropocentrism	-0.073	0.930
	(0.314)	
Constant	-4.336	0.013
	(3.300)	
Model Correctly Predicts	69.5%	N = 105

Note: Logistic regression with unstandardized coefficients, and in parenthesis, standard errors. *p<0.05, **p<0.01.
[a] Variables that are constant for all respondents within a partnership, but vary across partnerships.

Although the prediction power of the revised logistic regression model is somewhat decreased (Table 10), the overall model has been fundamentally improved by addressing the collinearity issues present in the initial model and adding over thirty additional observations (observations that were previously dropped due to the *years participated* variable missing so many responses). Significant variables in this model include *facilitation perception, stalemate perception* and *problematic science perception*.

The interpretation of the significant variables is as follows: stakeholders perceiving effective facilitation were 3.3 times more likely to have experienced belief change for a one unit increase along the facilitation perception scale; stakeholders perceiving a hurting stalemate were 2.7 times more likely to have experienced belief change for a one unit increase along the stalemate scale; and stakeholders perceiving science levels to be a problem were 1.5 times more likely to experience belief change for a one unit increase along the science level scale.

The final chapter of this thesis summarizes the preceding chapters and presents major findings and lessons learned through my regression results. This includes a discussion of the distinction between general learning and belief change learning. I also offer recommendations for potential conveners and practitioners of collaborative processes.

Chapter 6

DISCUSSION

This chapter is divided in three components that circle back to the research literature: I discuss (1) the factors in my analysis that are present in contested or competing theories from the collaborative literature; (2) the factors in my analysis that currently represent gaps in the literature; and (3) other factors in my analysis including those that are part of uncontested theories throughout existing empirical research. I conclude with recommendations for practitioners of collaborative policymaking.

Contested or Competing Factors Addressed

Two factors included in my analysis that were part of competing or contested empirical theories were the level of existing science and facilitation issues. A third competing or contested factor, partnership duration, was in my initial models but had to be thrown out for technical reasons explained in the previous chapter. Each of these factors were present in at least two empirical studies that had somewhat different interpretations of meaning, importance, and consequences.

Level of Accepted Science

As stated previously, I operationalized the concept of accepted science through a survey question pertaining to the lack of available science to make sound decisions regarding aquaculture siting and operations. The variable was a significant and positive predictor of general learning and belief change. The positive correlations indicate that an individual who perceives aquaculture science to be problematic is more likely to report general learning and belief change. It's possible that problematic science allows for more

learning to occur as the science becomes cleared up through the collaborative process. A larger sample of marine aquaculture partnerships may have allowed for the inclusion of a variable that would have more accurately captured the level of science concept. Such a variable could potentially capture the precise type of marine aquaculture (geoduck, manila clam, salmon, etc.) and thus control for the differences between groups addressing those types of aquaculture. The level of accepted science surrounding geoduck aquaculture is very low (as evidenced by discussions with SARC stakeholders) while the level of accepted science around salmon (a much larger and more mature industry) is probably much higher.

Facilitation

One of the two key findings of this analysis, the variable relating to an individual's perception of effective facilitation, was significant and positive in both the general learning model, and the belief change model. The coefficients indicate that effective facilitation is a relatively strong predictor of general learning and belief change compared to other variables in the models. The interpretation is that individuals perceiving the process to have been effectively facilitated experienced additional general learning and were more likely to experience belief change. This finding supports those theories such as the ACF, ADR, and CL that give a lot of weight to issues of facilitation. For future research into this important issue, a larger sample size of marine aquaculture partnerships may allow for a more dynamic operationalization of the facilitation concept. One such method would be to calculate an unbiased mean value for the entire group's perception of the level of effective facilitation as opposed to merely just the individual.

Duration

The length of time an individual has spent in a marine aquaculture partnership was unfortunately not a variable I was able to accurately assess in this analysis. The number of respondents skipping this question hindered my ability to include it in the final models. A future study would be well served by evaluating meeting minutes to determine the number of meetings that the average respondent attended. Alternatively, a better designed survey question could capture individual level data. Such a question could measure buckets of time versus asking respondents to report a precise number of years (thus increasing response rates).

Research Gaps Addressed

My models included one variable, hurting stalemate, which was lacking in empirical research throughout the collaborative literature.

Hurting Stalemate

The second key finding of this analysis, is that the perception of a hurting stalemate was significantly and positively related to both learning and belief change. Along with perceptions of effective facilitation, this is the only other variable that is significant and strong across both measures of learning. This finding supports the idea that stakeholder interdependence is a necessary pre-condition for successful collaboratives. The perception of a hurting stalemate has one of the stronger effects on general learning (+0.37 movement along the scale for a one unit increase in perception). Perception of hurting stalemate also has a strong effect on belief change – a one unit increase translates to the individual being almost three times more likely to have changed

beliefs on a scientific or policy issue. The significance of this variable in both models reinforces the fundamental importance of collaboration being used when other methods have been explored and exhausted.

Resources

The level of resources available to an individual's organization (as measured by access to financial and scientific resources, supportive constituents, elected officials, government officials, and non-governmental leaders) has a significant and negative coefficient in the general learning model, but is insignificant in the belief change model. The variable's significance in the general learning model can be interpreted in the same vein as the importance of a hurting stalemate. Namely, stakeholders who believe they have access to sources of power outside the partnership may feel less pressure to reconsider their existing views and assumptions in an effort to find common ground solutions. Interdependence among stakeholders motivates learning because the lack of viable alternatives outside the partnership makes learning within the partnership more vital.

Other Variables Addressed

In addition to addressing some of the contested or competing theories and empirical gaps from the research literature, I also assessed variables from the research literature that are components of uncontested theories.

Participant Selection

The solitary partnership level variable utilized in my analysis, a dummy variable for whether or not the partnership included aquaculture critics, was significant and

positively correlated with general learning. However, this variable was not significant in the belief change model. This finding potentially reveals that marine aquaculture partnerships with a robust membership (including diverse stakeholders) can produce more general learning than those partnerships which may be more industry heavy (closer to being associations). Those partnerships that included aquaculture critics produced 0.16 more general learning than those partnerships without such critics, a small but statistically significant gain. Again, the true importance of this concept may be getting blurred by data limitations. A larger data set with more partnerships would provide the ability to actually measure true diversity within a group. Groups with a full range of stakeholders could be more fully differentiated from groups with very limited stakeholder representation.

Local Knowledge

An individual's receptiveness to local knowledge was a non-significant variable in both learning models. This may have been due to being forced to rely on an individual-level variable to measure the concept; a partnership level variable or set of variables indicating the group's openness and use of local knowledge may have produced more meaningful results. As stated earlier, one reason for this line of thinking is that if the partnership as a whole was not receptive to local knowledge, then such knowledge may have never even been introduced. The non-introduction of local knowledge essentially nullifies any variable measuring individual receptiveness to local knowledge.

Interpersonal Trust

A prominent variable in the literature, my measure of interpersonal trust was a significant variable that was positively associated with general learning, but not belief change. The individual's perception that other stakeholders in the partnership are honest and trustworthy had a relatively large magnitude of estimated effect on general learning. This finding further supports the importance of trust in collaborative settings and suggests that group trust needs to be nurtured and developed as much as possible.

Respondent Characteristics

Respondent characteristics controlled for in the dual learning models included affiliation (government versus non-government), sex, age, and general opinions about nature and science (measured on an anthropocentrism scale). Of these characteristics, none were significant across both learning models. Being affiliated with a government entity has a significant and moderate effect on general learning (coefficient, B = +0.24). Somewhat surprisingly, two of the partnerships (SARC and Florida Net Pen Working Group) with lower levels of either kind of learning had higher levels of government stakeholders than did other partnerships with higher learning scores.

Another significant characteristic variable in the general learning model is females under 50. Females under 50 were more likely to experience general learning as evident by the relatively strong and positive direction of the female under 50 dummy variable (coefficient, B = +0.48). Because there are few females over 50 in this dataset, it is not possible to disentangle the separate effects of age and sex. Furthermore, because the learning data are self-reported, it is unclear whether females under 50 are truly more

likely to experience general learning or whether they are simply more likely to report it in a survey.

Conclusion and Implications

This analysis has illustrated that several factors and conditions affect the learning and belief change that occurs within a collaborative setting. Most importantly for practitioners of collaborative governance, this analysis has shown that there are certain factors with significant influence on learning that can be influenced by the convening agency/entity (perceptions of trust, perceptions of effective facilitation, and the inclusion of aquaculture critics).

Furthermore, the factors and conditions that affect general learning are not necessarily the same factors and conditions that affect belief change. Standing as the key finding of this analysis, only two factors have significant and strong relationships across both measures of learning (perceptions of facilitation and perceptions of hurting stalemate). The significance of more variables in the general learning model over the belief change model is consistent with the notion that it is easier to build good models for continuous dependent variables than dependent variables with little variation (binary in this case).

Although the scope of this study was rather narrow in dealing only with marine aquaculture partnerships and therefore not absolutely generalizable, the findings do offer useful guidelines for practitioners of collaborative policymaking in the broader environmental and natural resource arena. Specifically the convening entity/agency should be sure to attend to the following items in order to develop and nurture a

productive learning environment: (1) do everything possible to foster trust and honesty within the group; (2) ensure that, at a minimum, the facilitation of meetings ensures that all parties are treated fairly and consistently, and that discussions are civil with mutual respect and recognition; and (3) ensure that all stakeholders (including relevant critics) are present for discussions.

APPENDIX A

Table A1: Descriptive Statistics

Variable	N	Min	Max	Mean	Std. Dev.
Dependant Variables					
General Learning	109	-1.25	2	0.81	.77
Belief Change	110	0	1	0.55	.49
Explanatory Variables – Revised Model					
Trust perception	107	2.5	5	4.13	.50
Facilitation perception	111	-1.67	2	0.85	0.69
Includes aqua critics[a]	129	0	1	0.67	0.47
Government	126	0	1	0.43	0.49
Stalemate perception	111	-2	2	0.18	0.88
Female under 50	129	0	1	0.1	0.3
External resources	108	1	5	2.85	0.74
Local knowledge receptiveness	109	-2	2	-0.15	0.93
Problematic science perception	117	1	5	2.62	1.29
Anthropocentrism	110	-2	1.75	-0.51	0.82
Explanatory Variables – Removed from Revised Model					
Belief Conflict[a]	129	0.45	1.17	0.76	0.2
External resources[a]	129	2.59	3.29	2.86	0.25
Years participated	82	0.37	15.66	6.28	4.57
Age	107	25	75	54.07	10.33
Local knowledge receptiveness[a]	129	-0.67	0.35	-0.13	0.32
Problematic science perception[a]	129	2.92	4.16	3.38	0.39
Critical parties absent perception	109	-2	2	0.03	0.97
BATNA	109	-2	2	0.03	0.87
Female	106	0	1	0.21	0.41

[a] Variables that are constant for all respondents within a partnership, but vary across partnerships.

APPENDIX B

Table B1: Correlation Matrix

	General learning	Belief change	Trust perception	Facilitation perception	Belief conflict^
General learning	**1.000**	.513**	.333**	.482**	-.065
	.	.000	.000	.000	.504
Belief change	.513**	**1.000**	.185	.366**	-.118
	.000	.	.057	.000	.218
Trust perception	.333**	.185	**1.000**	.400**	-.066
	.000	.057	.	.000	.498
Facilitation perception	.482**	.366**	.400**	**1.000**	-.198*
	.000	.000	.000	.	.037
Belief conflict^	-.065	-.118	-.066	-.198*	**1.000**
	.504	.218	.498	.037	.
External resources^	.042	.104	.070	.221*	-.767**
	.668	.280	.474	.020	.000
Includes aqua critics^	.077	.034	-.321**	-.061	.499**
	.428	.726	.001	.525	.000
Years participated	-.087	-.016	.127	.008	-.299**
	.446	.888	.264	.944	.006
Age	-.074	.058	.204*	.064	-.044
	.456	.558	.039	.511	.655
Government	.116	.046	-.020	.059	.152
	.231	.634	.838	.543	.089
Local knowledge receptiveness^	-.010	.027	-.360**	-.162	-.105
	.916	.779	.000	.089	.234
Problematic science perception^	-.008	-.026	.186	.173	-.552**
	.936	.790	.055	.069	.000
Critical parties absent perception	-.091	-.039	-.015	-.119	-.066
	.353	.688	.876	.219	.498

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

	External resources^	Includes aqua critics^	Years participated	Age	Government
General learning	.042	.077	-.087	-.074	.116
	.668	.428	.446	.456	.231
Belief change	.104	.034	-.016	.058	.046
	.280	.726	.888	.558	.634
Trust perception	.070	-.321**	.127	.204*	-.020
	.474	.001	.264	.039	.838
Facilitation perception	.221*	-.061	.008	.064	.059
	.020	.525	.944	.511	.543
Belief conflict^	-.767**	.499**	-.299**	-.044	.152
	.000	.000	.006	.655	.089
External resources^	**1.000**	-.258**	.478**	.071	-.149
	.	.003	.000	.468	.095
Includes aqua critics^	-.258**	**1.000**	-.272*	-.100	.054
	.003	.	.013	.306	.550
Years participated	.478**	-.272*	**1.000**	.401**	-.327**
	.000	.013	.	.000	.003
Age	.071	-.100	.401**	**1.000**	-.248*
	.468	.306	.000	.	.011
Government	-.149	.054	-.327**	-.248*	**1.000**
	.095	.550	.003	.011	.
Local knowledge receptiveness^	.343**	.502**	.047	-.153	-.049
	.000	.000	.674	.116	.590
Problematic science perception^	.700**	-.322**	.458**	.091	-.110
	.000	.000	.000	.352	.219
Critical parties absent perception	.043	-.200*	.102	.164	-.269**
	.660	.037	.370	.094	.005

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

	Local knowledge receptiveness^	Problematic science perception^	Critical parties absent percept	BATNA	Stalemate perception
General learning	-.010	-.008	-.091	-.027	.470**
	.916	.936	.353	.784	.000
Belief change	.027	-.026	-.039	.025	.394**
	.779	.790	.688	.799	.000
Trust perception	-.360**	.186	-.015	-.094	.122
	.000	.055	.876	.338	.209
Facilitation perception	-.162	.173	-.119	-.075	.407**
	.089	.069	.219	.437	.000
Belief conflict^	-.105	-.552**	-.066	.110	-.297**
	.234	.000	.498	.253	.002
External resources^	.343**	.700**	.043	-.122	.340**
	.000	.000	.660	.207	.000
Includes aqua critics^	.502**	-.322**	-.200*	.015	-.014
	.000	.000	.037	.881	.885
Years participated	.047	.458**	.102	-.091	.123
	.674	.000	.370	.422	.275
Age	-.153	.091	.164	.009	.012
	.116	.352	.094	.924	.903
Government	-.049	-.110	-.269**	-.152	-.129
	.590	.219	.005	.117	.180
Local knowledge receptiveness^	**1.000**	-.007	-.027	.063	.038
	.	.934	.781	.513	.689
Problematic science perception^	-.007	**1.000**	-.125	-.217*	.146
	.934	.	.194	.024	.125
Critical parties absent perception	-.027	-.125	**1.000**	.178	-.032
	.781	.194	.	.066	.739

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

	Female	Female under 50	External resources	Local knowledge receptiveness	Problematic science perception
General learning	.094	.202*	-.046	-.078	.340**
	.340	.035	.640	.421	.000
Belief change	.067	.079	.109	-.066	.231*
	.497	.412	.261	.498	.016
Trust perception	-.053	-.086	-.061	-.246*	.097
	.599	.377	.538	.011	.320
Facilitation perception	-.020	.073	.123	.056	.043
	.838	.449	.206	.564	.656
Belief conflict^	-.106	-.127	-.241*	-.054	.181
	.282	.152	.012	.575	.051
External resources^	.058	.112	.307**	.104	-.203*
	.553	.207	.001	.282	.028
Includes aqua critics^	-.097	.013	-.031	.152	.085
	.323	.886	.749	.115	.361
Years participated	-.087	-.099	.199	-.001	-.121
	.452	.376	.081	.992	.280
Age	-.427**	-.556**	.050	-.179	.019
	.000	.000	.613	.067	.849
Government	.000	.023	-.262**	.059	-.010
	1.000	.802	.006	.545	.914
Local knowledge receptiveness^	.025	.049	.156	.333**	-.036
	.800	.580	.106	.000	.700
Problematic science perception^	.032	.126	.198*	-.013	-.303**
	.748	.155	.040	.893	.001
Critical parties absent perception	-.100	-.073	-.218*	-.056	.105
	.312	.451	.024	.567	.281

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

	Anthropocent
General learning	-.289**
	.002
Belief change	-.131
	.173
Trust perception	-.051
	.604
Facilitation perception	-.087
	.365
Belief conflict^	.210*
	.028
External resources^	-.153
	.110
Includes aqua critics^	-.091
	.345
Years participated	.241*
	.032
Age	.189
	.051
Government	-.199*
	.038
Local knowledge receptiveness^	-.226*
	.018
Problematic science perception^	-.114
	.236
Critical parties absent perception	.083
	.395

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

	General learning	Belief change	Trust perception	Facilitation perception	Belief conflict^
BATNA	-.027	.025	-.094	-.075	.110
	.784	.799	.338	.437	.253
Stalemate perception	.470**	.394**	.122	.407**	-.297**
	.000	.000	.209	.000	.002
Female	.094	.067	-.053	-.020	-.106
	.340	.497	.599	.838	.282
Female under 50	.202*	.079	-.086	.073	-.127
	.035	.412	.377	.449	.152
External resources	-.046	.109	-.061	.123	-.241*
	.640	.261	.538	.206	.012
Local knowledge receptiveness	-.078	-.066	-.246*	.056	-.054
	.421	.498	.011	.564	.575
Problematic science perception	.340**	.231*	.097	.043	.181
	.000	.016	.320	.656	.051
Anthropocent	-.289**	-.131	-.051	-.087	.210*
	.002	.173	.604	.365	.028

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

	External resources^	Includes aqua critics^	Years participated	Age	Government
BATNA	-.122	.015	-.091	.009	-.152
	.207	.881	.422	.924	.117
Stalemate perception	.340**	-.014	.123	.012	-.129
	.000	.885	.275	.903	.180
Female	.058	-.097	-.087	-.427**	.000
	.553	.323	.452	.000	1.000
Female under 50	.112	.013	-.099	-.556**	.023
	.207	.886	.376	.000	.802
External resources	.307**	-.031	.199	.050	-.262**
	.001	.749	.081	.613	.006
Local knowledge receptiveness	.104	.152	-.001	-.179	.059
	.282	.115	.992	.067	.545
Problematic science perception	-.203*	.085	-.121	.019	-.010
	.028	.361	.280	.849	.914
Anthropocent	-.153	-.091	.241*	.189	-.199*
	.110	.345	.032	.051	.038

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

	Local knowledge receptiveness^	Problematic science perception^	Critical parties absent percept	BATNA	Stalemate perception
BATNA	.063	-.217*	.178	**1.000**	.050
	.513	.024	.066	.	.603
Stalemate perception	.038	.146	-.032	.050	**1.000**
	.689	.125	.739	.603	.
Female	.025	.032	-.100	.204*	.021
	.800	.748	.312	.038	.832
Female under 50	.049	.126	-.073	.080	.192*
	.580	.155	.451	.411	.044
External resources	.156	.198*	-.218*	-.019	.232*
	.106	.040	.024	.845	.016
Local knowledge receptiveness	.333**	-.013	-.056	.072	-.007
	.000	.893	.567	.462	.940
Problematic science perception	-.036	-.303**	.105	.083	.103
	.700	.001	.281	.395	.285
Anthropocent	-.226*	-.114	.083	.148	-.041
	.018	.236	.395	.128	.668

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

	Female	Female under 50	External resources	Local knowledge receptiveness	Problematic science perception
BATNA	.204*	.080	-.019	.072	.083
	.038	.411	.845	.462	.395
Stalemate perception	.021	.192*	.232*	-.007	.103
	.832	.044	.016	.940	.285
Female	**1.000**	.731**	-.034	.197*	.020
	.	.000	.734	.044	.838
Female under 50	.731**	**1.000**	-.005	.113	-.061
	.000	.	.960	.244	.512
External resources	-.034	-.005	**1.000**	.015	-.085
	.734	.960	.	.877	.385
Local knowledge receptiveness	.197*	.113	.015	**1.000**	-.030
	.044	.244	.877	.	.753
Problematic science perception	.020	-.061	-.085	-.030	**1.000**
	.838	.512	.385	.753	.
Anthropocent	-.123	-.102	-.087	-.081	-.163
	.209	.289	.374	.402	.091

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

	Anthropocent
BATNA	.148
	.128
Stalemate perception	-.041
	.668
Female	-.123
	.209
Female under 50	-.102
	.289
External resources	-.087
	.374
Local knowledge receptiveness	-.081
	.402
Problematic science perception	-.163
	.091
Anthropocent	**1.000**
	.

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
^ Variables that are constant for all respondents within a partnership, but vary across partnerships.

APPENDIX C

Descriptions of the Nine Marine Aquaculture Partnerships

The following pages describe nine marine aquaculture partnerships that have developed out of this complex context. The partnerships are the Pacific Aquaculture Caucus, the Shellfish Aquaculture Regulatory Committee, the California Aquaculture Development Committee, the Florida Net Pen Working Group, the Maine Aquaculture Advisory Council, the Maine Fish Health Technical Committee, the Maryland Aquaculture Coordinating Council, the New Jersey Aquaculture Advisory Council, and the Rhode Island Aquaculture Working Group. These nine partnerships collectively provide the data used for this paper's analysis.

Pacific Aquaculture Caucus (PAC)

The Pacific Aquaculture Caucus (PAC) is a collaborative in Washington State that was formed circa 1998 with the assistance and funding of the National Oceanic and Atmospheric Administration (NOAA). According to stakeholders, PAC was one of several caucuses that NOAA funded with the general goal of assisting the development of aquaculture at the regional level throughout the United States. Originally intended to encompass the entire pacific region (Washington State, California, Hawaii, Oregon, and Alaska), PAC is only realistically active in Washington State (interview sources). PAC represents the last of the NOAA funded regional caucuses.

The mission statement of PAC is "…to promote economically viable and environmentally responsible marine and freshwater aquaculture for the Pacific region through sound public policy and best available science." PAC operationalizes their

mission through an eight point plan which includes the following strategies: (1) assist local governments with aquaculture regulations, (2) support production systems that address economic and environmental systems, (3) encourage best management practices, (4) encourage collaboration, (5) promote and assist with scientific research, (6) utilize collective expertise, (7) take on specific tasks to resolve issues around aquaculture, and (8) provide a central point for information dissemination.

Shellfish Aquaculture Regulatory Committee (SARC)

The Shellfish Aquaculture Regulatory Committee (SARC) is a collaborative in Washington State that was formed by the state legislature through the passage of House Bill 2220 (Chapter 216, Laws of 2007). The committee was formed primarily to develop recommendations on "…a regulatory system or permit process for all current and new shellfish aquaculture projects and activities that integrates all applicable existing local, state, and federal regulations and is efficient both for the regulators and the regulated" (Washington State Department of Ecology, 2007a). The committee's secondary objective was to guide new research in the nascent industry of geoduck clam farming in Washington State.

The creation of SARC was due to a contentious political landscape regarding shellfish farming (more specifically the new practice of geoduck farming) along the shores of Puget Sound. According to one stakeholder a handful of influential homeowners in Pierce County took issue with geoduck farms popping up along the shorelines of their large properties. These homeowners joined forces with environmental groups and took the issue to the legislature leading to the creation of SARC in 2007

(personal communication, October 5, 2009). The Washington State Department of Ecology was charged with convening and facilitating the committee meetings throughout its 18-month lifespan. The meetings began in July of 2007 and continued through December of 2008 at which point Ecology compiled a final report of the committee's recommendations.

Maine Aquaculture Advisory Council (MAAC) [19]

The Maine Aquaculture Advisory Council (MMAC) was created in 1995 under the Chapter 24 Regulations of the Maine Department of Marine Resources (DMR). The formal creation of the Council was preceded by the creation of an ad hoc industry based advisory committee. The purpose of the ad hoc advisory committee was to convene a group of individuals from the aquaculture community who could provide insight on various aquaculture related issues associated with the increasingly prominent aquaculture industry. The Council consists of four to five members, including aquaculture producers and government representatives. The Council is advisory in nature, and its primary purpose is to provide recommendations to the Commissioner of Marine Resources on issues identified by the DMR, members of the public, and/or other members of the aquaculture industry.

Maine Fish Health Technical Committee (MFHTC)[20]

The Maine Fish Health Technical Committee (MFHTC) was created in 1994 in response to the growing aquaculture industry in Maine. As the industry grew larger, so

[19] Adapted with permission by Saba Siddiki.
[20] Ibid.

too did concerns regarding fish health and public safety. The Committee serves both the Maine Department of Inland Fisheries and Wildlife (IFW) and the Maine Department of Marine Resources (DMR) and deals specifically with providing recommendations for managing disease outbreaks and issues of fish health in the State of Maine and in the region more broadly. For example, the committee makes recommendations on establishing testing requirements, site selection requirements, and aquaculture facility management techniques to prevent the spread of harmful fish health diseases. The Committee was originally formed as an ad hoc advisory committee to advise public officials on issues relating to fish health and was later formally mandated under statute in the Chapter 24 Regulations through the Maine Department of Resources. The Committee is required to have representatives from private industry, academia, and state and federal government.

New Jersey Aquaculture Advisory Council (NJAAC)[21]

The New Jersey Aquaculture Advisory Council (NJAAC) was created under the New Jersey Aquaculture Development Act in 1998. Members of the aquaculture industry seeking more representation in the regulatory decision making processes impacting their practices supported the creation of the Council. One noteworthy actor in this effort was Joseph Azolina, a businessman and advocate for the aquaculture industry. The two State agencies involved with managing the Council are the New Jersey Department of Agriculture and the New Jersey Department of Environmental Protection (DEP). The primary purpose of the Council is to provide a forum in which stakeholders from multiple

[21] Ibid

sectors can share information regarding aquaculture issues, policies, regulations, etc. Toward this aim, it is regarded as an advisory entity. The Council is comprised of 20-40 individuals representing state governmental officials, university researchers, and aquaculture producers.

Rhode Island Aquaculture Working Group (RIAWG)[22]

The Rhode Island Coastal Resources Management Council's (CRMC) regulatory approach to aquaculture has been driven by the dual goals of protecting the public trust while at the same time encouraging a sustainable aquaculture industry that respects the traditions of the state. In the past decade the Rhode Island aquaculture industry has been growing at double digit rates. This growth has been cause for concern by various user groups of the state's public trust lands and the waters above them. In response to this concern the CRMC's Working Group on Aquaculture regulations was formed.

The CRMC believes that including as many user groups as practical in the regulatory process is essential to achieving a lasting consensus on the issues. The working group was first formed in 2000 and met until 2001, when the participants decided the issues had been explored to everyone's satisfaction. This series of meetings did result in changes in CRMC regulations and increased communication between the industries and regulators. This series of meetings focused upon Narragansett Bay. This increased communication served the process well until 2007. The current series of meetings (initiated in 2007) has focused upon the salt ponds along the state's southern shores.

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[22] Description used with permission from John Calanni.

The working group has been meeting monthly since 2007 (through 2009). These meetings have resulted in a number of deliverables including a report on the biological impacts of aquaculture in Rhode Island, recommendation of a 5% cap on the total pond surface area that aquaculture operations can occupy, and a report detailing the biological carrying capacity of the ponds in support of the 5% cap determination. The working group process has resulted in suggested changes that have been extensively discussed and agreed upon by a majority of the working group members. These recommendations have been made to the CRMC and are currently awaiting incorporation into CRMC code.

Maryland Aquaculture Coordinating Council[23]

Legislation enacted during 2005 created the Maryland Aquaculture Review Board (MARB), which provides regular interagency review of permits and issues across departmental lines. The Maryland Aquaculture Coordinating Council (MACC) was also created, comprising seventeen designated members from industry, academia, regulatory, and political categories (listed above). The Coordinating Council guides the responsible development of the aquaculture industry. The MACC is headed by a chair and vice-chair which rotate each year through the council members. Their duties include, making annual proposals, for advancing the industry, to the Governor and General Assembly, conducting studies of projects and products that will lead to expanding the industry, developing best management practices (BMPs), and providing for the establishment of Aquaculture Enterprise Zones. This Council also periodically reviews state regulations

[23] Ibid

impacting aquaculture and makes recommendations on any necessary or advisable regulatory changes.

In order to create the BMP document, the MACC created six subcommittees. These were chaired by MACC members, with additional membership provided by council members, as well as knowledgeable individuals able to provide insight into development of the BMPs. During the summer and fall of 2006, these subcommittees met and formulated drafts. Subcommittee meetings were open to the public for input by non-subcommittee members, and to ensure that citizen comments and concerns were heard and considered for incorporation into the BMPs. The final BMP document was completed in 2007.

These BMPs were formed from existing state and federal laws and regulations, as well as voluntary measures that are recommended. Their purpose is to provide producers with a base of knowledge regarding expectations in the development of their businesses. In all, they comprise a roadmap for those entering the aquaculture industry to follow as they grow businesses in the state. Since another task of the MACC is the regular and periodic review of all laws and regulations pertaining to aquaculture, these BMPs will be reviewed and revised as a part of this process so that they reflect current practice. It is hoped that they will aid the industry in continuing to grow while maintaining a position of environmental compatibility.

Florida Marine Net Pen Working Group

The Florida Marine Net Pen working group was formed by the Florida Division of Aquaculture (seated within the Florida Department of Agriculture), in order to develop

best management practices associated with the installation and operation of marine net pens within Florida state waters, and to address any operational and management issues that could impact marine resources, site selection, feed management, nutrients, escape, solid waste, and general facility management. Additionally, the Division of Aquaculture saw a general need to develop guidance for fish farming that incorporated both economic and environmental considerations. They also felt that there was going to be some sort of federal action to regulate the use of net pens in federal waters (commensurate with the 2005 release of the Federal National Off Shore Aquaculture Act), so the Division wanted to get ahead of the policy curve so they could help set policy, rather than react to it. At that point, the Division convinced the DoA of the need to create the group. A best management practices document, produced by the group, was developed and submitted for public comment and hearings. The document that resulted from this process was then submitted to the Department of Agriculture for incorporation into the larger DoA BMPs.

The group, convened by the Division of Aquaculture, was chaired by the Florida State Aquaculture Coordinator, Mr. Sherman Wilhelm. Membership within the group was primarily by invitation from the Division of Aquaculture, which sent out an initial set of invitations to individuals and organizations that they believed to be interested in the outcome of such a process. Additional groups and/or individuals expressed interest in attending as the process went forward, so additional invitations were submitted to those entities.

California Aquaculture Development Committee[24]

The California legislature created the Aquaculture Development Committee through the California Aquaculture Promotion Act of 1995 (Assembly Bill 1636, Cortese). The language of the law appears as Chapter 8 of the California Fish and Game Code, Sections 15700-15703, which specifies the membership of the committee as including at least 12 members representing various state agencies, the University of California, and all sectors of the fresh and salt water aquaculture industry. The committee is advisory to the director of the Department of Fish and Game, and is chaired by the Department's Aquaculture Coordinator (an official position created by AB1589 in 1987). By law, the Committee is charged with identifying opportunities for "industrial development" and "regulatory relief." However, the membership was informally expanded in 2008 to include two organizations that are skeptical of aquaculture—The Ocean Conservancy and the Monterey Bay Aquarium. In recent years, the Committee has focused on implementation of the Sustainable Oceans Act of 1996 (SB 201), which prohibits marine finfish aquaculture in state waters without a lease from the Fish and Game Commission. This legislation made California the first state in the nation to enact stringent environmental standards for marine finfish aquaculture. The act requires the Department to consult with the Aquaculture Development Committee to prepare a Programmatic Environmental Impact Report for existing and potential commercial aquaculture operations.

[24] Description used with permission from William Leach.

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