

The Collaborative Power of Conflict:

Using Public Participatory GIS to Resolve Conflict over Responsibility for Marine Debris

By

A. Carson Rehn

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Supervisor: Melanie G. Wiber, Phd, Department of Anthropology

Examining Board: Daniel Tubb, Phd, Department of Anthropology
William Parenteau, Phd, Department of History

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ABSTRACT

Marine debris in the Southwest Bay of Fundy is having negative impacts on the economy, tourism, transportation, safety and wildlife. As much of the problem remains unquantified, remediation efforts must begin by mapping debris types, location, origins, and interactions. The data for such a mapping project, though, must come from stakeholders who are caught up within an environment of blame. Literature suggests that the oppositional interests of stakeholders influence their perceptions of risk. Within the context of a PPGIS process, this research traces how risk perceptions emerge from and interact with mapping processes to produce a contestable document. Utilizing the lenses of critical geography, actor network theory, and relational power, it is argued that by deploying the PPGIS map within the resultant political context a type of conflict is produced that both demands stakeholders' engagement, while necessitating that they also adopt a more collaborative approach to mitigation.

DEDICATION

To Mom and Dad

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Though every written work eventually needs, for practical purposes, an author's name on its cover, its production rests upon a hinterland of preceding relations, theories, values, methods, and infrastructures. I would like to use this space to express my gratitude towards those whose guidance and support were positively instrumental to me throughout the process of researching this thesis.

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Chapter 1: Introduction

Recently, there has been an increase in the number and variety of stakeholders using the Southwest Bay of Fundy (SWNB) coastal waters. Human uses within the Bay includes a multi-species inshore fishery (lobster, scallop, and herring), open-net finfish aquaculture, year-round international shipping, and tourism. With the increase in activity there has also been an increase in interactions that both result in and are impacted by marine debris (M. Wiber, Young, and Wilson 2011). The problem of marine debris and its associated impacts on the economy, tourism, transportation, safety and wildlife has been widely documented at the supranational scale (Cho 2005; Moore 2013; United Nations Environment Programme and Division of Early Warning and Assessment 2014; Liu, Kao, and Chen 2015; Wilcox et al. 2015), yet understudied in SWNB. Yet, marine debris is difficult to survey and much of the problem remains unquantified (Cho 2005). Any study of the problem, therefore, must begin by figuring out what debris is out there, where it is coming from, where it is located, and what it is doing.

For this task, the implementation of a Geographic Information System is well suited. Collecting this data within SWNB, however, will not be so straightforward. Unlike regulatory counterparts in the United States, Canada lacks a comprehensive legislative framework for marine debris, and has no mitigation strategy in place. In the absence of clear policy, an atmosphere of finger pointing, blaming and entrenchment has emerged between the various stakeholders, as they seek to avoid potential penalties associated with marine debris, should they be held responsible. This situation will undoubtedly have an impact on the kinds of information stakeholders would or would not be prepared to share.

Even with a robust and accurate picture of the marine debris problem, resources for remediation are limited. The challenge becomes, then, to figure out what debris should be considered a priority for removal, and how to do so within a diverse community possessed of conflicting answers to this question. One way of navigating this problem is by mapping the stakeholders' perceptions of risk into a GIS in order to render visible "hot spots". Literature suggests that the oppositional interests of the various stakeholders will likely influence their perceptions of the risks associated with marine debris (Boholm 2003; Beck 2006). Indeed, Boholm (2003) has alerted us to the fact that simply quantifying objective risk data into a GIS will not be sufficient to address the problem of marine debris.

1.1 Objectives

This research investigated whether the methods and techniques of public participatory GIS (PPGIS) to map subjective risk are helpful in dealing with the debris problem. The project began as part of a larger collaboration between faculty and students at UNB, with an environmental NGO (ENGO) and a local fishermen's association.¹ The collaboration was based on a shared objective to map and mitigate large scale marine debris in the SWNB waters of the Bay of Fundy. It tested the utility of PPGIS to assist stakeholders in overcoming their entrenched positions while fostering a more collaborative environment. The reasons for this approach are, first, that PPGIS has the

¹ This research was part of a SSHRC Insight project (435-2014-0299) under the supervision of Melanie G. Wiber at the University of New Brunswick. Team members involved in the marine debris subproject include: Allain Barnett, Donna Curtis Maillet, Michael Rooney (all from UNB), Matthew Abbott (from the ENGO The Fundy Baykeeper) and Maria Recchia (Executive Director, Fundy North Fishermen's Association).

potential for encapsulating the widest possible range of information about marine debris, its impacts and risks, in separate layers that can be compared and contrasted. Second, it has the opportunity, when shared, to increase understanding, cooperation, and the capacity to participate in governance processes (Smith, Barrett, and Box 2000; Brown 2012; Baldwin, Mahon, and McConney 2013; Rambaldi et al. 2006; Threlkeld 2005; Mukherjee 2015). Finally, it has been argued that the “visual language” of GIS can serve to delineate responsibility while supplying common points of reference or “hot spots” with a high priority among all stakeholders for remediation (Harvey and Chrisman 1998; Harley 1988).

1.2 Background of Research Area

Following Chang *et al.* (2013), the University of New Brunswick research team identified a 60 X 60 km area of the Bay of Fundy with the highest density of interactions between a variety of stakeholders (including commercial fishermen,² aquaculture industry,³ shipping, transport, and others). In consultation with our research partners at the Fundy North Fishermen’s Association (FNFA), we extended our area of study to also include fishing areas up to and including the area around Saint John Harbour (Figure 1). As Barnett *et al.* (2016) points out, the Bay of Fundy feeds and supports many commercially and environmentally significant species, earning for parts of the Bay the designation by the Federal Department of Fisheries and Oceans Canada (DFO) of

² In this study, the term commercial fishermen refers to persons involved in the wild catch fisheries as an occupation.

³ The term aquaculture industry refers to persons involved in the cultivation of aquatic plants and animals, but in this study area it usually indicates someone who farms salmon. Within this work the use of the terms “aquaculture” or “aquaculture industry” refers to the representatives or employees thereof.

Ecologically and Biologically Significant Areas (EBSA). The density of interactions within the area increases the potential for the destruction and/ or loss of equipment or gear. Indeed, in a study conducted that investigated the viability of recovering lost lobster traps in the Saint John Harbour area (Canaport LNG Limited Partnership 2009), fishermen reported an increase loss of traps due to a coinciding increase in the level of construction and cruise-ship traffic. The SWNB area in the Bay of Fundy is similarly subject to the negative impacts of extant marine debris while also being susceptible to the potential ongoing generation of new debris. For these reason, this 60 x 60 km area is a suitable place to test PPGIS in the ways outlined above.

1.3 Outline of Chapters

I have organized the work herein into six chapters. The first and the last of these constitute this introduction and my final conclusions respectfully. In the second chapter I present a review of the relevant literature I will use to inform my analysis. The third chapter provides an outline of the methods I used to gather the necessary and relevant data. The fourth chapter contains the results of the research, and the fifth is where I examine the results and provide my analysis of the data.

1.4 Summary of Results

Through this research I find that PPGIS and the mapping of subjective risks can and did help move stakeholders off of their defensive positions and fostered more cooperation and a willingness to collaborate. Initial conflicts between stakeholder interests - in this case commercial fishermen and the aquaculture industry - can be harnessed by the PPGIS process in order to, first, bring otherwise reluctant stakeholders

together and, second, balance and stabilize uncertainties and subjectivities in order to generate a common understanding of the problem to which stakeholders can agree. This is accomplished by way of the introduction of objective spatial and material elements into an otherwise entirely subjective and contested space, while also encouraging those subjectivities to be shared and understood by opposing stakeholders who otherwise may not be exposed to them. Further, the in-person (face-to-face) environment and collaborative organization of the PPGIS process introduces collective oversights and generates a sense of accountability between stakeholders that, in turn, can motivate action. In effect, PPGIS provides the opportunity, within contested spaces, for the co-production of values. Other ways of organizing a PPGIS process that do not rely on face-to-face stakeholder interactions are unlikely to generate the same coproduction of values and, therefore, may be less useful as a reconciliatory process and tool.

Chapter 2: Literature Review

This research was guided and informed by a variety of disciplines and ideas. Of these, five principal areas or categories emerged as particularly influential: the marine debris literature; risk, Public Participatory GIS and critical geography; power and empowerment; and Actor-Network Theory. In this chapter I will first give a brief description of the study area and the reason for its selection, followed by a brief review of the literature within each of the influential theoretical areas.

2.1 Marine Debris

Marine debris consists of any manufactured or processed solid material discarded or lost within the marine environment (United Nations Environment Programme and Division of Early Warning and Assessment 2011; Hinojosa and Thiel 2009; Coe, Andersson, and Rogers 1997). Historically, such solid debris was of organic materials that would break down quickly, thereby confining the possible impacts it had on marine activities to a finite period of time. There has been, however, a general move away from natural degradable resources towards cheaper and more resistant synthetic substances. It is the case now that marine debris, such as derelict fishing and aquaculture gear, plastics, Styrofoam, and bottles, can persist on the seabed, in water columns and on the surface almost indefinitely (Cho 2005).

Marine debris is generally classified by its origin, as having been the result of either land-based or oceanic activities (Hinojosa and Thiel 2009). Accordingly, activities that may contribute to the accumulation of debris are commercial fishing, aquaculture,

agriculture, tourism and industry (Thiel et al. 2013). In their study across three U.S. states, Hoagland and Kite-Powell (1997) found that ocean-based sources – that is, debris that can be traced conclusively to a marine source – comprised between 15 and 20 percent of marine debris. Further, the authors found that of all the identifiable sources of offshore debris, the commercial fisheries industry⁴ was the most significant contributor. Oigman-Pszczol and Creed (in Liu, Kao, and Chen 2015) reached a similar conclusion in their more recent study of subtidal regions in Brazil. It has been estimated that some 6.4 million tons of fishing gear is lost to the oceans annually (Wilcox et al. 2015).⁵ This study focused on ocean-based marine debris originating from the fisheries sectors, but further clarifies debris as being that which is enacted around risk (see below).

The Canadian coastal waters of SWNB are governed by a complex regulatory structure at both the provincial and federal branches of government. Federally, the Oceans Act (*Oceans Act* 1996) outlines a mandate for the federal Minister to lead a collaborative relationship with other ministers and bodies towards the carrying out of the integrated management of all activities in or affecting coastal waters. Through this mandate, provincial governments have the responsibility for managing aquaculture, and the federal Department of Fisheries and Oceans (DFO) is responsible for managing the wild capture fishery while providing support for the research and development of aquaculture. In 2004 the provincial government of New Brunswick and the federal

⁴ For the purposes of this study, I take the Government of Canada's (*Fisheries Act* 1985) definition of "commercial fisheries" as being in relation to "fish that is harvested under the authority of a licence for the purpose of sale, trade or barter." This definition, then, applies to both wild catch fisheries and aquaculture.

⁵ To put the problem of coastal debris in perspective, however, marine debris from mismanaged land-based sources is estimated to be some 275 million tons globally; and that is just the plastics (see Jambeck et al. 2015). Better management of ocean-based debris is still crucial.

government jointly launched the Southwest New Brunswick Marine Resources Planning Process, aimed at linking all fisheries and aquaculture with other uses of marine space – such as tourism and shipping – into a more integrated management structure. Though some marine debris has been cleaned up by both aquaculture and fishermen (see (Southwest New Brunswick Marine Advisory Committee 2013; and Canaport LNG Limited Partnership 2009 for example), much of the recommendations of this work plan have yet to be implemented. Currently, there is no developed framework, at the provincial or federal levels, that adequately addresses the issue of marine debris – its generation, prevention, or mitigation, and the responsibility therefore and thereof.

The consequence of this lack of policy, as mentioned above, is that the various stakeholders are caught up in a situation where avoidance of responsibility for the marine debris problem is currently viewed as economically advantageous. This is likely the case, in part, due to the uncertainty about how a remediation plan would be funded – for example, if the various industries will have to pay for debris cleanup, if taxpayers will have to foot the bill, or some combination thereof. Furthermore, flowing from this is the potential for negative media attention and a subsequent public outcry associated with industries seen to be doing harm to the environment or increasing the tax burdens of the public. This sets up oppositional interests among stakeholders that will likely affect their perceptions of risk related to marine debris (Boholm 2003; Beck 2006); thus, it is important to sample and account for these subjective views.

2.2 Risk

According to Boholm (2003, 160), risk has been traditionally defined mathematically as a “statistical probability of an outcome in combination with severity of the effect construed as a ‘cost’ that could be estimated in terms of money, deaths or cases of ill health.” Within much of the body of social research, she points out, a distinction between objective and subjective risk is made: objective risk being in relation to a positivistic approach that measures sources of potential harm and calculates probabilities; subjective risk relates to the emic, locally defined values and concerns of people. Boholm (2003) argues that what constitutes a risk is largely contextual and fluent; it is inextricably bound up with social relationships, power relations, cultural beliefs, trust, knowledge, experience, discourses and etcetera. Indeed, as Vera-Sanso (2000) points out, the concept of risk is inherently political; definitions of risk “set the terms of debates in which people engage both to enforce and resist the impact of such definitions” (2000, 128–129). Following how the various stakeholders differently deploy risk, then, provides an indication of the distribution, sources and tactics of power within society (Vera-Sanso 2000).

Rosa (1998, 28) defines risk as “a situation or event where something of human value (including humans themselves) has been put at stake and where the outcome is uncertain.” Renn (1998), agreeing with Rosa, suggests that since risk refers to the potential for actual consequences then it should be properly understood as both a social construction and a representation of reality. The tension between the more subjective socially constructed and the more objective and measurable aspects of risk is, therefore, a site for potential struggle and conflict. Barnett et al. (2016) argue that the differences

between these two aspects of risk can lead to an uncertainty as to just what constitutes an acceptable threshold for human and environmental impacts. Risk management, then, becomes a process of “reducing the risks to a level deemed tolerable by society and to assure control, monitoring, and public communication” (Renn 1998, 51). Yet it is precisely the conflict and tension generated through disagreements as to the definitions of risk, between the subjective and objective aspects of it, and what that means for decisions about risk management actions that makes marine debris problematic. Working to bridge these differences, suggests Barnett et al. (2016) is central to the formation of collaborative risk management strategies.

Modern society, reveals Beck (2006) - characterized by egoism, autonomy, autopoiesis and self-isolation - finds itself more and more occupied with the debating, preventing and managing of self-induced risks. Paradoxically, he argues, risk becomes the “compulsory medium of communication in a world of irreconcilable differences,” where a “publicly perceived risk compels communication between those who do not want anything to do with one another” (2006, 339). In other words, risk generates a kind of “involuntary democratization” through which no development or techno-breakthrough goes unchallenged - according to the perceived risks associated with them. As issues of risk become increasingly more political and controversial, risk identification and management thus becomes the site for the deployment of political techniques and tactics of power (Boholm 2003; Vera-Sanso 2000). The focus of this research is the possibility that the process of Public Participatory GIS (PPGIS) might be a useful tool for assisting in the merging and bridging of the subjective and objective elements of risk, and that this,

in turn, may prove useful in navigating through the barriers to collaborative actions on marine debris risk.

2.3 Public Participatory GIS and Critical Geography

Harley (1988, 129) argues that “[b]oth in the selectivity of their content and in their signs and styles of representation maps are a way of conceiving, articulating, and structuring the human world which is biased towards, promoted by, and exerts influence upon particular sets of social relations.” Understood in this way, maps are seen as inescapably linked to the techniques and mechanisms of power. Indeed, throughout the history of the Mediterranean and Europe, “mapmaking,” Harley (1988, 131) continues, “was one of the specialized intellectual weapons by which power could be gained, administered, given legitimacy, and codified.” In more modern times, the enthusiasm for maps appears to be directly proportional to the state’s administrative complexity and its territorial and social ambitions (Harley 1988). So, over the past several decades, any claims that a technical knowledge of mapmaking necessarily entails positivist assumptions of analytical objectivity, political neutrality, and subject-object dualism have been thoroughly challenged and criticised, both within and without the discipline of geography. Now, the inseparability of facts and values looks to have become conventional wisdom (Lake 1993).

2.3.1 Geographic Information Systems

It was around the time that this “conventional wisdom” was established that GIS (Geographic Information Systems) rose to prominence and gained influence within geography. Newly established institutions, such as the National Center for Geographic

Information and Analysis (in 1987), began making ambitious claims that the emergence of GIS marked the possibility of a new integrated and scientific geography (Sheppard 2005). Definitions of GIS, such as can be found represented in Kennedy (2013, 4) for example, reflect this tendency to focus on the objectivity of data: “A geographic information system is an organized collection of computer hardware and software, people, money, and organizational infrastructure that makes possible the acquisition and storage of geographic and related attribute data, for purposes of retrieval, analysis, synthesis, and display to promote understanding and assist decision making.” GIS, Kennedy continues (2013, xliii), is “basically a computer program designed to make a computer think that it's a map...The difference between a paper map and a GIS map [though] is that the latter exhibits intelligence. You can ask it a question and get an answer.” What definitions like this insinuate is that the people, money, and organizational structures of GIS exist only to make possible the acquisition and storage of data for analysis. What is more, Kennedy reifies GIS as possessing “intelligence” and the ability to answer questions, completely neglecting to mention the human interventions of programming and data input necessary for that to be so. The fact that claims like these were coming at a time when the discipline of geography had largely moved beyond positivist and critical rationalist approaches instigated a number of critical responses.

Sheppard (2005), from which this paragraph takes its direction, offers a succinct summary of the critical reaction to the claims of GIS. Many saw in GIS the resurrection and reassertion of the rationalist and positivist approaches within human geography. Critics argued that geography was far too complex to submit itself to just one method of analysis and that GIS, through its ambition to overpower post-positivist approaches, was

at risk of undermining geography's interpretive potential. Social theorists argued that the apparent empirical epistemology of GIS ignored non-western conceptions of the world, that the particular forms of reason embedded within GIS, in fact, rendered it incapable of representing any alternative rationalities of everyday life. Politically, researchers began to wonder about an emerging digital divide, where unequal access to the use of GIS was seen as likely to maintain, if not intensify, social and geographical inequalities based upon, for example, minority status, gender, ethnicity, wealth, age and location. This, the critics argued, would in-turn make available to those with access to GIS technologies those techniques and mechanisms of power related to surveillance, social engineering, opinion formation, and warfare. Harley (1988, 134), borrowing from Foucault's work on subject formation, develops this argument even further, contending that "[m]aps impinged on the lives of ordinary people. Just as the clock, as a graphic symbol of centralized political authority, brought 'time discipline' into the rhythms of industrial workers, so too the lines on maps, dictators of a new agrarian topography, introduced a dimension of 'space discipline.'"

These criticisms, points out Sheppard (2005), did not go unanswered. GIS specialists accused the critiques as being too simplistic, overly pessimistic and even paranoid. Furthermore, they viewed such criticisms as evidence of inexperience and lack of expertise in GIS and, therefore, a minor irritation that could be ignored. Consequently, there remained little communication between critics of and specialists in GIS throughout the decade between 1983 and 1993. It was at the end of that decade that Robert Lake (1993) published his *Planning and Applied Geography: Positivism, Ethics, and*

Geographic Information Systems, marking an important transition into a more reflexive critical GIS.

What Lake (1993, 405) drew to everyone's attention was that the positivist logic of GIS - and its claim to value-neutrality – constituted an “epistemological condition[s] with political and ethical consequences.” Though some information technology (IT) based institutions were adopting codes of ethics that implored IT professionals to use their expertise to do ‘good’, he argued, in practice these codes amounted to little more than statements that defined the proper behaviour of practitioners in the carrying out of their work. In effect, the emphasis of these codes was on how one was doing GIS and not the act of doing GIS. As Lake (1993, 406) summarizes:

In short, practitioners are enjoined to use the technology at their disposal to good ends, to prevent its use for harmful ends, and to conduct themselves according to professional standards of practice. The emphasis on regulating personal conduct, however, fails to address the problem of unanticipated and somewhat more indirect negative outcomes that accrue despite the best of intentions. In a cogent review, Klosterman (1992) details potential problems arising, not from practitioners' evil intent, but from the institutional impacts of adopting techniques of computer aided planning. Among these 'generally conservative' impacts of computerization in planning are support of the status quo through 'reinforcing existing structures of influence; empowerment of the technically sophisticated while disenfranchising the less technically adept; and the burying of political choices under 'technological mystification'.

Moreover, computerization itself may potentially alter the investigative process, restricting its area of inquiry to only those questions answerable through technology and by neglecting questions of politics or ethics (Lake 1993). The practice of GIS, says Lake, is intrinsically ethically flawed because it is unable to understand and acknowledge the subjective differences among the individuals who themselves make up the complex data upon which GIS is built. It was this well-structured critique of GIS, says Elwood (2014)

that spawned a myriad of theoretical and methodological mediations that sought to address these flaws and expand the epistemological range of GIS.

During the 1990s, then, the intellectual divide that had kept the critics and practitioners of GIS apart broke down. An active research program in GIS and society emerged, with researchers on both sides interested in dealing with theoretical and practical questions, like the history of GIS, its relevance for community and grassroots perspectives and life-worlds, issues of privacy and access, environmental justice, political ecology, the human dimensions of global change, and alternate kinds of GIS, to name a few (Sheppard 2005). Throughout this period there had been enormous technological advancements with respect to recording the physical world, yet the measurement and mapping of the subjective experience of place – the social and cultural landscapes – remained elusive. One avenue through which researchers interested in this area approached the problem was to develop methods for allowing non-experts to identify the subjectively relevant spatial dimensions of their social and cultural landscapes (Brown and Kyttä 2014).

2.3.2 Public Participation GIS

With the detailed critiques of the social, political and knowledge practices of GIS now receiving concerted attention, many scholars avoided rejecting GIS outright by attempting to understand how the technology is socially constructed and generates space, knowledge and power (Elwood 2006). Like all technologies, GIS has been shaped in a way that reflects the social context in which it arose, only to feedback upon and shape that very social context (Sheppard 2005; Harvey and Chrisman 1998). This understanding

laid the groundwork for the development of participatory forms of GIS that aimed to establish more equitable access to information, develop new diverse representational forms of GIS, and to establish alternative ways GIS spatial data can be represented and, therefore, analyzed (Elwood 2006).

So, public participation GIS (PPGIS) emerged as a form of GIS that sought to combine the activities of technology-based spatial analysis and participatory democracy. Since the mid- 1990s, PPGIS has attracted a wide range of researchers, practitioners, developers and activists who believe that the visual and analytical elements of GIS represent an opportunity for community change and empowerment (Schlossberg and Shuford 2005). As Brown (2012) points out, though, a formal definition of PPGIS has remained vague. Part of the problem is the lack of clarity on just what constitutes the public and its participation within the GIS context. Even within the broader tradition of public or citizen participation studies, public participation is usually thought of along some broad type of power continuum or demarcations of particular participation techniques (Schlossberg and Shuford 2005).

Schlossberg and Shuford (2005) detailed several forms of public and participation. First, for them participation can be imagined in two ways: as specific activities or in the broader goals the participation is supposed to achieve. They argue that, for GIS, the broad reasons as to why participatory approaches are sought in the first place should be the principal consideration. To this end, the authors identify four fundamentally different orientations for the basic idea of participation: power, administration, conflict resolution, and planning processes. Given these orientations, then, it becomes obvious

that simply claiming a need for public participation in GIS suggests fundamentally different understandings of just what that participation is supposed to achieve.

Schlossberg and Shuford (2005, 18) also see public in two distinct ways: as “actual people organized in some type of grouping or in terms of methods for identifying and selecting such people.” What defines the public in PPGIS can be essentially boiled down to the question of “who should be involved?” Common definitions of what constitutes a stakeholder, such as those affected by a decision or program, those who bring important knowledge or information, or those who have power to influence or affect implementation, while useful, lack the nuanced ability to track how the composition of stakeholders can change over time, how publics may be geographic, economic, professional, social or political, or how agency goals or other interests can generate different conceptions of a relevant public (Schlossberg and Shuford 2005). One way, Schlossberg and Shuford (2005, 19) suggest, to identify a relevant public is by asking the following five questions:

1. Who are potential beneficiaries?
2. Who might be adversely affected?
3. Have vulnerable groups been identified?
4. Have supporters and opponents been identified?
5. What is the relationship among stakeholders?

By working through these questions, decision makers must think more broadly about who should be included in a particular public participation project. Certainly, a well-defined idea of who the public is makes attaining their involvement in PPGIS easier (Schlossberg and Shuford 2005). While understanding participation and public separately is useful, for

PPGIS it is crucial that the two concepts come together to comprise an integrated approach. Decisions at the outset about what categories of each suits a particular project will dictate the flow of possible outcomes (Schlossberg and Shuford 2005).

2.3.3 Uses of PPGIS

In a survey of PPGIS studies completed over the past decade, Brown (2012) identified a variety of ways it is being applied and implemented. These include the use of PPGIS for “national forest and national park planning, regional conservation planning, marine and coastal area conservation, urban park and open-space planning, tourism development, and scenic byway planning” (Brown 2012, 8). With the evolution of spatial information technologies trending towards more accessible and cost permissive forms, traditionally marginalized groups, such as Indigenous peoples, have been cautiously employing GIS for cultural and natural resources planning, community planning and infrastructure, monitoring environmental change, managing urban sprawl, integrating traditional ecological knowledge into decision making practices, and, importantly, to defend traditional territories from resource development encroachment (Threlkeld 2005).

Kyem (2004) has suggested that PPGIS may have a role in helping to resolve disagreements and conflicts between multiple stakeholders. For the author, the oppositional differences in values and interests that can sustain conflicts can sometimes rest upon the information available to the individual. A lack of adequate information, or even misinformation, can therefore promote misunderstandings and distrust. PPGIS, argues Kyem (2004) can help stakeholders move past these initial barriers. For Kyem, though, the effective use of PPGIS as a tool for mediation may rest upon the adequate

development and distribution of power between stakeholders. This can take the form of political organization, legal challenges or disruption tactics, says Kyem (2004, 50), but, notably, he excludes the use of PPGIS itself as a basis for empowerment (an omission that will be discussed later in the analysis chapter).

An example of PPGIS with some interesting implications for approaching the mapping of priority marine debris can be found in Smith, Barrett and Box (2000). They turn participatory GIS methods towards the subjective perceptions of risk of pastoralist populations in Ethiopia and northern Kenya to better target government research and development resources. In order to map risks – colloquially understood to be “uncertain consequences, and in particular exposure to potentially unfavourable circumstances, or the possibility of incurring nontrivial loss” (Smith, Barrett, and Box 2000, 1946) – the authors utilized a two-stage system of ordinal rankings; respondents first identified particular risks and then ranked them based on severity. Though respondents were selected purposefully or opportunistically, introducing bias to the results, the authors argue that a truly random sample may not be conducive to participatory methods that work best with willing and talkative informants.

In the first step of the research, the authors used an open-ended questionnaire, where the participants were asked to identify risks. Informants were encouraged to list as many or as few risks as they wished – not just the ones in which the researchers were interested. The second step then involved asking respondents to rank and order the risks they had identified along an axis between most severe and least severe. After listing and ranking specific risks, respondents were then asked to detail each in turn, with specific attention to how risks had been traditionally solved, if and why they no longer could be

solved, and how they wished to solve them in the future. Once this data was collected, it was indexed, with risks identified being quantified along a proportional index between no one affected and everyone affected, and severity of risk located along a joint index representing context-appropriate weighting of severity and overall incidence (Smith, Barrett, and Box 2000, 1948). Smith, Barrett and Box (2000) argue that through indexing in this numerical fashion, the data was easily transferred into a GIS display to render visible the spatial/ ecological distributions of risk incidence and perceived severity. Communication and comprehension amongst subject communities and policymakers was thereby greatly enhanced by the “visual language”(see J. Brian Harley 1988, 130).

2.4 Empowerment and Power

GIS is generally seen as either empowering or marginalizing. As Harris and Weiner (1998, 71) point out, though, “both processes are occurring simultaneously and are context dependant.” For instance, providing citizens with greater access to data about their own regions also increases the opportunity for and capacity of government surveillance.⁶ So, while PPGIS initiatives emerged out of an interest in the socio-political role, the technology might play in the empowerment of marginalized populations (Brown 2012, 8), it can also be about how it at the same time can disempower (Kyem 2000; Harris and Weiner 1998). The question, then, is not whether GIS is empowering or disempowering, but, rather, in what ways it produces empowerment or disempowerment (Elwood 2002).

⁶ Here, government surveillance increases both because of the direct participation of the public in handing over certain data, but also through the aggregation of that very data.

Mukherjee (2015) raises troubling questions about the efficacy of PPGIS methodologies. He calls our attention to comprehensive reviews (see Brown 2012; Barndt 1998; Ghose and Huxhold 2001) that have found they have not made any significant impacts on the outcomes of regional and environmental planning, nor have they been successful in their endeavours to empower inner-city neighbourhoods. Kyem (2000) suggests that part of the reason for the uncertainty surrounding the ability of PPGIS to empower may, in fact, be due to the difficulties encountered in the evaluation of just what empowerment entails. This being the case, proceeding with the development of a PPGIS program must involve a clear understanding of empowerment. Here I follow Kyem (2000) who proposes four main ways to imagine empowerment: as distributive power, as generative power, as building human capital for collective action, or as social change.

For Kyem (2000), empowerment as distributive power implies a distributional change that results in a greater degree of access to resources and/ or political capital. Empowerment thus imagined is a process through which individuals or communities attain influence or authority that allows for the exercising of rights or capacities more freely. It seems that within this distributive model, then, agents are pitted against one another in adversarial roles and locked in a competition for a finite power. Accordingly, one agent's empowerment necessarily must come at another's expense. This conception, says Kyem (2000), posits an environment within which trust is reduced and organization is mobilized towards adversarial ends.

Empowerment as generative power is understood as the "acquisition of skills that enable individuals and communities to assert control over their circumstances" (Kyem 2000, 5). In this type of empowerment there is an increase in the capability of agents to

take action on their own behalf (Elwood 2002). Elwood (2002) discusses how, for some scholars, the building up of capacity at this level is an essential precursor to the dismantling of oppressive and disempowering structures. Capacity building may occur in several ways: at the individual level it may occur with the development of skills that cumulatively strengthen a community; it may proceed from a buildup of community-based knowledges in which members engaged in the process of gathering information about conditions or resources form the basis for informed action; or it may occur through the development of “a politicised consciousness - an understanding of structural power inequities and how these affect them” (Elwood 2002, 910). If distributive empowerment takes a zero-sum view of power, where there is only so much power to go around, generative empowerment takes a positive-sum view, instead assuming every individual to have some power (Kyem 2000). As generative power is not obtained at the expense of others, it is, perhaps, a more useful framework for discussing participation in GIS and community empowerment.

Empowerment can also be seen as building human capital for collective action. Here, empowerment begins with the individual by “touching the heart, changing the values and beliefs, overcoming fear and a sense of separation” (Wilson 1996, 657). An increase in personal self-worth and self-esteem creates a sense of belonging and interconnectedness, which in turn produces commitment, cooperation and feelings of solidarity (Wilson 1996). Empowerment, it is argued (Kyem 2000), is both unattainable and unsustainable if it does not begin, at its base, with internally empowered individuals. Further, in absence of self-empowered individuals, structures of dependency and paternalism would remain intact (Kyem 2000). The act of participation is one way

individual empowerment may be enhanced. (Wilson 1996), and the task of a PPGIS would, therefore, be to identify those issues around which participants could rally and strengthen solidarity (Kyem 2000).

Finally, empowerment may be viewed as changes in social institutions and in society more generally. This kind of empowerment is seen to produce a political consciousness and participation that further develops into a sense of responsibility for altering institutions and organizations (Kyem 2000). It is, in effect, the transfer of decision making control over resources and needs to communities and organizations. Cheater (1999), however, cautions against accepting such claims at face-value. If a collectively negotiated construction of a new social order stems from a recognition of individually made choices, she asks, why then does there appear to be so much concern about empowerment within liberal democracies? Further, if adjudication is disempowering, how can a rule-based negotiated reformulation of institutions be empowering (Cheater 1999)?

Cheater's challenges notwithstanding, these four models of empowerment, proposes Kyem (2000), share some common threads. All of these models imply the realization of empowerment at both the individual and communal levels. The entire community is empowered as the capacities of fulfilled individuals are turned towards collective ends. Empowerment is also seen as an "interactive process in which both the powerless and the powerful undergo changes and, over time, develop new relations and norms" (Kyem 2000, 9). Finally, these four understandings of empowerment hold that its achievement requires transformation in existing political structures and local institutions. Therefore, in order to apply PPGIS methods towards an empowering agenda – or at least

one that avoids disempowering – the technology must be removed from embedded and persistent structures of vested interests (Mukherjee 2015). This will require the restructuring of power relations in a manner that allows empowerment supporting institutions to emerge (Kyem 2000).

If, then, empowerment – or at least the avoidance of disempowerment – is our objective, and the restructuring of power relations our path, it will not be enough to simply attend on those characteristics that comprise empowerment. In what ways, for example, do power relations need to be altered to allow individuals to acquire skills and assert control over their lived experiences? How should relationships be changed so that values and beliefs may overcome fear? What does an empowerment supporting institution look like, and how do the power relations within such institutions differ from those that do not support empowerment? It seems clear that if we are to truly understand how to evaluate empowerment or, indeed, develop a program sensitive to its production, we need to go deeper. If, as the above discussion suggests, empowerment can be understood as the restructuring of power relations – either on an individual or societal level – then it seems necessary to ask “what is power?”

2.4.1 How Power Works

The term power can be confusing and elusive (Cheater 1999). Often the use of the word is presented in a way that suggests it means the same thing to everyone, that it can be reduced to some sort of essential principle (Wolf and Silverman 2001). There are, though, according to Wolf and Silverman (2001), at least four conceptually useful ways to think about power. The first is to think of power as a capacity. This kind of power can

be observed, for instance, in the superior physical stamina and strength one individual has over another, in the greater access to resources one class possesses at the expense of another, or in the monopoly on the use of violence the government maintains, legitimately or illegitimately, over its subjects. Power conceived in this way is limited in that it can only point to particular attributes of individuals or groups and says nothing about why, how or if those attributes are exercised (Wolf and Silverman 2001). The second type of power is understood as “the ability of an ego to impose its will on an alter in social action, in personal relations” (Wolf and Silverman 2001, 384). Here we can see the transactional nature of an individual or group acting upon another. Yet if we confine our analysis of power to these interactions we will fail to establish the contexts that both gave rise to those specific actions and rendered them desirable or even possible in the first place. That is, saying that one actor possesses a greater capacity to impose their will upon another, and that they so did, is to say very little.

The third kind of power offered by the authors (Wolf and Silverman 2001) is tactical or organizational power. This kind of power can be understood as that which dictates and controls the relational sites in which people define and utilize their capacities. Here, then, we see how actors limit the actions of others within defined environments (Wolf and Silverman 2001). For example, a person who wishes to fish for a living must, at least part of the time, submit to the rules and regulations that organize and control the fisheries sector. When that fisherman engages in the activity of fishing, his capacities for certain actions are emphasized while others are constrained. This environment is not only constituted by laws and regulations, but also by and through the presence of various actors within the environment, possessed of their own particular

capacities that, once exercised, impact upon and influence the possible actions of others. We must be careful not to place regulatory bodies, like the Department of Fisheries, outside the effects of these force relations. How they attempt to regulate and control is equally influenced by how the various actors within the environment attempt to obey or ignore those regulations.

Finally, the fourth kind of power, what Wolf and Silverman (2001, 385) call “structural power”, not only operates within these defined environments, but also “organizes and orchestrates the settings themselves, and...specifies the distribution and direction of energy flows (2001, 384). The authors suggest that this kind of power is what Foucault (2000, 340) alludes to when he says: “In effect, what defines a relationship of power is that it is a mode of action that does not act directly and immediately on others. Instead, it acts upon their actions: an action upon an action, on possible or actual future or present actions.” The concept of “structural power”, then, enables us to ask about why and how certain environments formed the way they did, how they are maintained in particular ways, and how the ways in which they constrain, inhibit, or promote certain actions connects with or links to broader structural forces (Wolf and Silverman 2001). Wolf and Silverman argue that tactical/ organizational power and structural power are, together, of great analytical value. But if Wolf and Silverman employed these Foucauldian concepts towards an analysis of political economy (2001, 385), my goal is to show how they might have much to offer to the analysis of participation and empowerment. Further, rather than maintaining Wolf and Silverman’s reimagining of Foucauldian power as “tactical” and “structural”, I turn directly to Foucault.

2.4.2 Foucault, Power and Participation

What Foucault intends when he uses the term “power” can be difficult to grasp, both because of the concept's inherent difficulty and because of the tendency to equate the term with its common-sense usage (Prado 1995). In the English language, power often takes the shape of power-as-capacity (see above). It assumes power to be rule-based and institutionalized: it represses, excludes, limits, refuses, censors, blocks, divides, and rejects; it is monolithic and centralized, possessed by a ruler or elite who exercise it in a domineering and authoritative manner over the relatively powerless “others” (Foucault 1977). Those dominated by a greater power, then, either justifiably or illegitimately, have their freedom limited by codified prohibitions – the transgression of which makes them liable to punishment (Deacon 2003). This conception of power is that it is assigned to and exercised by particular agents over other agents (Prado 1995). Indeed, the types of empowerment discussed above seem to assume this traditional view. For Foucault, however, “power is not an institution, and not a structure; neither is it a certain strength we are endowed with; it is the name that one attributes to a complex strategical situation in a particular society” (Foucault 1978, 93). In other words, to see power as a force that can be attributed or institutionalized – that is, to reify it – is to “misunderstand the strictly relational character of power relationships” (Foucault 1978, 95). It has been suggested (Gallagher 2008) that at least some of the confusion about what Foucault means by power stems from an inadequate translation from his native French - it having two words, *pouvoir* and *puissance*, that are both commonly translated as power. Morriss (Gallagher 2008), argues that *pouvoir*, used by Foucault, connotes action, while *puissance*, largely ignored by Foucault, resembles more closely the English concept of capacity.

As already mentioned, Foucault understands power as actions taken upon actions. In this view, power enables or encourages certain actions while it inhibits or discourages others. It may be tempting to view power as conspiratorial, as covert domination, whereby a reified Power comes to be seen as serving an historical inevitability (think Hegel's idealism or Marx's class struggle). Further, argues Prado (1995), this view makes it seem as though Power, if only properly identified and understood, was something that we could be liberated from. Again, this is also a common thread in empowerment discourse. But to assign instances of intimidation, coercion, prohibition, and domination as constituting power would be to mistake the parts for the whole (Prado 1995). Indeed, wherever there is power, argues Foucault (1978, 95), "there is resistance, and yet, or rather consequently, this resistance is never in a position of exteriority in relation to power." This is because power is to be understood as the totality of relations, a dynamic whole whereby the "multiplicity of force relations" that constitute it, through their ceaseless struggles and confrontations, are constantly being modified by one another as well as internally (Prado 1995, 71).

If power is a "complex strategical situation" – the totality of relations – then it is not a disposition, a capacity, nor a commodity; it is something that is exercised (Gallagher 2008). For Foucault, power does not exist in the abstract. If the power to do something, such as voting or vetoing, is not enacted, it remains an unrealized capacity or potential, but not a power (Gallagher 2008). We need to move beyond thinking about power as a system composed of law-and- sovereign, argues Foucault (1978), and seek, instead, to analyze the mechanisms of power in the sphere of force relations. To further clarify, Foucault calls our attention to Machiavelli: "And if it is true that [he] was among

the few – and this no doubt was the scandal of his ‘cynicism’ – who conceived the power of the Prince in terms of force relationships, perhaps we need to go one step further, do without the persona of the Prince, and decipher power mechanisms on the basis of strategy that is immanent in force relationships” (1978, 97).

Prado (1995, 72) offers a useful model for conceptualizing Foucault’s actions upon actions. He asks us to imagine an assortment of small magnets spread out on a surface just far enough apart so as not to clump together. Magnetic force vectors, as we know, will consequently be established amongst and between the magnets. Now imagine iron filings scattered over this surface. These filings will trace along the magnetic vectors, aligning in various ways relative to the magnets. Now, he asks us, imagine shifting the magnets around. The movement of the magnets will alter the force-vectors, changing the alignment of the filings. The magnets in this model represent agents, the filings are behavioural options, and the force-vectors are power. What Prado (1995, 72) makes clear here is that “every time an agent acts, the ‘strategical situation’ in its vicinity changes and in turn affects the whole.” What is more, it becomes clear that this field of power is not any one agent’s to have at the expense of another any more than one magnet can claim responsibility for the totality of force relations between all the magnets. As Foucault (1980b, 98) argues:

[P]ower is not to be taken to be a phenomenon of one individual’s consolidated and homogeneous domination over others, or that of one group or class over others. What, by contrast, should always be kept in mind is that power, if we do not take too distant of a view of it, is not that which makes the difference between those who exclusively possess and retain it, and those who do not have it and submit to it. Power must be analysed as something which circulates, or rather as something which only functions in the form of a chain.

The implications here are instructive. If the field of power shifts and changes every time an agent acts, we should not expect that any particular instance of participation will be the same as another (Gallagher 2008). The power that the Department of Fisheries exercises over the fisherman or aquaculture industry, for example, will not be the same power that the fisherman or aquaculture industry employ to conform to or resist it. Further, it will be of no use whatsoever to go in search of a grand theory of power (i.e. one that explains the surface upon which the magnets are located, as well as all the magnets, all the forces between them and all the filings along those forces). What is required is to focus on how power is employed and exercised in particular contexts and at particular relational sites. To say, for example, that the Department of Fisheries exercises power over fisherman, or that the aquaculture industry exercises power over politicians, is similar to saying that a room is made up of atoms – true in a strict sense, but meaningless in its generality (Gallagher 2008). It is, then, the localized mechanisms, deployments and effects that are of concern when analysing power.

2.4.3 Critical GIS

Critical GIS, then, begins by taking a critical look at who is likely to benefit from such a map, as well as why, and how. Here, maps are viewed as the product of human decisions that are, themselves, based upon assumptions about representation, emphasis, shape, design, uncertainty, and so forth. As these decisions and assumptions have impacts upon and are impacted by force relations, maps become a locus of power, whether or not this is observed or desired (Wright, Duncan, and Lach 2009). Clayton (2015) argues that maps are, in fact, the quintessential instruments of Foucault's governmentality: they sift

and sort populations and territories into grids of power and normalization. For instance, in the fisheries sector lobster fishermen have been sorted into lobster fishing areas (LFAs). The licensing of their activities are now arbitrarily delineated along geographic boundaries and subjected to the scrutiny of additional government surveillance. This being the case, maps must be viewed as political statements, located within specific relations of power, and are not, therefore, simply neutral documents (Crampton and Krygier 2005).

Even if the production of a marine debris map was founded on the best of intentions, there remains many troubling ethical implications. For example, once created, there is no way to predict the impacts and ramifications that would flow from such a document. One of the largest criticisms levied against the application of GIS technologies is that it greatly facilitates surveillance. It renders populations visible (Crampton 1995). This increase of surveillance capacity could lead to oppressive new policies and greater government control throughout ocean industries that are already heavily burdened with bureaucracy and restriction. Undoubtedly, then, some stakeholders, such as government or industries with deep pocketbooks, could withstand, if not benefit from, the impacts of the map, while more marginal industries or stakeholders could find themselves at a terrible disadvantage.

Critical GIS helps to rectify some of the gaps in the mapping process by attending to the political nature of map production. It helps to situate the researcher within the field of force relations and, thereby, demands a more thoughtful and deliberate undertaking of the research. Critical GIS, though, has its blind spots too. Here, the analytical emphasis turns on how a GIS map empowers some while disempowering others. It follows the

trajectory of power amongst and between the stakeholders and seeks to explain imbalances in power relations through a careful study of the “techniques and tactics of domination” (Foucault 1980a, 102). The power/ knowledge apparatus of a Foucauldian critical analysis recognizes, to be sure, the discursive conditions of possibility and boundaries of subjectivity that the introduction of a GIS establishes between agents. What is lacking, however, is an adequate explanatory consideration of how the resultant relations of power stabilize and become entrenched. This blind spot is the result of traditional social science methods confining analyses to only human agency – or, to social explanations. Indeed, even Foucault, in both his archaeological and genealogical works, reserves explicit agency for humans only (Pyyhtinen and Tamminen 2011).

Here, actor-network theory (ANT) seems capable of not only accounting for the analytical holes discussed above, but also of providing a more complete and nuanced interpretation of just how the introduction of a GIS map of marine debris might interact with, and act upon, research participants, stakeholders, and beyond.

2.5 Actor-Network Theory

According to Latour (2005, 24), “ANT claims that it is possible to trace more sturdy relations and discover more revealing patterns by finding a way to register the links between unstable and shifting frames of reference rather than by trying to keep one frame stable.” Latour argues that instead of taking the traditional path of the social sciences – that is, delineating a list of actors, methods, and domains as pre-existing categorizations of a *social realm*; or, to mistakenly employ the terms ‘power’, ‘society’, ‘structure’, and ‘context’ as indicators of a behind the scenes puppet master at work –

social science research should instead proceed by puzzling through five major uncertainties: the nature of groups; the nature of actions; the nature of objects; the nature of facts; and, the nature of texts. In the following section, taking my cue from Latour (2005), I will explore what a “puzzling through” of these uncertainties might have to offer to an analysis of the application of GIS technologies, and how my research project as a whole might benefit from a consideration of ANT.

2.5.1 Determining the Aggregate

As briefly touched upon above, my task in beginning an investigation into the variety of subjective experiences and perceptions of risk would traditionally be to place respondents into certain *groups* or categorizations. I might, then, decide that I wish to categorize informants by occupation, location, education, or some other arbitrarily determined kind. I would, of course, acknowledge this arbitrariness and the limitations that choosing one category or group over others may place on the findings of my research; this decision would likely be justified as part of the necessity of “limiting my scope” and of “defining my object of study”. Yet beginning here, argues Latour (2005), is to proceed from a faulty and misguided debate of just what social aggregates are or should be made of. Social science has, when defining this group or that as constituting the appropriate level of analysis, tended to appeal to a kind of “social inertia”, as if the various connections amongst and between members of the group were held together with

an invisible glue whose bonding power could only be loosed after the long passage of time. ANT does not accept this position.

Latour (2005, 35) states: "...if you stop making and remaking groups, you stop having groups. No reservoir of forces flowing from 'social forces' will help you." For him, groups are not an established *thing*, but instead the conditional outcome of a myriad of contradictions about "what is a group and who pertains to what" (2005, 31). In traditional social science, "social forces" hum in the background of an already constituted social order. These forces of the social order at once, then, give form to groups, while also reflecting said social order through them. That is, groups are mere avatars for the already established social order; they represent it; they are the *intermediaries* that transmit it. ANT, however, maintains that there is no society to begin with, no invisible glue or magical social forces that keeps groups bound together. They are, instead, "a movement in need of continuation" (Latour 2005, 37).

Members of groups, then, must actively engage in the process of defining and redefining what the group is. Further, there is no reason why members of a particular group should be bound to only that group. In fact, it is the case that all people are engaged in the process of defining and constituting multiple groups at any given time. Today, for example, I went to the university campus where I participate as a member of the group *student*, drove my car with a licence plate that defines me as a member of the

group *New Brunswicker*, shopped at the grocery store where I was a member of the group *store patron*, and played my guitar as a member of the group *musician*. For ANT, there is very little analytical value in arbitrarily designating me as only a member of, say, musician. To do so would only serve to amplify that part of me that participates as a member of the musician group, while rendering invisible those aspects of me that fall outside of this membership. The narrowness of such an approach becomes even more apparent when considering that what it means for me to be a musician might, in fact, be informed by my residency in New Brunswick or my experiences as a student. These are precisely the nuances that ANT seeks to capture. Further, it should also be noted that these groups can only be groups if there continue to be students attending the university, people living in New Brunswick, patrons shopping at the grocery store and musicians playing instruments. Without the active and ongoing participation in these activities, the groups simply cease to exist. There is no social order that they return to, no social force operating to maintain the group in absence of the interest of participants to continue to participate.

If I were to take these uncertainties of groups offered by ANT seriously, there are some interesting implications for the direction of my research. It is obvious that the mapping of subjectivities into GIS layers would not be as simple as grouping commercial fishermen into one layer, the aquaculture industry into another layer, and tourism operator into another layer. To say, for example, that on average commercial fishermen

view chains and rope as the riskiest marine debris is so narrow and vague a statement that it is almost meaningless. As ANT suggests, grouping subjectivity based on an arbitrarily assigned group affiliation, such as occupation, fails to notice and account for all the other ways an individual's subjectivity may be [in]formed. For instance, what if one of the respondents assigned to the group 'commercial fishermen' used to work as a diver for aquaculture? Shall we count his data in both the fishermen and aquaculture layers? Or, what if our informant fisherman has a partner that works for the aquaculture industry? Is it not likely that discussions around the dinner table would affect his subjective point of view? Imagine also that our informant fisherman has only been an active member of this occupation-based group for two seasons, or is a deck hand rather than a skipper, or is the son of a fisherman rather than just growing up in a fishing community. Which one of these indicators is sufficient enough for his subjective perceptions to be counted as part of the aggregated data of all members of the fishermen group?

Rather than determining at the outset how to group respondents, ANT encourages the researcher to instead allow the respondents to define themselves. My goal here, then, would be to attempt to trace connections to other subjective forming sites – including (but not limited to) past employment, close associations, or years of experience – that may emerge through discussions with a particular respondent. The challenge then would be to figure out how to reflect a more nuanced account of subjective perceptions of risk within a GIS. If maps are not just the communicative *intermediaries* of a reality “out there”, but, rather, the *mediators* through which data enters on one side and a reality becomes enacted – produced – on the other side, then limiting its productive capacity at the outset by

myopically focusing on such and such a group reduces the value of even doing the research in the first place.

2.5.2 Determining Who is Acting

There is a long-held suspicion, a tradition in social sciences, that one is never alone in settling on a course of action. Indeed, this intuition is so strong that it often transcends academe and expresses itself in popular discourse. We might, for example, read in the newspaper of how a young man accused of manslaughter had a “rough childhood”; we might overhear teachers wondering if Sarah’s negative behaviour indicates that things are not going well at home; we might even find ourselves wondering, when visiting a university campus, how it is that everyone seems to be dressed in the same way, carrying around the same devices, and drinking the same drinks. Latour (2005, 45) argues that action has been “...taken up by others and shared with the masses. It is mysteriously carried out and at the same time distributed to others.” We are never alone when we act. “Action is not done under the full control of consciousness; action should rather be felt as a node, a knot, and a conglomerate of many surprising sets of agencies that have to be slowly disentangled” (2005, 44).

So, ANT accepts that action is entangled, that it is never an isolated event. This realization, however, must be accepted with caution. It is, Latour (2005) points out, an enormous and indefensible leap to begin with the notion that action has been overtaken –

a position ANT accepts – to the conclusion that some sort of social force has done the overtaking. Latour (2005, 46) suggests that the best way to avoid falling into this trap is to “reactivate the metaphors implied in the word *actor*.” This is because the word ‘actor’ avoids pinpointing who and what is doing the acting. An actor on stage is never alone; she is always implicated in a complex network of stage-hands, prompters, sets, props, other actors, and so forth. Through this metaphor, then, it becomes obvious that action is not a particular incident, but, rather, the culmination of a multitude of interactions, “a surprise, a mediation event” (2005, 45). The solution to not being able to determine exactly what is making us act, suggests Latour, is to evaluate a set of features that are always present in opposing accounts regarding what has happened: the account of agencies; the figuration of those agencies; the opposition of those agencies by other competing agencies; and, the accompaniment of some explicit theory of action.

Through the course of my research, I have noticed a particular action cropping up over and over again: when the floor is opened up for stakeholders to express their concerns about certain types of debris, representatives from the salmon aquaculture industry invariably raise the alarm over the potential damage that herring weir debris, and specifically floating wooden stakes, could do to their various operations. To date, no one has offered an occasion where this has actually happened, nor do very many informants (outside of aquaculture) seem to take seriously that this is something that even *could* happen. So, how might I go about trying to explain why aquaculture representatives act, or, rather, perform, in this way? A traditional approach might attempt to explain the

performance as merely the effect, expression, or reflection of some other thing, such as, say, market pressures, government regulation, or homo economicus. Here, the act is just one of many possible effects deduced from a small handful of imagined prime causes. It should be noticed, however, that these causes are just arbitrarily defined groups of *stuff*, containing no more substance than *New Brunswicker*, or *student*, and lead just as surely to myopia.

An ANT investigation into this performance, this action, of an aquaculture actor does not allow for the invocation of social forces or prime movers. Instead, an ANT approach would look to locate the agencies in the accounts of what aquaculture has *done*, what *difference* it has made thorough the act, what *transformation* it has caused. It would seek to distill the *actant* from the various *figurations* of the account of agency. That is, an ANT approach will not assume that aquaculture's performance was an effect 'in potentia' just waiting to spring forth, but that it was a response to, or provoked by, an introduction into the network assemblage. ANT traces the various oppositions of some agencies against other agencies and the ceaseless debate over which agencies should be defended and those that should be, in the case of marine debris, held responsible. Finally, an ANT approach, rather than simply assigning to the cause of the performance a metaphysical theory originating outside of the network assemblage, or one the actors had not even themselves considered, will, instead, give room for situated accounts of what is going on.

This means listening to the explanations of the performance offered by the various stakeholders (weir fishermen, government, NGOs, aquaculture, and so forth). In short, the solution to the uncertainties regarding actions is to imagine a world composed of a web of interconnected mediators where each node can be said to fully act (Latour 2005). Humans, though, are not, according to ANT, the only things capable of acting.

2.5.3 The Agency of Objects

Perhaps one of the more controversial aspects of Actor Network Theory is that, in tracing agencies out within research assemblages, objects, too, need to be included. That is, objects have agency. For Latour (2000, 19), objects, such as quirky keyholes and specialized keys, "...do not express, symbolize, reflect, reify, objectify, incarnate disciplinary relations, they make them, they form them. The very notion of discipline is impractical without steel, without the wood of the door, without the bolt of the locks." That this is so, he argues, is evident in the observation that the owners of the building, of which the keyhole and key belong, were not able to establish the desired relations, behaviours, or disciplines through verbal persuasion, negotiations or friendly customs.

Instead, the owners had to expand their network assemblage by incorporating new relations and new alliances, by recruiting the expertise of a locksmith, an architect, a mathematician, a carpenter. Once completed, the key to the lock proceeds from being a simple tool to assuming "all the dignity of a mediator, a social actor, an agent, an active

being” (Latour 2000, 19). Yet the key does not force the enactment of certain behaviours by itself; it has, of course, no agenda or intentions of its own. Nevertheless, the key assumes the role of an *actant*, of a node in a series of nodes, each mediating the enactment of the other. Actors who wish to pass through the door must do so in the manner in which the *key* allows. The key, then, might be seen as the stabilizer of a set of social relations of which social forces on their own were incapable of sustaining, i.e. no one can accidentally leave the main entrance to the building open at night when there is no caretaker on duty.

Indeed, if the social world of the building owner was constructed out of only local social ties, such as persuasion, negotiations or local customs, it could only ever be of the provisional sort - constantly susceptible to fast-decaying relations and shifting alliances, and in continual need of shoring up. Even if the owner was able to persuade the people to lock up carefully after themselves when they enter at night it would likely be that at some point some people would require an exception for some extenuating circumstance or other. Soon, there would be people who would seek an exception for less urgent circumstances. Before long, many people might not see much need in continuing this particular arrangement at all. Such is the nature of relational asymmetries, imbalances and inequalities generated through only social ties. This, then, is the point to stress: if power relations have become entrenched, if inequality and asymmetry have stabilized, it is not the result of society itself. It is, rather, the consequence of that power being

“exerted through entities that don’t sleep and associations that don’t break down, that allow power to last longer and expand further” (Latour 2005, 70).

ANT, then, would view the construction of a GIS map as being the introduction into the network assemblage of an actant that has the potential to both shift and stabilize asymmetrical power relations. Moreover, what makes the GIS map so interesting from an ANT point of view, as Harvey and Chrisman (1998, 1693) point out, is that it is not constructed upon a monolithic nor autonomous edifice, but is, rather, the result of “processes of negotiation that involve the construction of artifacts to fit various social perspectives.” In other words, the map, as an actant, does not become inserted into the network assemblage, nor obtain its stabilizing abilities directly from the interests of any one particular group or stakeholder; it is an artifact that has been manifested as a consequence of multiple values.

Maps, as with other objects, however, by the very nature of their entanglement with humans, quickly recede into the background, where the importance of their agency and mediation within the network assemblage disappears. The visibility of their connection to human action is rendered invisible, forgotten, lost (Latour 2005). The benefit of using an ANT approach in my research is that the generation of a GIS map and its introduction into the actor-network assemblage of marine debris stakeholders is, in effect, a site of innovation; the connections are fresh and the agency of the map, its ability to make actors *do*, is still visible in its novelty. Further, the negotiations, compromises and contentions that precede the final shape of the map are also observable. This provides

the opportunity to trace in real-time the journey from several mediating actant nodes to the genesis of a new node, and then the subsequent impacts this may have in the production of new stabilized relations. Interestingly, that the content of the map is admittedly decided upon through contestation means that the map itself cannot be the mere objective representation of marine debris “out there”. It means that it must be the embodiment of something other than *truth*.

2.5.4 Manufacturing Facts

“If truth by itself is not a gold standard,” wonders Law (Law 2004, 13), “then perhaps there may be additional *political* reasons for preferring and enacting one kind of reality rather than another” (emphasis in original). Indeed. I have observed, through my participation in several Marine Debris Advisory Group (MDAG) meetings, for example, how some stakeholders wish to anonymize, or render invisible, any spatially rendered data that may single out their industry as a producer of marine debris. One spokesperson for the aquaculture industry responded, when asked if they had any concerns about, or felt there were risks in, the mapping process, that “mapping could lead to finger pointing, rather than taking a holistic approach to remediation.” They felt that any sector specific data would divert from the objective of environmental remediation, that the process, therefore, should avoid blame. Contradictorily, this same respondent, during the same interview, stressed that “... my pet peeve really is the abandoned herring weirs.” There is, quite obviously, an ontological politic (described further below) at play here.

So, what reality, then, shall the map depict? One in which the marine debris has no source, no origin, no cause? One in which all debris is created equal, in which a 5” diameter floating softwood pole poses the same risk as steel chain moored to a cement block and derelict aquaculture staging? Perhaps the map should reflect a reality where the composition of debris is categorized by type, or weight, or material, or recoverability, or, instead, is associated with the activity that produced it. What is at stake, then, is what *reality* is going to be represented; and, as Law rightly suspects, there are political reasons for preferring one enactment over another. What should be obvious at this point in the discussion is that there are *multiple realities*, multiple truths, being moved around and considered.

ANT is not suggesting that there does not exist a shared world, a common single reality; it accepts that there is. What is suggested, rather, is that this common reality only comes into being *after* the controversies, negotiations and statements reporting on it have become fixed and have gained assent. Moreover, prior to becoming fixed, reality is not only indefinite, but also multiple (Law 2004, 32). It is important to note, though, that it is not the materiality of marine debris that is being rearranged and manipulated during these negotiations, but the levels of gathered figures, tables, charts, graphs, symbols, and maps, meant to represent it. These data are gathered using various research methods, by using what Law (2004) calls *inscription devices*. Inscription devices are the instruments

(machines, tools, approaches) that mediate between the reality “out there”, and the disciplinary knowledges “in here”.

Inscription devices, as with the objects described above, tend to disappear after agreement on a statement of reality “out there” has been reached, along with the subjective and personal positions that were in play during the negotiations thereof. This has the effect of making it seem as though the research methods and inscription devices were simply engaged in discovering and depicting reality. Yet, a consideration of how the map, as an inscription device and methods-assemblage, is filtered through various perspectives and negotiated into being paints a very different picture of what is going on. Inscription devices, rather than mere depicitors of reality, are themselves participating in the enactment of the realities they purport to be explaining (Law 2004). In other words, there is a two-way interaction between enactments on one hand, and reality on the other. Enactments are not just the performance of something already assembled, they also have productive, generative properties; they help produce reality.

ANT does not assume that a map of marine debris is anything more than an inscription device that enacts and produces the particular reality arrived at by the marine debris stakeholders and researchers. Such an approach, then, leaves me, as the researcher, free to explore and trace all the nodes and interactions that have led to the construction of a particular map that is enacting a particular reality and the ways in which that enactment might stabilize and entrench certain social relations. Yet, as Harvey and Chrisman (1998) argue, the social construction of a GIS object is only stable for a specific moment and

susceptible to constant renegotiation. If this is the case, an ANT approach suggests that it will be possible to observe an actant (map) make actors do some things now and different things later. It will be possible to see reality become fixed, relations transformed, shifted, stabilized, before it is all springs forth anew from a reinterpretation of the very same inscription device. This has the potential to shed a fascinating light on how policy is shaped and reshaped.

2.5.5 What can ANT Produce?

The goal of any scientific or social science inquiry is to wind up with enough data that an analysis may be undertaken, a conclusion of some sort reached, and a textual document produced that proclaims to the world (or at least to the discipline) the marvelous new realities and the terrific new truths revealed. As I have shown, however, those realities and truths are not things waiting “out there” to be discovered. They are, instead, the momentary assemblage of a multitude of things – objects, actors, social relations, statements, agencies – that we have agreed to call, for now, reality and truth. There are, in fact, other possible realities, multiple other truths that could have just as easily been derived, negotiated, achieved, through this same assemblage, and even more that will surely flow from it. If this is the case, though, if the truths written down in our texts are just momentary, locally situated, contested, and contingent assemblages that will

become something different as soon as we publish, what is it that can be achieved through ANT? What good are our texts?

Here, Mol (1999) might have some direction to offer. She begins by stressing differences in the terms social science and philosophy traditionally use when talking about reality. *Perspectivalism*, she explains, “broke away from a monopolistic version of truth. But it didn’t multiply reality. It multiplied the eyes of the beholders” (1999, 76). So, within perspectivalism there remains a fixed ‘object’, but a plural understanding and experience of it. This is a pluralistic reality. Alternatively, *constructivism* suggests that alternative constructions of reality were possible in the past, but vanished when those potentials were narrowed down to one choice. This, Mol (1999, 76) says, “is a plurality projected into the past.” What ANT gives us, however, by talking about *multiple* realities, is a reality that needs to be *done* and *enacted*, rather than simply observed. In her own words:

[R]eality is manipulated by means of various tools in the course of a diversity of practices. Here it is being cut into with a scalpel; there it is being bombarded with ultrasound; and somewhere else, a little further along the way, it is being put on a scale in order to be weighed. But as a part of such different activities, the object in question varies from one stage to the next. Here it is a fleshy object, there one that is thick and opaque and in the next place it is heavy. In performance stories fleshiness, opacity and weight are not attributes of a single object with an essence which hides. Nor is it the role of tools to lay them bare as if they were so many aspects of a single reality. Instead of attributes or aspects, *they are different versions of the object, versions that the tools help to enact. They are different and yet related objects.* They are multiple forms of reality. (1999, 77 emphasis added)

In ANT, there is not one object, experienced variably, but variable objects multiply enacted.

This distinction is significant. What both Law and Mol propose is an *ontological politics* that recognizes that there might be options between the various versions of an object, some more desirable than others, and that we might choose which reality or version to enact. In order to do this, in order to know which realities should be enacted, we would need to be able to locate where these differences are located within the network assemblages. We would need to be able to trace decisions from one node to another and ask what was at stake when choosing one enactment over possible others (Mol 1999). With an ontological politics, argues Law (2004, 67), “we might hope, instead, to interfere, to make some realities realer, others less so. The good of making a difference will live alongside – and sometimes displace – that of enacting truth.” Tracing, then, all of the various connections and interactions that coalesce into and flow from a GIS map of marine debris might equip stakeholders with more than just the traditional social science capacity to describe, explain, and espouse a discovered truth; it may, in a decidedly more useful sense, empower them to intervene, craft, and decide which realities they wish to enact, produce, and amplify. To summarize, marine debris is defined by its association with risk. That is, something can only be called debris if it is viewed as posing a risk – be that to safety, the economy,

property, human endeavours or wildlife. Risk itself is differentially enacted, affected by social, cultural or political positionality, and, therefore, locally situated. Yet risk has also become a compulsory medium of communication through which even those separated by geographic space or irreconcilable differences must engage. In the next chapter I explore the research methods suggested by this theoretical approach.

Chapter 3: Methodology

Testing the utility of a PPGIS in dealing with the environmental and human risk of marine debris requires a multi-methods approach capable of gathering a number of different kinds of data: the types, location, sources and objective impacts of marine debris; how a diversity of stakeholders with varied interests, but operating in the same regulated space, view the associated risks of this debris differently; how risk becomes the medium of communication within a “forced democracy”, where different conceptions of risk are contested and constitute part of the positionality within a political economy of force relations; and finally, how the introduction of collaborative PPGIS methods, and the map generated through them, into this political economy may or may not assist in building consensus for more robust institutional systems of mitigation. As noted in the previous chapter, the use of GIS systems of mapping, especially within a contested space, has not been without its controversy.

3.1 Defining “Participation” and “Public”

As the knowledge of debris location, its impacts, and any associated risks to marine activity must come from the various situated stakeholders – in this case, those parties who see themselves as being in opposition with respect to the management of marine debris - their participation was essential. As PPGIS, in response to the various criticisms of GIS technologies (see previous chapter), seeks to combine the activities of technology-based spatial analysis and participatory democracy, its deployment must begin by defining what constitutes *participation* and *public*. For the purposes of this study, *participation* was oriented towards the goals of conflict prevention/ resolution and

empowerment in planning processes. Connor (1988) argues that participation can be used as a “systematic approach to preventing and resolving public controversy about specific policies, programs and projects...whether governmental or private sector in sponsorship.” This goal was well suited to the problem of politically deployed enactments of marine debris and risks being addressed by this study.

Schlossberg and Shuford (2005) define the *Public* in two distinct ways: as “actual people organized in some type of grouping or in terms of methods for identifying and selecting such people.” Taking a combination of the two, we (the UNB research team) approached the concept of *public* first by identifying fishermen as a particularly mobile and active stakeholder group within the study area - and, therefore, likely to have a broad knowledge of the types, locations, and impacts of marine debris. We then conducted focus group discussions to gauge what marine debris they view as posing the greatest risks (see below for more on the mapping of marine debris). Proceeding from this information we were then able to follow Schlossberg and Shuford’s (2005, 19) “five questions” (see previous chapter) to identify what constituted the ‘public’ that we needed to include in the PPGIS process. We determined that the two primary⁷ stakeholders this study should account for were the commercial fishermen⁸ and the aquaculture industry, but also needed to include federal and provincial government – as they were called upon to mediate the disputes between fishermen and aquaculture – environmental scientists

⁷ This determination was made on the basis that much of the marine debris that the study was focused on - that is, large, mostly fixed in the water column, and posing immediate and direct risk to human activities - comes from these two stakeholder groups. As a consequence, these two industries have at once the most to gain or lose from outcomes regarding risk management actions and policies.

⁸ Throughout this work I use the word fishermen to refer to all the members of the fisheries that I interacted with. While it is certainly the case that women can be and are fishers, in the study area fishing is still an activity done almost exclusively by men.

and researchers – as they were called upon to conceptualize the problem – and other groups – as they were called upon as experts in remediation. With public and participation frameworks established, I will now move on to describe what marine debris is and how it was mapped.

3.2 Mapping Marine Debris and Capturing Subjective Risk

As described in the previous chapter, marine debris can consist of many types, many sources and can pose a wide assortment of risks. For the purposes of this study we limited our focus to debris that was both of high priority for remediation - as determined by perceived risk and actual impacts - yet was also feasible to mitigate. This generally meant that much of our focus was on marine debris generated by the fisheries and aquaculture sectors, such as ropes, netting, buoys, derelict caging, derelict weirs, piping, mooring blocks, etcetera.

The process of constructing the GIS tool for use was primarily undertaken by other members of the UNB research team. To summarize Barnett et al. (2016), regional topographic data, US Geological Survey bathymetric data, LFA boundaries, ferry routes and shipping lanes, and other relevant information was imported into GIS layers comprising a baseline data set. Federal and provincial data on the geographic location of weir leases, aquaculture leases, and lobster pounds were also incorporated, along with the locations where ghost trap removals had previously been completed (see Canaport LNG Limited Partnership 2009). This cursory data provided stakeholders with points of reference through which to recall the spatial locations of marine debris.

With this baseline data in hand, the research team and I first turned to inshore fishermen, representing collective experience with a variety of fishing methods and technologies, as well as specific geographic and spatial knowledges. Three focus group discussions (FGD) were held at Deer Island, Campobello, and Back Bay (Figure 2), representing a geographic sample that captures the areas with the highest density of activities. Fishermen were asked what kinds of debris they encountered and what posed the greatest risk to their activities. We also asked them to elaborate on types of debris and their sources, what should be considered a priority for cleanup, and if they had any concerns about the mapping process. The FGDs were audio-recorded and I transcribed them for accuracy. Identified marine debris points were transferred into the GIS tool by other parties in the research, along with the event the data was captured from and any associated descriptions and perceived risks.

Data was also captured opportunistically at public meetings and events like “lobster tag distribution days,” in an effort to ground-truth previously captured data as well as add to the comprehensiveness of the GIS tool. In total, fishermen provided a total of 59 unique marine debris data points, many of which were identified as posing some kind of risk to human activities, and many of which were directly associated with the aquaculture industry. We then sought the participation of aquaculture in order to incorporate their subjective and objective data into the GIS.

Two meetings were held with aquaculture representatives. The first, held on September 23, 2015, included two industry representatives, a spokesperson each from two of the biggest aquaculture companies operating in the area, and two representatives from the provincial Department of Agriculture, Aquaculture and Fisheries. The second

meeting, held on December 3, 2015, included an industry representative and two persons employed in the sector. The selection of participants here was undertaken opportunistically, as tracking down and coordinating with willing participants from the aquaculture industry proved difficult and time consuming. We asked them to respond to the GIS tool that had been updated to reflect the data captured from the fishermen, as well as to a similar set of questions that had been posed to the fishermen. The incorporation of their data helped us to refine our data and ground-truth some points. With all relevant data combined, the GIS tool at this time reflected 63 unique debris points (Figure 3)⁹.

This approach allowed the research team and I to capture the specific and differentiated risk perceptions of both major stakeholder groups, while quantifying these within the GIS locations of debris. This combination of subjective and objective data allowed us to move forward to include other stakeholders; it opened up the opportunity to introduce this data into the political economy of marine debris stakeholders in order to verify objective data while using the subjective perceptions to get at questions of priority ranking, positionality, empowerment, and risk management actions. So, with the map incorporating data from the two primary stakeholders, I moved towards addressing the political economy of marine debris in the study area.

⁹ For a better understanding of how the complete GIS map appeared and how the various layers related to one another, follow this link to an online version: <https://www.google.com/maps/d/viewer?mid=1q9PlxtLr4GsqMWfyh0hEvTHFrXy&ll=45.00892604366778%2C-66.86064430810546&z=12>. See also Appendix 3 for discussion of the problems associated with digital maps.

3.3 Political Economy of Risk

In order to answer how and why risk is differently enacted within the same regulated space, how these differences might affect outcomes, and how risk might become a medium of communication I relied on direct and indirect participant observation (see Bernard 2011). First, along with 4 other team members, I attended several Marine Debris Strategic Advisory Committee (MDSAC) meetings. The UNB research team held a collaborative seat on this committee, contributing our accumulating knowledge of marine debris as well as making available resources and skills. These meetings also provided me with the opportunity to identify key stakeholders as well as to observe how these stakeholders were organizing themselves around the issue of marine debris prior to the introduction of the PPGIS process and resultant GIS tool. Observations and meeting notes were recorded in notebooks by each attending UNB team member, and these were shared and compared after the meetings.

In addition to the MDSAC meetings, I organized a multi-stakeholder roundtable discussion on behalf of our research partners at the Fundy North Fishermen's Association (FNFA). Here, the FNFA had a modest budget - around \$12,000.00 - that they had received from the government with the mandate to do marine debris remediation/cleanup. The idea, stemming from a lack of active public or government engagement with the issue,¹⁰ was to utilize our connections with many of the key stakeholders in the area in order to work towards the effective and efficient utilization of the remediation

¹⁰ By April, 2016, the MDSAC had become idle as a result of the departure of the coordinator and no active process to hire a replacement.

budget. The organization of the roundtable was based upon the PPGIS framework for *public* and *participation* (see above). Individuals or groups were invited to participate in the roundtable if they were identified as being key stakeholders in the area.¹¹ Attendees were provided with an agenda and map handouts at the event. The GIS map of 63 objective debris locations and associated subjective risks was used to guide the roundtable discussion, offering an opportunity for all attending stakeholders to engage with, improve upon, negotiate and prioritize the GIS data within a collaborative PPGIS-based environment. Attending stakeholders consisted of the following: 1 DFO marine biologist; 5 representatives from the aquaculture industry, 4 representatives from fisheries, 3 members of environmental NGOs, 3 representatives from the provincial government, 3 members of the UNB research team (including myself), and 1 waste disposal services representative. In all, there were 21 participants including the facilitator.

The roundtable provided the perfect opportunity to observe in real time how stakeholders responded to the map - what was useful to them or problematic, and why - how the assembled stakeholders interacted with one another and the GIS technology, and whether or if consensus regarding risk management and remediative actions could be attained through the PPGIS process. Observations of the PPGIS process was recorded in notebooks and shared between the three attending UNB researchers afterwards. With our collective observations of the process gathered, it was next necessary to hear from the

¹¹ A stakeholder is any individual or group that has been identified as falling within Schlossberg and Shuford's (2005) "5 questions", or otherwise in possession of an expertise required to intercede at any stage of the remediation process.

participants themselves as to their perceptions of the usefulness of the GIS map and the PPGIS process as a whole.

3.4 Assessing the Usefulness of PPGIS

In order to further gauge the usefulness of the map and PPGIS process I conducted subsequent semi-structured interviews with participants of the roundtable. All roundtable participants were invited to participate in a one-on-one interview with me following the roundtable. A total of eleven participants - consisting of aquaculture, fishermen, provincial government, NGOs, regional services and federal science department - agreed to be interviewed. This sample represented approximately 50% of roundtable attendees; this, in addition to the diversity of backgrounds, makes the data gathered statistically relevant to gauge participant perceptions. The semi-structured format of the interviews allowed for comparable data to be gathered across all participants while allowing for the emergence of other important and relevant leads to be explored at the interviewer's discretion. (see Appendix 1 for interview guide). All interviews were audio recorded for accuracy and were subsequently transcribed for analysis.

3.5 Understanding the Problem through Firsthand Observations

To better understand the nature of the marine debris problem, as well as the logistics necessary for its remediation, I spent two days out on the water. The first day, on the water (August 19, 2016) I accompanied the Fundy Baykeeper for a visual survey of several bays and islands in and around Deer Island (Figure 4). Here, we could easily observe several of the kinds of problems many of the Roundtable participants had

referred to. Examples of some of the marine debris we came across during our short outing include an exposed aquaculture compensator buoy (Figure 5), an old herring weir (Figure 6), and washed up aquaculture ABS plastic caging (Figure 7). All of these pieces of debris, explained the Fundy Baykeeper, can pose navigational hazards, depending on their visibility, locations, and whether they are fixed or moving throughout the water column.

On my second day on the water (November 2, 2016) I joined two fishermen to better understand, through my participation, what is entailed in first finding submerged debris, and then removing it. In this case, we were primarily focused on the retrieval of lost lobster traps. Here we relied on dragging a purpose-built grappling hook (Figure 8) around an area of the Bay in hopes of snagging a snarl of traps we could then retrieve. We were able to retrieve close to 20 traps over the course of approximately 6-8 hours on the water (see Figure 9 and Figure 10).

3.6 Data Analysis

The data gathered from the FGDs, meetings with aquaculture, MDSAC meetings, marine debris roundtable and participant interviews was rendered into plain text and loaded into the free and open source software, *RQDA* (HUANG 2016), for coding and qualitative analysis. Charmaz's (2006) grounded theory was used as a methodological guide for doing both the coding and analysis. Following Charmaz (2006, 46), the coding of data took place in two phases: first, an initial phase that involved naming each word, line, or segment of data; the second phase using the most significant or frequent initial codes as the basis for the synthesis and organization of larger amounts of data. Every

effort was made to keep the initial coding as open-ended as possible, allowing the data to guide discovery. This type of analysis lends itself to dealing with the problems associated with tracing the networks – in an ANT fashion – that determine (1) the different ways marine debris risk is enacted – that is, how the multiple “realities” of marine debris risk are *done* – and (2) how through this enactment, and the culmination of the various connections of a particular risk network, specific possibilities of risk management actions become possible while others do not.

Finally, this project has been reviewed by the Research Ethics Board of the University of New Brunswick and is on file as REB 2014-092 (see appendix 2). The review was of Dr. Melanie G. Wiber’s SSHRC Insight project, under which this research falls.

Chapter 4: Results

In the strictest sense, this project is really about the engagement of participants in a roundtable discussion on marine debris facilitated through the process of PPGIS. By interviewing these participants, I endeavored to discover if PPGIS processes are capable of bringing the oppositional interests of stakeholders away from defensive positions and towards a more collaborative stance. This investigation, however, really began to take shape more than a year prior to the round table when I participated in two separate focus group sessions with local fishermen and two meetings with aquaculture industry representatives.

The intent of the focus groups with the fishermen was to gather fishermen's knowledge of the locations of marine debris, the interactions and activities in the Bay of Fundy that might lead to the generation of that debris, and to use their subjective perceptions of the risks posed by the debris, to develop a GIS tool that might be useful in determining priorities for recovery. After discussing the subsequently generated GIS map with aquaculture, however, it became clear to me just how political marine debris - and the activity of mapping it - really was. As this realization was the first step in determining the shape that this project eventually took, it is necessary that this chapter begin by detailing the themes that emerged from those early meetings. I will then proceed to a description of the multi-stakeholder, roundtable panel on marine debris, followed by an overview of the participants who were subsequently interviewed and the major themes that emerged from them, before providing my concluding thoughts on the data that was generated.

4.1 First Steps: Focus Group Discussions with Fishermen

One of the first activities I undertook as a member of the research team was to accompany my thesis supervisor, Melanie Wiber, and a post-doctoral researcher, Allain Barnett, to two focus group discussions (FGD) that they had organized in order to begin laying the groundwork for the PPGIS project. My goal in this section will not be to go over the results from those discussions in great detail, but, rather, to highlight two themes that emerged from them that had direct impacts on the direction of this investigation: the impacts of marine debris and the tensions it can in turn produce.¹²

4.1.1 The types and impacts of marine debris

When asked what types of debris posed a risk to human activities or the environment fishermen highlighted a variety of examples. One of the main risks highlighted was aquaculture ropes and buoys:

... the aquaculture ropes and buoys and stuff would be the main risk on the water. It doesn't have to be fishermen, it could be recreational or anybody that's on the water, from ferries, to fishermen, to sports people. I've seen 150 feet or more - probably 300 feet of plastic pipe floating in the water. I've called the Grand Manan ferry and warned them. If you get that in a prop on a windy day, by the time they got it out, they'd have a good chance of being ashore. If I hit it with my boat, I could move, I wouldn't be there. That's just an example of some of the stuff that we see. And an inch and a quarter of rope - there is no prop around that would be able to spit that out ... and that's what they use in aquaculture. And we don't use that in lobster fishing. (FGD, March 11, 2015)

The hazards associated with the rope is further complicated, however, by its interaction with the environment itself:

¹²For a more comprehensive treatment on these particular focus group discussions and how they relate to the overall marine debris PPGIS project, see Barnett *et al* (2016).

R1: ... and once the buoy is off of it and the growth is on it, it sinks. So they don't know where it is. And eventually that stuff, when it gets to bottom, dies and decays, and the rope floats again. And if they are not there to get it, it grasses up or the mussels grow on it, and it'll go back to the bottom again. We foul it with our lobster gear and haul it up and there it is. If we don't put a tie on it, but drop it overboard, then somebody else comes along and they are going to foul it. Someday, somebody - well they have already - is gonna get in a mess themselves.

R2: Yes, I've seen it on a number of occasions on a number of sites, where [aquaculture] clean it up and they don't get it all. Because they can't see it, you know? You can't go and say: "Well you didn't clean it up," because they tried and they didn't get it all. You can't point fingers at any one person. But it happens - I seen it. And if you want to know where, in Letete, in Kelly's Cove. There is no salmon there anymore but last spring, setting traps, a bunch of rope came up, and I didn't even know it was there. Scared me half to death, and I took my traps and moved them somewhere else. I don't want to go back in there, you know? If you moved the boat at the wrong time, or didn't know it was there and got it in your prop, you are done for. (FGD, March 11, 2015)

Fishermen also noted that derelict or untended aquaculture caging can have significant impacts on Bay activities. They can interfere with, for example, the running of shut offs:¹³

R1: Like I say, me shutting off around here, there's lots of places with pieces of cage and stuff left there.

R2: You see, you don't know what's garbage and what's being used. But last year, on the end of Beans Island, just outside the giller (*unclear*), there was a lot of herring there, but there was an [aquaculture] bird ring and two moorings so you didn't dare run there with 30 or 40 thousand dollars' worth of twine, you don't know what you'll run through. So whether it is legitimate stuff or whether it is just stuff they wanted a place to put it, you know what I mean?

R1: I've gone to do shut off at nighttime back of (*unclear*) Island a couple of times, and they had the beach full of cages, and I couldn't get in to shore to run a shut off. (FGD, March 12, 2015)

¹³A shut off is a fishing method whereby a net is run across the mouth of a cove in still water in order to trap the fish between the cove and the net.

Such debris can also potentially cause the loss of lobster traps:

R1: But that don't bother me at high tide - it's just an eyesore - up there at Storktown (*unclear*) there is old square cages there. But it is better up there where I can see it although it is an eyesore, then somewhere where I can't see it.

R2: Well we got [an aquaculture cage] out in Sandy Island harbour. On the shore there. But if it comes off - there is a weight ring on it - if it comes off in lobster season, it could take quite a lot of traps. If it comes off the beach and comes drifting through your lobster gear. It has potential, do you see what I mean? (FGD, March 12, 2015)

They can also be navigational hazards:

Nothing serious ever happened, but you know. I've gone through [aquaculture cages] with my boat before. I was going out of here one morning, and my cousin called me, and said: "Come and get me." I said: "What's the trouble?" And he said: "I'm in a salmon cage." I said: "how did you get in the salmon cage?" He just went right in over top of it, right in - when he seen it, it was too late. He went right in over the handrails - he was inside and he couldn't get back out. Because those rails are braced from the outside in, angled in like - and when he tried to get out, the bracing would fetch him up. But when he went in, the bracing went down and he went right over top of it. No trouble at all. He never broke the cage. He never hurt anything. So I got a line on him and I said: "I'll bring you out, one way or the other." Once I got him under headway he came over the cage and broke the handrail, and never hurt the boat any. (FGD, March 11, 2015)

Finally, they can also pose potential safety hazards:

What scares me is working herring at night time. I've hit them [aquaculture] cages quite a few times - you could break your neck! Night thick with fog, see what I mean? You go over top of that cage in the skiff you get thrown out ... the hand rails is just the right height for your neck! It would break your neck. I was some mad, I called them after trimming it (*unclear*) one night. They brought cages to Fish Island and one night after dark, thick fog, and just moored them anyway ... just left them! Moored them on the corner of [the aquaculture site] and they was swung out 70 - 75 fathom outside the site. Well, I went out in the middle of the night to the weir, and it wasn't thick fog but it was right there where we went through there, do you get what I mean? I've had this argument, they should be noticeable, they should be yellow - the cages? At least the hand rails. And the Provincial Government said: "No, we

don't want them to show up any more than they are.” (FGD, March 12, 2015)

While much of the impacts and associated risks of marine debris noted by the fishermen were a result of fixed or moving objects in the water column, some activities, such as scallop dragging, require a higher degree of interaction with the ocean floor. Here, the fishermen noted that the large mooring blocks and anchors - some weighing tens of thousands of kilograms - used by the aquaculture industry to fix caging make dragging for scallop impossible in some areas:

There are places up that Blue Water site you wouldn't dare haul a scallop net, a scallop drag or set lobster traps in those places. Lobster traps aren't so bad, the [debris] is covered up with mud so it's not so bad. But with scallop gear you just don't dare go up in those places. It'd be too heavy to move, if you catch it right. (FGD, March 12, 2015)

This kind of fetch up can cause damage to gear and result in downtime on the water, all of which, say fishermen, can have negative economic consequences:

R2: We was doing good for them days - probably 2 or 3 hundred dollars an hour for scallops - but I [caught] this big [aquaculture] anchor. Frigged me. So I got it up and I couldn't handle it. Or I couldn't get it off my boat. Or out of the [scallop] drag. So my son-in-law was there and he came and he backed into me and he picked it up out of my drags with rope and then he steamed off to shore into 70 fathoms of water and let it go ... and I lost about 3 hours fishing time. And he lost a couple of hours ... your gear, [it can] handle we'll say a ton or a ton and a half, but you got your ton and a half [of scallop] and then you hook one of these things. It tears your nets out and bends your frame - steel frame.

R1: The thing is when you are fishing, you don't want to take time out of your day to get this stuff. You've got a short season. (FGD, March 12, 2015)

Throughout the course of both focus group discussions it became clear that much of the debris the fishermen were most vocal about was debris closely associated with the aquaculture industry. To be sure, there were occasions when other kinds of debris were

mentioned - wooden weirs, sunken boats, and plastic feed bags for example - but these were often marginal to the conversations and rarely lingered upon. What the fishermen were emphasizing, then, was that the activities of one particular industry, and the resultant artifacts from them, were having direct adverse effects on their own activities. It should perhaps come as no surprise that this would have the potential to create animosity and an adversarial environment between fishermen on the one hand and aquaculture on the other - a sentiment the fishermen themselves expressed.

4.1.2 The political tensions of marine debris

There were several times throughout the FGDs that fishermen, intentionally or not, revealed an antagonism towards the aquaculture industry. One exchange, for instance, reflected the frustration that aquaculture had made careless decisions in the past regarding the types of infrastructure they would put in the environment, and yet were not expected to be held accountable for the results:

R2: I asked the province on removing them [mooring blocks] - and the province said they don't have to remove them, they can't remove them. Because they are too big. And I said: "they weren't too big to put there. For your information, they just lifted a 500 foot nuclear submarine out of 3 miles of water so don't tell me you can't get underneath them and lift them blocks of cement off the bottom!" But the will ain't there and they don't have to do it.

R1: And around home - this is how stupid what they did - they run them in with iron eye bolts in them. Which is a stupid thing. If you were going to put anything why not a stainless steel eye bolt on them? So you could get hold of it. There is no way to get a hold of them today. (FGD, March 12, 2015)

Yet this frustration, at least for some fishermen, came with some hesitation, and even caution:

I should never start on aquaculture because I am for it and against it. I'm 100% for the jobs it creates - 100% for the work. And most of the fellows you know are friends of mine. And I hope they don't go out of business. But the negative side of it from the very beginning - nothing was ever done to make it right. And all the laws that were created or that they tried to create when they set it up, never had anybody to enforce them. You can say we can co-exist, but unless you've got enforcement, sometimes someone is going to take the easy road out. If there is a hard road or an easy road they'll take the easy road. Whether it be for (*unclear*) or discarding material or for whatever reason. (FGD, March 11, 2015)

Yet perhaps more to the point:

R1: Biggest place I know - a place we shut off herring, is right in Fairhaven. Clam Cove, Fairhaven. Up in the head of it. And this is one of them things we talked to Fisheries about, and where it bothers you but they enlarged the [aquaculture] site to encompass it. It was all kinds of steel - you know them steel cages - pieces stuck up and all kinds of railing. Cause we've had divers down and towed it out of there and stuff. Cause I shut off herring there. But they say they haven't got to clean it up, because it is within the boundaries of the site. Even though it is there stuck in the mud and been there for 10 years or 20 years.

R2: *But we have to be careful what we wish for. Because we don't want to have to dismantle weirs when they are no longer in use.*

R1: But like I say, that's wood.

R2: Yeah, I know that it's wood ... *but you are going to have the other side hollering just as hard.* (emphasis mine). (FGD, March 12, 2015)

The information provided by fishermen in these discussions, together with another FGD in Campobello and opportunistic discussions with other fishermen at public meetings and gatherings (see Barnett et al. 2016), did become the basis of a GIS map of marine debris within the study area – 59 unique points in all. Also emerging through these two FGDs was an understanding that marine debris is having significant impacts on fishing activities, and that fishermen appear to be most concerned about the debris generated by aquaculture activities. This being the case, I will now turn to the response

from the aquaculture industry.

4.2 Next Step: Meetings with Aquaculture

Having compiled, through the experiences of fishermen, a solid baseline for a GIS map of marine debris, we reached out to the aquaculture industry to get their input. Two meetings were held, one on September 23, 2015, and one on December 3, 2015. Aside from the research partner from CCNB (who was present at both meetings), the first meeting included two industry representatives, a spokesperson each from two of the biggest aquaculture companies operating in the area, and two representatives from the provincial Department of Agriculture, Aquaculture and Fisheries. The second meeting included an industry representative and two persons employed in the sector.

By comparing my meeting notes with the other members of the research team, several important themes emerge. The first relates to differences with respect to what debris constitutes the greatest risk and, therefore, warrants the most attention. The second charts aquaculture's reactions to the GIS map itself; and the third contrasts with the emergent tensions characterized by the fishermen in the way aquaculture questions who is responsible for the debris in the first place.

4.2.1 The types and impacts of marine debris

At both meetings with aquaculture, as at the focus groups with fishermen, participants were asked to describe what types of debris were causing impacts to activities or posing the greatest risks. Unlike the fishermen, though, the types of debris emphasized by the aquaculture industry was not cages, ropes or mooring blocks - that is,

debris related to their own activities - but, instead, debris related to fishing activities.

At the top of the list of perceived troublesome debris, nearly all of the aquaculture representatives reported herring weirs as being of significant concern. First, they reported that old weirs represent a hazard to navigation within the Bay. One representative joked that herring weirs represented a “pet peeve” of theirs, as old broken weir poles remain obscured and out of view underneath the water; boaters not knowing what areas to avoid - and even those that do - can easily collide with these stakes, or have the bottom of their boats punched if they become caught in a swell. One of the company spokespersons suggested that weir poles become perfectly preserved by the mud. If the top of these poles subsequently break free, they argued, they can become mobile in the water column and can threaten to damage aquaculture cages and netting. Torn netting can also allow salmon to escape. When asked if there was any particular occasions when this had taken place, no one was able to provide an example.

Another kind of debris mentioned by aquaculture was abandoned lobster pounds (ALP). In fact, one representative emphasized this by stating: “... if you are going to talk about [sources of debris], you have to talk about abandoned lobster pounds” (Meeting with Aquaculture, December 3, 2015). This representative went on to explain that the lobster pounds used to be made of creosote treated wooden stakes and were capped with tar. When asked if there was any ALPs that represented a risk to aquaculture activities, the representative said that “... it is more about the environmental issues” (Meeting with Aquaculture, December 3, 2015).

Similar to the pattern observed with the fishermen reports, aquaculture did

mention debris related to their industry, such as old cages, but these examples were usually mentioned in passing and rarely lingered upon. In closing the meetings, the representatives stressed that they felt weirs represented the biggest risks posed by marine debris. The two industry employees felt suspended or floating ropes were a significant issue. Both of them recounted several different occasions when their motors had fetched up in ropes, requiring significant time and effort to clear.

4.2.2 Reactions to the map

When presented with the baseline map, aquaculture representatives took issue with its representation, the source of the data and its implications. Of primary concern was the placement of the points on the map – many of them are clearly placed in areas where there are aquaculture sites. Many felt that this would create the impression that aquaculture is the source of the problem. One representative was concerned that the map could lead to finger pointing “rather than taking a holistic approach to remediation” (Meeting with Aquaculture, December 3, 2015). The company spokespersons said they felt fishermen only mentioned marine debris at meetings like this instead of approaching them on the wharf – that they use marine debris to politically attack aquaculture.

Several people felt that this (finger pointing) would divert from the whole objective of environmental remediation. They advocated for an approach and strategy that will be free of blame. One representative, however, did acknowledge that “we can’t have a strategy until we know what the problem is” (Meeting with Aquaculture, December 3, 2015), and accepted the map as being a necessary project. Yet, though the aquaculture industry was quite concerned about having the finger pointed at them, they

had little objection to suggesting other explanations as to who or what might be responsible for the marine debris problem.

4.2.3 Questioning who or what is responsible for the problem

One industry representative described the “re-rationalization” of the industry as responsible for some of the problems of ownership experienced now. They said that when the industry began to gain momentum in the area in the 1980s there were over forty or so operators. Over the years most of these operators went bankrupt or sold their operations to bigger companies, leading to an arrangement today of having just 3 operators in the area.¹⁴ What has emerged out of this trend, explains the representative, is a situation where there is debris out there that doesn’t belong to anybody – or, rather, for which no one will take ownership. The debris that is caught in limbo through this process was affectionately labeled as the “sins of the past.” This sentiment of assigning responsibility to the past was echoed by one of the company spokespersons in a different meeting when he mused out loud: “How far do we go? Just because I picked up the assets doesn’t mean I picked up the ... [liabilities?]” (Meeting with Aquaculture, September 23, 2015).

Another possibility for culpability suggested by the aquaculture company spokespersons is fishermen who have purchased used equipment from aquaculture operators. Such aquaculture spokespersons reported that they have seen debris from old barges that aquaculture had sold to fishermen and that had broken up. One spokesperson distinguished between this sold gear and their own gear: “If it is round, then, for sure, that

¹⁴As of November, 2016, Grey’s aquaculture has gone into receivership, leaving just two companies operating in the area: Cooke’s Aquaculture and Northern Harvest.

is ours and we will clean it up, but fishermen have to clean up their mess too” (Meeting with Aquaculture, September 23, 2015). One representative also alluded to issues of fairness and equal treatment as concerns, citing the requirement that aquaculture have navigation poles on their sites where weir sites have no such requirement. For them this represents a double standard where aquaculture is unfairly singled out.

The last of the reasons for marine debris given by aquaculture that I will highlight here is a lack of government enforcement. Industry representatives explained that before a site can be returned to the province it must be fully cleaned and inspected. One of the ways that this costly procedure can be avoided is by simply paying the nominal lease fees every year, whether there is an intent to use the site again or not. According to the industry, as long as you pay for the right it is not considered debris. One representative said that this really comes down to the government: “it is up to them to either enforce cleanup or else take it upon themselves to do it” (Meeting with Aquaculture, December 3, 2015).

4.2.4 Summary

So, from the meetings with aquaculture emerges a concern that debris is having an impact on navigation and the environment, with the debris from the fisheries – weir debris, lobster pounds and netting/ ropes – being emphasized. Four unique points were added to the baseline map, bringing the total number of unique debris points referenced on the map up to 63 (Barnett et al. 2016). It also became clear through these meetings that the map was something that was contestable. Aquaculture felt that it had the capacity to unfairly implicate their industry as being responsible for the debris, that it would

unfairly point the finger at them. Even if one could link the debris with the aquaculture industry, the problem of legacy and ownership made responsibility for the debris problem less than clear.

Nevertheless, the debris was there, and both the fishermen and the aquaculture industry acknowledged that it is having negative impacts – albeit with different ideas about what debris and what impacts should be emphasized. With agreement on the existence of the problem and that mapping – if not in its current form - was an appropriate way to more fully understand it, we now had to turn our attention to how to go about refining the map and making it something that can be agreed upon and used by all stakeholders to address the problem.

4.3 Making the Map Public:

On September 25, 2013, the Southwest New Brunswick (SWNB) Marine Advisory Committee (MAC) - a multi-stakeholder group of managers and volunteers supported by two levels of government – published a report on marine debris suggesting that:

[A] management group for the Southwest New Brunswick Marine Planning Area be established consisting of industry, government and the public, funded by stakeholders and government with the appropriate resources to manage programs such as: coordinating beach clean-ups; establishing and maintaining a marine debris inventory; and, preparing and publishing annual status reports on the state of marine debris in the planning area. (Southwest New Brunswick Marine Advisory Committee 2013)

As a consequence, the Marine Debris Strategic Advisory Committee (MDSAC) was established. This group, as described to me by a coordinating member, aimed to:

... highlight issues that might affect the Southwest New Brunswick marine planning area and [the] numerous stakeholders in that group who come to the table without their stakeholder hat on; they come to the table with their expertise but without their institution or industry behind them. (ENGO Rep, June 17, 2016)

So, it was particularly important, this individual felt, that the committee tasked with addressing the marine debris problem be a completely neutral space, where stakeholders ideally come to the table without any interests besides those related to the tackling of marine debris. In fact, our team had attended several of these meetings as participants – I having personally attended two of them – and we noticed that a recurring theme throughout these meetings was an outward concern over “pointing fingers,” laying blame, and avoiding contention.

Interestingly, we noticed that at these meetings, despite this outward appeal that everything should be neutral and non-finger-pointing, much of the same patterns of emphasis noted above were repeated. That is, representatives for the fishermen tended to want to direct the group’s attention towards aquaculture debris that they view as having the most impact on their activities, and representatives from the aquaculture industry tended to want to draw the group’s attention towards debris related to the fisheries – weir debris in particular. In other words, stakeholders were claiming an ideal of neutrality on one hand while acting as a partisan on the other.

There also seemed to be a tension, as one of my colleagues pointed out, between what should be made public and what should be kept behind closed doors. These meetings of the MDSAC took place while UNB was still in the process of constructing and refining the map of marine debris, yet many of the stakeholders were quite interested

in what it was revealing. There were some appeals from stakeholder members of the committee that the map could and should be something that only the committee has access to; this, again, would ostensibly be to avoid any contention, finger pointing, or any political fallout that might come from publishing the map and, thus, having the public aware of the debris.

As the goal of this project is to assess if and how PPGIS might assist stakeholders in moving off their defensive positions and building collaborative actions, it was suggested by my supervisor that the best opportunity to do so would be by presenting the map to the MDSAC (and possibly the MAC) during the summer and then trace the outcomes from doing so. In fact, this fit in perfectly with our research partners' agenda, as they had a mandate to do debris cleanups for which they were eager to see results; working from the map, for them, provided a positive and tangible step in that direction. This agenda would not come to pass. By April, 2016, the main facilitator and coordinator of the MDSAC had resigned and the committee placed on hiatus while a replacement could be hired and new sources of funding secured.¹⁵ A new approach was needed.

4.3.1 The Marine Debris RoundTable – July 19th

On May 31, 2016, and in lieu of working through the MDSAC, I drove down to St. Andrews to meet with our research partners in order to determine what a good next step would be. At this point in the project we had a map – however imperfect – and a modest budget for targeted debris removal, yet it was no longer clear where to take them

¹⁵A new coordinator was only hired in January 2017, after this research was concluded.

and how best to use them. After some brainstorming we hit upon the idea of hosting our own workshop. The idea was simple: we knew many of the main stakeholders in the area already – through the MDSAC and other professional affiliations – so we would invite all the ones we thought would have something to contribute to a round table format on marine debris. We would use the map as a way to engage the expertise in the room as to how best to prioritize the remediation of debris within the confines of the available budget.

In collaboration with the research team and partners, I crafted a list of experts and stakeholders that could potentially walk us through the whole lifecycle of a debris remediation project – including identifying what debris to target, what equipment would be needed for removal, what kind of impact remediation would have, disposal, and costs. This list included stakeholders from the fisheries, aquaculture, all three branches of government, waste disposal services, NGOs, the coastguard, scientists, and researchers. Those who were able, willing and did attend the roundtable consisted of the following: 1 DFO marine biologist; 5 representatives from the aquaculture industry, 4 representatives from the fisheries, 3 members of environmental NGOs, 3 representatives from the provincial government, 3 members of the UNB research team (including myself), and 1 waste disposal services representative. There were 21 participants including the facilitator.

The roundtable began with UNB researchers explaining the university's role in the project as being a provider of support through the public participatory GIS mapping component. It was explained that the map had been assembled primarily through

government sources and fishermen's knowledge of debris locations, and that the layers of the map not only represented debris points but also suggested potential source points as well. Handouts were provided to all participants that included slides of the map with all the debris points represented and detailed explanations for each spot as to type, impacts and sources. UNB then walked the participants through the map, how to understand it and use it. After the presentation of the map, each participant was invited to raise any comments, questions, or concerns – to respond freely in whatever way they wished – to the information within the map or the map itself.

The first responses were from the aquaculture industry. As with the private meetings described above, they questioned the validity of the map on the grounds that much of it had not been ground-truthed and was, therefore, anecdotal. They echoed each other, stating that each point on the map needs proof before “going public.” They also noted that some of the debris points on the map were not debris, but, rather, equipment on sites still under lease from the government. This concern was responded to by a research partner who clarified that “one of the points of a meeting like this is to verify and validate.” The goal was, in fact, to work with the map, and to make it a more useful tool. It was also noted by one participant that there appeared to be two parallel processes to address marine debris going on, the MDSAC and the roundtable, and there was a request for clarification as to how the two were different. The research partners explained that the goal was not to form a new standing committee, but, rather, to collaborate with stakeholders in the hopes of identifying the most impactful way to utilize a limited budget towards debris remediation. Much of the remaining comments related to agreements with others, or a general interest in the project and how they might contribute their particular

expertise.

Proceeding from introductory comments, participants were then asked what debris on the map poses a high risk and is within the scope of the existing budget to mitigate. There was a general discussion as to types of debris posing problems to navigation or fishing activities that included: sunken boats, nets, rope (attached to mooring blocks and floating below the surface), gear snarls from fetching up on ropes or mooring blocks, and weirs – especially ones that have partially hidden posts during high tide that can create a navigational hazard. With this list of risky debris types, the question was posed as to how to go about setting priorities. What should be targeted first? At this point in the proceedings it seemed to me to take on an almost free-for-all, with the focus of the discussion moving from one point to another point without any kind of relationship to risk or priority, but instead based on who had experience with a particular point and who had similar or dissimilar experiences. The discussion almost became a place for the display of experiential knowledge rather than a focused task. Participants seemed quite comfortable interacting with the map through stories.

If the process appeared to be somewhat derailed by segue and sentimentality, at least in the eyes of a slightly worried researcher who would prefer thing to proceed more orderly, several debris points emerged on which the group felt action could be taken. In total, 11 points were discussed in detail. Of those points, 9 led directly to action items being identified and agreed to by the participants. The action items ranged in scope, from simple confirmation of ownership, to ground-truthing, to actual cleanup and remediation.

4.3.2 Summary

The round table became the site for the public deployment of the PPGIS map. This was primarily due to the hiatus of the MDSAC, as without it there was no obvious place to work with the map. The roundtable was able to bring the diversity of expertise and perspectives on the issue of marine debris to a seat at the same table. It provided a focused agenda and a common frame of reference in the map. What is more, a list of action items was approved by all the participants at the group. Setting sights on answering my research question, my goal now was to figure out what the participants themselves thought of the process, and in particular what role they felt the PPGIS map played in it.

4.4 Round Table Participant Interviews

In order to paint a clear picture as to what role the map played (if any) in bringing people to the table, in shaping perspectives, and in generating collaboration between the stakeholders, I coded the participant responses to my semi-structured interview questions along four main themes: how the participants understand the problems associated with marine debris, the types of conflicts or tensions that can arise from the debris problem, the reactions of participants to the PPGIS map and its uses, and how the participants viewed the round table itself. In this section I will recount participant perspectives according to these four themes.

4.4.1 Problems of marine debris

Throughout the interviews participants frequently made references to the types of problems caused by debris – be they on activities, the environment, but most notably with

addressing the problem itself. Participants highlighted concerns about debris impact on fishing, navigation and entanglements/ fetching up:

The loss of fishing gear both in terms of trawls, mobile gear and fixed gear. The traps and having ghost fisheries in place has always been a concern, particularly when it involves equipment that continues to fish -- also risk of entanglements with other marine mammals in particular. Again, a long term pollution issue. (Gov Rep, September 12, 2016)

I just wish we could just sort of come together and say “okay, this is a problem.” ‘Cause really, this is a joint problem. It’s a problem for the aquaculture industry because it’s their garbage. It’s a problem for the fishing industry because they can’t fish there. (Fishing Rep, August 26, 2016)

Then also part of Fisheries and Oceans concerns is also safe navigation in waterways. Having submerged or semi submerged equipment that’s not well marked becomes a hazard to navigation. Those are the issues that come to me in terms of coastal marine debris issues and things that are important. Things to pay attention to. (Gov Rep, September 12, 2016)

... there’s areas we tend to avoid just because we tend to fetch up. We’re not sure what we’re catching up on but we’ll avoid it. I would expect that fishermen who’ve been in the water for many, many years probably know exactly what areas they would tend to avoid to not catch their nets. They have a much better knowledge. I’ve only been on the water a few years doing it and already I have sense ... “oh you don’t go there, we’re not going to go there.” Not knowing specifically where there’s debris and where there’s just bottom it’s not good to trawl. (Gov Rep, September 12, 2016)

There’s also other debris out there and remnants of past fishing history and I’m thinking of weir stakes. There’s some weirs that aren’t used any more but they can puncture a boat pretty quickly. Especially for those that don’t know the area very well. (Gov Rep, September 30, 2016)

Several participants suggested a more comprehensive view of debris impacts, referring to the general environment rather than specific activities:

Again, more awareness and more ownership. That’s your backyard, that’s your livelihood back there. You want to make sure it’s looked after so we can continue doing this for years. If not and you just kept dumping garbage there, eventually you’re going to ruin a good thing. It’s just going to make sense. (Aquaculture Rep, August 26, 2016)

Because marine debris is far reaching in terms of the effect it has not just from an environmental standpoint, but you know, an ecological standpoint, a financial standpoint, economical stand point, I should say. Marine debris can affect things like tourism for example, negatively affect, I should say. It can affect the traffic safety in the bay, with vessels moving around if there's floating marine debris or sunken marine or partially sunken marine debris. (Gov Rep, September 12, 2016)

... things that are of interest to us with regards to marine debris in terms of safe navigation, impact to coastal environments, submerged coastal environments. Concerns with pollution and long term of pollution issues as well as just degradation of fish habitats and sea life habitats. In this area, one of the biggest issues that we've come across with the marine debris issue is the aquaculture sites. Understanding that the aquaculture industries need to put a lot of infrastructure into those sites in order to make those sites operational. What happens with the sites as they evolve, as they grow, and as they go through their production cycles? What happens with materials that are being placed in the water and periodically removed to be cleaned and sometimes not necessarily completely removed? Also, what happens to a site if the location is no longer viable or no longer being used? What happens to the materials that were left in the water? That has been one of the issues of marine debris. (Gov Rep, September 12, 2016)

The specific aspect of marine debris that seemed to be raised most in the interviews was just how difficult or problematic remediation is:

I guess what I'm really realizing is how hard it is to clean up some of it. The submerged stuff is really hard to clean up. We thought it was hard to clean up fishing gear and that's turned out to be quite easy to clean up compared to aquaculture gear. (Fishing Rep, August 26, 2016)

... bearing in mind that in this day and age, whether it's government or associations or whoever it is, everyone has limited budgets, and when you get into big ticket items with marine debris, that's where it becomes a real challenge. Where is the funding to come from to address some of the big projects? (Gov Rep, September 12, 2016)

One of the things that's of interest ... particularly if it's submerged ropes or things like that, that just aren't marked well, they only become a problem on low tide. A lot of the times on high tide or mid tides you don't see them at all. Most people know that. If it's a submerged rope or a submerged line you're probably not going to see it at high tide. It's probably something that only comes up on low tide. There's a timing effect as well as to how often

people are out there upon the appropriate tides to actually identify and find these. So there might be more. (Gov Rep, September 12, 2016)

For instance, nets historically have been treated with anti-foulants that's a copper based product - heavy metals - so they [solid waste disposal] may be a little resistant to accept something like that. (Gov Rep, September 30, 2016)

What it tells me is that maybe the reason these things haven't been cleaned up is because it's this complicated. It's physically difficult. Its bureaucratically difficult. There's all these liability issues and all kinds of stuff. Maybe it was ... the fishing industry was always saying to aquaculture industry: "I don't get it! You put it there; clean it up. What's the big problem?" I think maybe now we're recognizing that even for them it's not that easy to just do it. (Fishing Rep, August 26, 2016)

So, the participants consistently acknowledge that there are impacts caused by debris, and that one of the most difficult aspects of marine debris is remediation. In effect, what we have in the SWNB Bay of Fundy is a situation where there is a significant cost to having marine debris in the environment on the one hand, and a significant cost to removing it on the other. This is the kind of situation one would imagine would generate a fair amount of tensions and potential for conflict. This is something that the participants themselves also noted in various ways.

4.4.2 Potential for conflicts and tensions

It seems to be common knowledge that there is and has been friction between different stakeholders operating in the SWNB area. For example, several participants noted a history of tense relations between the aquaculture industry and the traditional fisheries:

Traditional fisheries and aquaculture have historically often butted heads on a number of things, just because of the nature of the business. Aquaculture comes in, traditional fisheries feel it's infringing on their fishing grounds. So there has always been, in the past, there has always been an adversarial

correlation between the two industries. (Gov Rep, September 12, 2016)

They [fishermen] want to get access to these places to fish because they've lost access to fishing grounds. They have a huge incentive to getting it cleaned up, and it's not their responsibility to clean it up, so it's easy for them to talk about it. Whereas the aquaculture industry, it is their responsibility to clean it up. The only thing, you know, cleaning it up means work and money costs for them, so they didn't really want to talk about that part of it. (Fishing Rep, August 26, 2016)

... there was possibility for a little bit of tension there. I felt a bit ... you've got fishermen and you've got aquaculture. I know people that do both. That fish and do aquaculture... But I mean, historically they've been a bit at odds. So there was that potential. (Gov Rep, September 30, 2016)

Now aquaculture is calling these weirs all "in the way." The weirs are biodegradable. Seven or eight years they will all be gone anyway. The worms will have a feast on them and they're gone. Plastics get 1500 years and it's still there... all it is "you're beating on my back door shitting on me, I'm going to shit on you." They're saying that "debris from the weirs is damaging to our salmon cages," which is all bullshit anyway. Most stuff from weirs sink. Anything that floats off of weirs would be poles, this big around [makes a gesture of a circle 4-5 inches in diameter]. (Fishing Rep, October 3, 2016)

I know there was times, it was lobster fishermen, they were worried about their traps. Even if there was a 48000 lbs mooring block that can't really technically be brought up with the equipment there now. It was just, you know, they just kind of wanted their needs looked after right away not seeing the big picture. (Aquaculture Rep, August 26, 2016)

One participant even noticed that tensions have not only been historically between industries, but within them as well:

R: To compare and contrast, I've been in meetings where there have been fist fights. That's not fun

I: That's a pretty big contrast

R: And that's within the industry not separate industries. Over my career I've been in and facilitated discussions where you bring groups and stakeholders together and I had to break up a fist fight. All the extremes in between, all of that, people walk out, people are upset. They're all different. I find every one that you go to is different. I think it depends on a number of things.

(Aquaculture Rep, August 26, 2016)

One of the most contentious aspects of the marine debris problem noted by the participants was the issue of determining who bears responsibility for it – its cause, it affects and certainly its cleanup. Every participant acknowledged the difficulty and vagaries of determining responsibility in one way or another. There were some who noticed that no one seemed to be responsible:

I didn't really understand how much debris has accumulated over the years and how nobody is really responsible for it. It seems like nobody wants to be responsible or accountable for that debris. (ENGO Rep, August 18, 2016)

Again those sites that there are.... doesn't seem to be anybody responsible for them. There would be some question as to well who's responsible for that? Is it just, you know, aquaculture comes in and then the business goes belly up and they walk away and leave it and nobody else can use it? They've left everything on the bottom, there's ropes everywhere. I think that's definitely a negative for the industry. There needs to be some sensitivity around that or at least figure out solutions to the problem. When a site is no longer managed by an active company, what happens? (Gov Rep, September 12, 2016)

There's been a mass of consolidation [of the aquaculture industry] in the Bay so I don't know where that leaves people. Then there's probably legacy gear that they talked about that no one is responsible for. That's a tough one. (Gov Rep, September 30, 2016)

Obviously, it's not Cookes', it's not theirs. It's not somebody else's. The guy that it belongs to passed away and it's his but it should be cleaned up so who does that? It really needs to get drilled down ... to someone's gotta pay and if no one's responsible then the only one that's gonna pay is government. (Gov Rep, September 30, 2016)

Yeah, some of these sites don't seem to be anybody's, but somebody owns it. Even though they own it they don't seem responsible for it. (Fishing Rep, October 3, 2016)

There were some who wished to suggest that the debris was coming from elsewhere:

So people could understand that there are natural marine depositional areas out there that are tracked and regardless if the gyres in the Bay of where the

debris came from, it could end up in your backyard and not even be locally sourced... It would be nice to know that debris is collecting in these areas as a natural occurring thing from other areas. (Aquaculture Rep, August 26, 2016)

Several participants suggested - or were under the impression - that government lending agencies, particularly Farm Credit, were the bearers of ownership and responsibility:

I think there was some understanding and consensus that there is a large amount of debris out there that is owned by Farm Credit that needs to be addressed from a liability access at which I think people were surprised. (Aquaculture Rep, August 26, 2016)

This whole Farm Credit business that I didn't understand at all what that meant. It kind of became more clear and, you know... I'm hoping that in September when all of the government people get back to work from vacations, that we can talk to some of the Species at Risk people in DFO. To say "we have these Farm Credit sites." Farm Credit is a government body, I don't really know how that works exactly, so can we get the Species at Risk people to put some pressure on Farm Credit to sort out the liability issues so stuff can get cleaned up? (Fishing Rep, August 26, 2016)

I think a couple of instances where we were going through your map and identifying areas of marine debris, there was areas where the it had to do with aquaculture sites that were abandoned or were in receivership. It wasn't terribly clear as to who to contact or who's responsible for those sites. I know they go to a third party and holding company... Farm Credit. It wasn't clear whether we had all the information as to how we get access to those sites, or who to talk to within Farm Credit or whether there was even an obligation to have those sites cleaned up or managed. An active aquaculture site, there would be site management, there would be a company that you would go to to talk about keeping the area clean... but when it goes to essentially, my understanding is when it goes to Farm Credit, there isn't necessarily anybody to contact. (Gov Rep, September 12, 2016)

Participants representing government departments seemed unsure as to if they have any direct responsibility:

From a professional standpoint, our department, from our mandate, it isn't our responsibility of our department to really deal with marine debris. That falls more under other provincial and federal departments than ourselves... I don't see where any department has it solely as their mandate. Transport

Canada is involved to a certain degree; Canadian coast guard is involved to a certain degree; Environment Canada is involved to a certain degree; some of the provincial departments, like Department of Natural Resources and Department of Environment and local government are involved to a certain degree. But nobody has a mandate to actually go in, focus on it, clean it up and deal with it. (Gov Rep, September 12, 2016)

For some participants, responsibility was somewhat more straightforward:

The aquaculture industry, the folks that are on the sites. They are putting material in the water but they're also responsible for cleaning up material and they are also responsible for transiting to and from their areas of work on a daily basis. Obviously, they are going to be seeing a lot and being able to contribute a lot of information in terms of locations of debris or locations for problems or things like that. (Gov Rep, September 12, 2016)

[T]he local aquaculture companies, Northern Harvest and Cooke Aquaculture, have been extremely helpful in helping to clean up that debris over the years. So if you know there's still aquaculture debris here, here and here, you don't need to involve the fishermen. You can go to the aquaculture companies and say "can we work together to deal with this"? In that sense, it allows you to focus who you need to get involved in certain aspects. (Gov Rep, September 12, 2016)

[T]hey (refers to round table participants) were there representing Kelly Cove Salmon and every site that [they] own that there was debris, they had an answer for it and that they were going to clean it up. They were aware of it and that kind of stuff too. It would have been good to see them other groups there as well [refers to other aquaculture lease holders] to kind of clarify what's going on at their sites. (Aquaculture Rep, August 26, 2016)

So by seeing that on map and having them say "oh yeah we've got that site and that site and that site and those are ours, we'll do that and take care of that." It sort of identified not just the problem but also who could be responsible for it. It also identified the areas that it wasn't really clear who was responsible for it. (Gov Rep, September 12, 2016)

In terms of the large stuff, and it was a testament today that I saw large stuff tended to be of aquaculture origin. Parts of cages or feed pipes and nets could be from weirs or other fishing gear as well. Certainly some kind if it could be identified as aquaculture. (ENGO Rep, September 12, 2016)

It is this ambiguity of responsibility that seems to have led to many of the tensions

and problems associated with the remediation of marine debris. Participants and stakeholders appear to be caught up in the confusion of who is responsible, are engaged in pointing the finger at particular industries or activities as being culpable, or else engaged in the process of intensifying the confusion. Similar to the early FGDs with fishermen and meetings with aquaculture there seemed to be a pattern of finger pointing going on. Yet, it was precisely this activity of finger pointing – or the possibility of being seen to be calling out another stakeholder – that participants viewed as particularly undesirable:

I think as long as we are not pointing fingers when we talk about the debris on the map. I think as long as it's just objective like "this aquaculture was found here", or whatever it is, you know? As long as it's not titled like "Grays' pen" or whatever. Just to keep it neutral. We are just all together trying to solve this problem. (ENGO Rep, August 18, 2016)

So now it's not, "we're here to talk about how the lobsters are doing" and because there's aquaculture in the area the lobsters aren't doing so well and "you did this" and finger pointing and stuff. Again, it's everybody coming in and working together for a common cause and again by doing that it helps the relations between different organizations. (Gov Rep, September 12, 2016)

[S]o I think it's in everybody's best interest to take what you've put together as a group and use that to move forward to start removing this material. Not a finger pointing exercise. We all win if we remove it... The finger pointing thing won't do any good at all. It's very tempting, but they're [aquaculture] the only ones that have the barges, the cranes. Those nets are very heavy and you aren't going to be bring them up with a dive or a small boat. They also know it's in everybody's best interest... that's why you don't finger point because you won't get anywhere. They'll walk away from the table. So it's better to play the game and work with them. (Gov Rep, September 30, 2016)

I can see it being a fine line and sensitive and I think anything around this issue is sensitive when the possibility of finger pointing comes up at a certain industry or otherwise. If it's done well and with open communication, and with consent on all, whether this becomes completely public or not, I think it [the map] could really be beneficial. (ENGO Rep, October 4, 2016)

I think it was very useful and informative for everyone. I think it helped a lot because I think around that whole table it provided everyone with an opportunity. I heard a lot of “ohs” at the table. You know, “oh, that was already done” or “oh, I didn’t know that was weir stakes”. It became more ... it wasn’t a “it’s yours, no it’s yours” it was more of a general discussion. (Aquaculture Rep, August 26, 2016)

The above codes at least establish that there is agreement that there is in fact a problem with debris and that facets of this problem are contentious. These contentions can lead to finger pointing and blame and can themselves become barriers to collaboration. With this established, I turn now to the deployment of the PPGIS map within the context of the multi-stakeholder roundtable on marine debris.

4.4.3 Perspectives on the GIS map

Interviewed participants were asked several questions related to the map: was it clear? Could it have been constructed differently? Did it accurately reflect the individual’s understanding? Does it have the capacity to change how the problem is addressed? And, are there any concerns about the map and the mapping process? These questions and the conversational style of the interview elicited a variety of responses from the participants.

First, more than half of the participants interviewed made references to the accuracy or validity of the map:

... perhaps if you had a layer that was this debris is verified and this one is yet to be verified. The results you guys were getting your feedback from your people that are traveling through the Bay or stuff and you know, it might have been there a year ago but it’s gone but it’s still on the map. (Aquaculture Rep, August 26, 2016)

I was surprised when the map was rolled out, how old the information was. A lot of it. I was really surprised at how many things had already been cleaned

up, removed, had a light put on it, clean up attempted and it's just too large... I mean, I was really surprised that the map wasn't more current. (Aquaculture Rep, August 26, 2016)

Well through conversations, perhaps the mapping wasn't 100% accurate... some of the fishermen say "yeah, I don't think it's right there, it's down around the other side of this ledge or somewheres like that." So, the map obviously is only as accurate as the information that is provided. (Gov Rep, September 12, 2016)

[O]bviously when people see a map you get different views. They see a map they put it in their own perspective. "Do I know that area? Is that information right". It was pretty clear that the information was captured at this period of time based on consultations with users and it's not necessarily validated, it's just that's the information at the time. The locations may or may not be precise. I liked it because it was a starting point for discussions. To understand the extent of the problem. (Gov Rep, September 12, 2016)

You just have to remind people that this isn't all of it. This is a portion of it. You look at all the various occurrences of their saying "that's been cleaned up or this hasn't been cleaned up". It's a living kind of indicator because you know, if somebody goes out and does a bunch of stuff and doesn't tell you, you don't know. It just has to be kept up to date if they're going to keep it as a real thing. (Gov Rep, September 19, 2016)

There's other stuff that can float around and move from here to there. A lot of it so big and heavy that it's not going to go anywhere. It's ever changing. The map has to be updated every so often... I think there's requirements for updates sometime because some of this stuff is not stationary. (Gov Rep, September 30, 2016)

There was one participant, though, who pointed out that if the points and locations on the map need to be ground-truthed, there also needs to be follow-up with the ground-truthing and cleanup efforts themselves:

I think all that information has to be ground-truthed again too, like this issue with the nets. Harbour de Lute, was it cleaned up, was it all cleaned up or part of it cleaned up? I think the cleanup is complicated because it's hard to see this stuff, so someone could say, "well we sent divers down there to clean up but they didn't see anything". The water quality, like the visibility can be really low and it's quite hard to know if it has been cleaned up or not. (Fishing Rep, August 26, 2016)

The accuracy of the map was not the only concerns raised by participants. Several participants wondered about how the map, instead of clarifying and focusing the problem, might actually make it less clear and less focused:

One thing I worried about was for people to try and take the map where they would consider it fair. They would try and get everything listed and that we could lose... if every weir was on there we might lose the extent of impact of rope, net and other plastic... I mean, there's no way to have everyone totally happy with the map. If every weir was listed as a debris site, obviously the fishermen side would not be happy with that, but my sense is that aquaculture would be happy with that and would kind of half want that. If you expand the definition of debris too much you might lose the ability to effectively really zero in on the most damaging stuff. (ENGO Rep, September 12, 2016)

I guess that's one potential downside, if it got too broad it could sort of be too big to mean anything. Aside from that, there may be contention over the map, but the contention is there anyway. (ENGO Rep, September 12, 2016)

I think it was useful but I think it did distort the real issue a little bit because they were really concerned about the map and not the real issue as much. Everyone kept pointing to the map and looking down at the key and pointing to the map but then they didn't really get to that next level of conversation which was setting priorities, identifying volumes. If we have \$8000.00 what can we do? They were so worried about this being represented over there and ... (Gov Rep, September 19, 2016)

Aside from these notable concerns, every participant felt that the map had the capacity to change how people think about and approach the problem of marine debris.

Several participants felt that the map could be used to raise awareness:

I think the big picture down the road and the map's developed to its fullest and if you are able to publish it so it's on a live website I definitely think it will bring awareness to it and might create more of a cleanup type mind set and keeping it clean and getting more interaction from people. (Aquaculture Rep, August 26, 2016)

Yes I totally do. Because you can see the sheer volume of it and kinds of debris. It's not like we're usually doing this piecemeal like, "okay there's a problem area right here" and we talk about this one spot, but to see so many points on the map like that, it's really powerful and it really has helped

motivate some people in government to work with us and the aqua industry too. (Fishing Rep, August 26, 2016)

... but I think with the map it really brings it home as to how big the problem is and how varied the problem is as well. (Gov Rep, September 12, 2016)

I think it gave everybody a common perspective as to what we're talking about. What's the extent of the problem? Really understanding that... it's not like there's big dumps of garbage in the middle of a lobster habitat or blocking someone's access to a caged site. (Gov Rep, September 12, 2016)

Yeah, it certainly informs my sense of the problem of submerged debris. Prior to the map I didn't really have a sense of scale or scope. I didn't have a sense of how widespread it was, that sort of thing. It certainly has helped inform that end of things. (ENGO Rep, September 12, 2016)

I think a lot of people it never really occurs to them that there is this big scale garbage on the bottom and what are the implications of that too. They probably don't realize what happens when plastic degrades. I'm hoping that this is going to be a powerful tool to help encourage prevention of this kind of debris. (Fishing Rep, August 26, 2016)

I think the map really drives home: "oh yeah, okay, now I understand where they're talking about. They said that it was such and such and that it was this. So now that's where it's located and I get it now and I can see why that's a problem." So I see that as one of the major advantages of the tool of the map. (Gov Rep, September 12, 2016)

That's what it is. It is visual. It's a visual representation of the problem. It's a big picture, an interactive big picture. I can look at that map and then I can zoom in and I can click on that dot. (Gov Rep, September 30, 2016)

Some participants noted that the map could become a venue through which actions could be tracked, monitored, or prioritized:

[I]t's a great visual. We love to see. Here's all the debris area; this one's been cleaned, date; this one's been cleaned, date. It's good for everybody that way - if that's how it's going to be used. I love those kinds of visual as a tool. It gives you a reference to go back and say "okay we still need to do something about this" or "we still need to do something about that." It gives everybody a visual to work with. (Aquaculture Rep, August 26, 2016)

I think so, certainly. It would be hard to keep track of all the information

without it. I can't think of any other way you can really talk about all these points without having a map. (ENGO Rep, August 18, 2016)

The map, we could have sat there without that tool and just talked about debris and all these different locations but there would have been things forgotten. It was such a nice tool to keep track of. (ENGO Rep, October 4, 2016)

So getting back to your marine debris committee, and when you're having discussions about what to prioritize and how, that is a key piece of information that you can add into that conversation, because now you can say, "you know what, we don't have to worry about this one on the list, that one can go down to the bottom." Now we can focus on these other ones. (Gov Rep, September 12, 2016)

It allowed people to start prioritizing... trying to figure out what do we do this year, or what can we do this year in terms of making some progress in moving marine debris, or at least identifying marine debris. I think it guided that conversation. (Gov Rep, September 12, 2016)

Yeah. Because it's a shot at ranking. So it's a shot at... it gives us a way of trying to assess what's most damaging. It gives you a starting place. If you want to find certain kinds of debris, it lets you narrow down your search much better. I think...my sense was the only real criteria for clean ups pre-map has been negative interactions with debris. So someone fetching up in it or someone getting into a dangerous situation with something that's a navigational hazard of fetching up gear or vessel. Hopefully the map lets us get things a bit more pro-actively and prior to that really it's just been, deal with [any] squeaky wheel exclusively. (ENGO Rep, September 12, 2016)

It was also felt that use of the map enabled clearer communication, facilitation, or even better collaboration:

I think the map is a tool. It's a facilitating tool. It allows... There's the map, there's the facilitator and the fact that you had academia and science and a diverse group, instead of people sitting across from the table, and they're like "no I was just out there. I remember it looked like this." You can say: "No. This is what we have on the map". I think it helps. (Aquaculture Rep, August 26, 2016)

Mostly because the maps were done. The maps made a huge difference. It was information taken mostly from fishermen, but because it was shown visually, it's easier to wrap your head around and have discussions about it.

(Fishing Rep, August 26, 2016)

I think the map was central. I think all of the discussion were framed around the map as it should be because it allowed us to talk specifics about each site. I think without the map it would have been a much less productive conversation. (Fishing Rep, August 26, 2016)

Again, I saw the map as a tool to really jump start the conversations and then from those conversations again, you were able to adjust the accuracy of the map, in terms of what was on it. (Gov Rep, September 12, 2016)

It was really good at talking about priorities and looking at different examples of marine debris, different types of marine debris. It did a good job of engaging different users in terms of the aquaculture guys say “yeah we know that site, we know what’s going on there. We can take responsibility for it or actually that site is abandoned and you’re going to have to talk to so and so to make any progress on that.” Same as the fishermen. They understand their areas. They can see themselves represented on the map even if it’s not absolutely precise. (Gov Rep, September 12, 2016)

I think by putting it on a map it makes a little more understandable as to... we can talk about marine debris, ropes here or sunken stuff. But until you actually put it on a map and people can see where it is and what potential interactions with human activities and no human activities. It makes it more real. It opens up the discussion a little bit better in terms of prioritizing, to see how important it is. (Gov Rep, September 12, 2016)

I don’t think there would have been particular value or productivity to having a meeting about marine debris with all those people there without a map or without something specific just to say... that would have just turned into an argument. It would have been all hypothetical. (ENGO Rep, September 12, 2016)

The value of that round table, I just found that there was more debris recorded and there was active involvement of people saying “oh that’s been cleaned up” or “oh I didn’t know that was an issue let's get that cleaned up”. It was really positive outcome and positive process. The map was essential to that. (ENGO Rep, October 4, 2016)

So, the reactions to the map were varied. Many participants understood the map to be a “work-in-progress,” a living document, with the potential to be used for the purposes of targeting stakeholders. Yet, those same participants also viewed the map as an

indispensable tool in tackling the problem. To gain a more grounded understanding of participant reactions to the map, however, it is necessary to also account for the atmosphere in which the participants were actively engaging with the map for the first time. With this in mind, I turn now to the participant reactions to the roundtable as a whole.

4.4.4 Perspectives on the roundtable

When it came to asking the participants how they felt the roundtable went, resoundingly they replied in the positive. Most participants pointed out just how beneficial they felt it was that there was a diversity of perspectives, experiences and expertise represented at the event:

Yes it was good. Everyone seemed to know about a lot of the debris that was there. I think most stakeholders were able to give examples. (Aquaculture Rep, August 26, 2016)

The map was built mostly with fishermen. We've tried to engage the aquaculture industry the way the fishing industry was engaged on, it just hasn't really happened. But I think some of that did happen at the workshop. So that was good. (Fishing Rep, August 26, 2016)

The fishermen as a rule don't attend the marine debris meetings. Representatives of the Fishermen's Association, the Grand Manan Fishermen's Association, the Fundy North Fishermen's Association...people like that are there, but the fishermen themselves are not necessarily there. In the meeting you had, you had fishermen and the guys that work on the water and the aquaculture industries, which - to identify and to gauge the level of importance - it's good to have those people sitting around a table once or twice a year. (Gov Rep, September 12, 2016)

As I was explaining when we were at the meeting, you could clearly see that both the fishery industry and the aquaculture industry were there participating, it was interesting to see that dynamic. At least those two sectors - industry sectors in coastal environment - were there to participate. (Gov Rep, September 12, 2016)

We were aware of a lot of stuff out there and I guess what you've done differently is you've put together this group that includes industry. (Gov Rep, September 30, 2016)

The roundtable itself I thought was great. Everyone showed up and everyone participated, and willing. There was good discussion and I don't think it got heated. I thought it was really great. (ENGO Rep, October 4, 2016)

It was also noted that the roundtable motivated action:

I think a lot of things happened at the workshop, because you also had some provincial government saying "some cleanup work was done on this site or that site." (Fishing Rep, August 26, 2016)

I think it was another starting point too. A lot of work was done up to that point and I think it launched us into a new realm ... I think you have a lot more groups working together on things. (Fishing Rep, August 26, 2016)

I thought it was really productive. I thought the conversations, the discussions were well directed and there was definite progress to be made through it. (Gov Rep, September 12, 2016)

I feel everyone left feeling like they contributed and that every stakeholder is a little more accountable to each other. Everyone met in a room face to face. (ENGO Rep, October 4, 2016)

Many participants noted that the roundtable appeared to be quite collaborative:

To see everybody in the room talking about the same problem and focusing on the same problem, I thought that was great. I thought everybody conducted themselves in a professional manner. I didn't see where the conversation really got heated or adversarial or anything like that. (Gov Rep, September 12, 2016)

I felt like the workshop was the clearest articulation I've seen from the aquaculture industry that they are willing to play ball with others and clean up. (ENGO Rep, September 12, 2016)

Oh I think it was a good roundtable. I think everybody communicated really well. I think there was value, there's no doubt about that. (Aquaculture Rep, August 26, 2016)

Instead we brought it to the table of all the people who care about it and had some interest in it as a real kind of working session of what can we do about

this problem. What are some things that we can maybe pick off and work together on and who can work with who on it? So I think it was a much more collaborative style of presentation of the map then we may have had otherwise. Which hopefully is going to be to our benefit in the long run. (Fishing Rep, August 26, 2016)

I see that's changing and I see meetings like you hosted, helping that change. Where everybody gets to a point where they are working together instead of working against each other. You saw that in the room when we got into the conversations about various things. The aquaculture guys were on the water every day said "yeah I saw that there, and this is this and that's that." Traditional fisheries fishermen were there and saying the same things. They actually got into some dialogue back and forth about where exactly is that located and how much of a problem for navigation is it and things of that nature. (Gov Rep, September 12, 2016)

The other thing that I'll add when we get talking about the meetings and bring these groups together on a common theme, I think it was very useful in the conversations that we had for the traditional fishermen to hear what the aquaculture industry has done in terms of clean up and vice versa. I don't think those are conversations that have happened in the past and I think, again, that puts a different light on the relations between the different groups. (Gov Rep, September 12, 2016)

I think it was pretty good. Could be better. But I think as a whole including aquaculture and fishermen and the ecologist and everything. I think we're all willing to work together for a more or less common goal. (Fishing Rep, October 3, 2016)

Several participants, when recounting their perspectives on the roundtable, also made comparisons to meetings held in the past:

[Y]eah, I think just because it was visual and because some ground truthing had already been done, it adds a lot of credibility than just saying "well fishermen are saying there's a problem here". We never had anything to really back that up except their experience and their verbal knowledge or whatever. Yeah, I thought it was much more productive than most of the meetings we've had about cleaning up some of this stuff... We've had lots of conversations without the maps and they haven't gone very far. I think it feels different now that we have this map. (ENGO Rep, September 12, 2016)

We've had a lot of those meetings. Although I have to say we haven't ever had a meeting that had those players at the table. We've just had a lot of

meeting between aquaculture industries, the provincial fisheries and aquaculture departments and us. We've had a lot of those. (Fishing Rep, August 26, 2016)

In our discussions that we had with the marine debris committee, we had talked about the various types of marine debris and people had, you know through conversation said "oh yeah, this is here and that's there", and "we've seen this and that". But it was never really, until I went to your meeting, never really put on a map so you could visualize where all this stuff is located. So I really liked that aspect of the meeting and I thought through the conversations that were brought up at the meeting, as you are well aware, a number of things were ticked off the list. (Gov Rep, September 12, 2016)

Again, bearing in mind that I sit on meetings with aquaculture people and sit on meetings with fisheries people and I sit on marine debris committee meetings with different stakeholders, so I'm kind of exposed to a number of different meetings on a number of different topics in the Bay and they're not always pleasant meetings. Especially when you're talking back and forth between different industries and stuff. To see everybody in the room talking about the same problem and focusing on the same problem, I thought that was great. (Gov Rep, September 12, 2016)

Yes, it's more tangible. Before it's been general or about research or about maybe there's been discussions about disposal. It's gotten specific aspects. This was about... this wasn't about the problem of marine debris; it was about marine debris sites, about pieces of marine debris - where everything else has been about the problem... It felt like this was much more tangible. (ENGO Rep, September 12, 2016)

I think the difference is the people that were in the room. It wasn't comm staff. It was people with some responsibility on the water. That was a more important difference than tone... everyone always manages to be civil. It was more that there were people there that I haven't seen at meetings like this before. It wasn't comm staff. It was people who could send out a barge or who could potentially be on the barge but more likely order it to go out. That's the key difference to other meetings. There was operations level people in the room from fisheries and from aquaculture. (ENGO Rep, September 12, 2016)

4.4.5 Summary

It was at the roundtable where participants were engaging with one another on the various aspects of the marine debris problem. All of the participants agreed that there

was, in fact, a marine debris problem, but approached the problem with differences as to what should be emphasized. It was also noted that there have been historic tensions between stakeholders - specifically between the fishermen and the aquaculture industry. There was acknowledgement between the stakeholders that responsibility was not an easy thing to pin down, and there was some general confusion as to just who in fact should be held responsible moving forward. The introduction of the map was held to be both problematic as well as necessary. Some stakeholders pointed out that the map data represented could be dated or otherwise should not be labelled as debris, demanding that things need to be better ground-truthed moving forward. Yet most agreed that in order to begin to grapple with the problem, data collection had to begin somewhere, and the PPGIS map was, therefore, a good place to start. Finally, nearly all of the roundtable participants viewed the roundtable as relatively successful in its ability to bring reluctant stakeholders to the table.

Chapter 5: Analysis

In this chapter I will layout my analysis. I will begin by, examining how risk is differently interpreted and used by the fishermen and aquaculture, and how these differences lead to uncertainty and inaction. Next, I will trace out how, with its insertion into the field of marine debris relations, PPGIS acts to stabilize the multiplicity of risk enactments, thereby rendering the problem actionable. I will then proceed to conclude this chapter with an exploration of how PPGIS can act as a mediation process to overcome conflict and build cooperative and collaborative relations towards the management of risk.

5.1 Subjective Risk

Boholm (2003) distinguishes between two types of risk: objective and subjective, objective risk being based on the scientific evaluation of sources of potential harms and the calculation of the probability of those potentials, and subjective risk being based on locally defined values and concerns (Boholm 2003, 161). Barnett *et al.* (2016) argue that differences between these two notions of risk can lead to uncertainty and conflict as to what are acceptable environmental impacts. Working to bridge these differences, the authors argue, is central to the formation of effective collaborative risk management strategies. While this is undoubtedly the case, the conflicts induced by risk perception in this mapping project were not primarily driven by a disagreement between objective scientific data about marine debris impacts on the one hand and the subjectivities of local stakeholders on the other (indeed, this project was conceived of, in part, as a consequence of objective data on the impacts of marine debris in the area not having been adequately

attended to).

Rather, what this project reveals is a much more nuanced account of how conflicts between multiple locally situated risk subjectivities becomes the main barrier to collaboration and risk management. As Vera-Sanso (2000, 128–29) notes, the concept of risk is political; definitions of risk “set the terms of debates in which people engage both to enforce and resist the impact of such definitions.” This “risk-talk” can, therefore, lead to the tracing of the distribution, sources and tactics of power within society (Vera-Sanso 2000). In this section I will show how conflicts between fishermen and aquaculture perceptions of risk do in fact expose the political nature of risk and how “risk perspectives” become entangled with and indistinguishable from the political deployment of risk. First, I will discuss the fishermen’s perceptions of marine debris risks, followed by those of the aquaculture industry. I will then finish this section with an examination of how these “risk perspectives” are used tactically in order to enforce or resist the impacts of competing definitions of risk.

5.1.1 Fishermen’s Risk-Talk

When asked what types of marine debris posed risks to humans or the environment, fishermen tended to provide examples that demonstrated how certain types of debris had effects on their activities as fishermen. They indicated, for example, that ropes and buoys prevented the setting of lobster traps, that derelict or unattended aquaculture cages can prevent the running of shutoffs, cause the loss of lobster traps, pose a challenge for navigation, and threaten their safety, and that large mooring blocks and anchors made it impossible to drag for scallops in some areas - lest their expensive gear

gets damaged. Fishermen, then, when given the opportunity to frame what risk was for them, did so by embedding it within “the practices of everyday life,” as something that “could be personally experienced (or perceived)” (Boholm 2003, 172). For fishermen, the risks associated with marine debris have mostly to do with the practice of fishing. That is to say, they are mostly concerned about the potential negative impacts of marine debris on *their* activities - not shippers’, nor tourists’, nor wildlife’s, nor other industries’ (though, at least minimally, they are aware of those risks, too). Risk, then, is not just locally situated, but also located within particular practices or interests.

Boholm (2003) argues that when the probability of outcomes is largely known, risk can be more easily calculated and decisions about actions amenable to using a “rational” cost-benefit analysis. When the probability of outcomes is largely unknown, she argues, “rational choice as a strategy for decision making clearly has limited value in explaining understandings and management of risk” (2003, 168). In such cases, says Boholm (2003), culturally based schemata are utilized, whereby objects *of* risk, objects *at* risk and evaluations of the potential human consequences are linked together in order to arrive at morally loaded judgments regarding actions. What was flowing from the discussions with fishermen was that when they approached the management of marine debris risks they preferred the former cost-benefit approach.

When the locations and effects of marine debris were well understood by fishermen, they modified their behaviour according to a cost-benefit calculation. For example, while laying lobster traps in Kelly’s Cove, one fisherman encountered a pile of fouled rope that had been hidden: “I didn’t even know it was there. [It] scared me half to death.” Determining that “if you moved the boat at the wrong time, or didn’t know it was

there and got it [the rope] in your prop, you are done for,”¹⁶ this fisherman moved his traps and decided never to go back there. He calculated that the risk of lost traps or downtime due to fetching up in rope would cost more than any benefit of fishing in the area. Another fisherman recounted a time there was a lot of herring coming in on the end of Bean Island. Noticing that there was an aquaculture bird ring and two mooring blocks in the area he judged it too risky to run a shutoff there: “[...] so you didn’t dare run there with 30 or 40 thousand dollars’ worth of twine; you don’t know what you’ll run through.”¹⁷ Here the fisherman was aware that there was a former aquaculture operation in the area, and that was enough for him to steer clear. For him, one cannot easily distinguish between “what is garbage and what’s being used” or what “is legitimate stuff or whether it is just stuff they wanted a place to put it.”¹⁸ The risk here is to thousands of dollars of fishing twine. This fisherman decided not to operate in an area he knew to be a good spot for catching herring because the presence of aquaculture caging, to him, meant he was likely to encounter debris that could damage his gear. This possibility of damaged gear was calculated as being costlier than the benefit of a sure catch.

There were situations in which fishermen knew there to be risks present, yet they were not well understood. In these situations, a cost-benefit calculation was not possible. Here fishermen engaged with the above-mentioned schemata to improve their understanding and management of risk. For example, one fisherman recounted his perceptions of risk when going out to work herring at night. This was a situation for him

¹⁶ FGD held on March 11, 2015

¹⁷ FGD held on March 12, 2015

¹⁸ FGD held on March 12, 2015

where actions could not be easily evaluated: “What scares me is working herring at night time. I’ve hit them cages quite a few times – you could break your neck.”¹⁹ In this case, the fisherman needed to work at night, but was unable to make clear judgments about how to manage the potential impacts of marine debris when so doing. He understood the object at risk – his boat and personal safety – and was able to link it with the object of risk – the aquaculture cages – but was unable to connect them with a judgment on a course of action due to a lack of certainty about just where those cages are at any given time: “I was some mad. I called them after trimming [*unclear*] one night. They brought cages to Fish Island and...after dark, thick fog...and just moored them anyway...just left them!”²⁰ In this case, according to the fisherman, the aquaculture company had moved cages 70 – 75 fathom off their site during dense fog conditions, thereby generating potential risks not easily calculable by fishermen; there was no obvious way for him to adjust his actions relative to the possible threat. That aquaculture did this without notifying or otherwise making fishermen aware constituted an unnecessary risk: “I’ve had this argument, they should be noticeable; they should be yellow – the cages. At least the hand rails. They said ‘No,’ the Provincial Government said: ‘No, we don’t want them to show up any more than they are.’”²¹ What the fisherman was advocating for was that the available information (rendering the cages visible) was provided so that he could complete the links in the schemata in order to return from a place of incalculable risk to at least a situation where the risk was more easily understood and managed.

¹⁹ FGD held on March 12, 2015

²⁰ FGD held on March 12, 2015

²¹ FGD held on March 12, 2015

At this point, regardless of how they are evaluating marine debris risks, what should be noticed is that fishermen were actively framing those risks as particularly bound up with the practices of aquaculture. Throughout the FGDs, fishermen were much more vocal about debris that was closely associated with the aquaculture industry than any other potential sources of risk. At several points throughout the FGDs, fishermen were even careful to head off any implications that debris from the fisheries carried the same degree of risks. When talking about the risks of rope, for instance, fishermen pointed out that: “[...] an inch and a quarter of rope – there is no prop around that would be able to spit that out...that’s what they use in aquaculture, and *we don’t use that in lobster fishing*”²² (emphasis added). This was also evident during a discussion on the risks of getting fetched up on debris while scallop dragging: “There are places up that Blue Water site you wouldn’t dare haul a scallop net, a scallop drag, or set lobster traps in those places. *Lobster traps aren’t so bad, the [debris] is covered up with mud; so it’s not so bad*”²³ (emphasis added).

It may simply be the case that the fishermen were focusing on aquaculture debris more than other kinds of debris because aquaculture debris does indeed pose the greatest risks to fishing activities. If this is in fact the case, then we should not expect that fishermen would account for and weigh the risks of all the other sources and kinds of marine debris; they need only be accountable for their own perceptions of risk which are embedded within the practices of their everyday lives. Yet, as the examples given above illustrate, fishermen, though primarily focused on debris that poses direct risks to their

²² FGD held on March 11, 2015

²³ FGD held on March 12, 2015

own activities, are acutely aware that they are themselves contributors to the overall marine debris problem. In this sense, fishermen are actively engaged in managing another kind of risk to their activities: political risk.

Fishermen were taking direct aim at the aquaculture industry, and they understood that they did not necessarily have the moral high-ground when it comes to marine debris. This is why they were careful to acknowledge, but push to the margins, the presence of fisheries related debris. They were also aware that while they could justifiably target aquaculture on the basis of that industry's impacts on their fishing activities, so too could they be targeted on the same grounds. This was most noticeable during one exchange between two fishermen during a FGD:

F1: “‘cause I shut off herring there...but they [aquaculture] say they haven't got to clean it up because it is within the boundaries of the site...”

F2: “But we have to be careful what we wish for, because we don't want to have to dismantle weirs when they are no longer in use.”

F1: “But like I say: ‘that's wood.’”

F2: “Yeah. I know that it's wood...but you are going to have the other side hollering just as hard.”²⁴

There are two things that are particularly striking about the language used in this exchange. First, it is clear that the fishermen desire and would benefit from the cleanup of aquaculture related marine debris. For the second fisherman, however, this desire becomes the site of a risk calculation. For him, it is possible that the benefit of pressuring aquaculture to clean up their debris and, thereby, gaining better access to productive

²⁴ FGD held on March 12, 2015

fishing grounds, might *not* outweigh the potential political risk – that is, the potential to become subject to further regulation, further monitoring, monetary sanctions, negative media attention, etcetera – that they may become exposed to by doing so. For him, you *do* have to be “careful what you wish for.”

Secondly, and perhaps as a consequence of the first, dealing with risk becomes adversarial. There is an “other side” in the management of marine debris risks. As Boholm (2003, 160) has argued: “Since interests invariably diverge — among individuals and more importantly among social groups, corporations, and organizations — issues of risk and safety are increasingly political and controversial.” What we captured in the FGDs with fishermen, then, was one group’s interests and how marine debris risk is perceived and lived by that one group. Yet, what fishermen were also articulating was that they are aware of other interests at play here, that these other interests may be adversarial or incompatible with their own, and that this possibility of incompatibility constitutes risk in its own right. Having begun our map with fishermen’s perspectives, it now became clear that their view was only one possible point of view. As fishermen seemed both particularly impacted by aquaculture debris and sensitive to the possibility of being themselves implicated in the marine debris problem by aquaculture, it was necessary to hear what representatives from the aquaculture industry had to say in response.

5.1.2 Aquaculture’s Risk-Talk

As was the case with the fishermen, at the meetings with the aquaculture industry, representatives were asked what marine debris they perceived as posing risks to human

activities or the environment. Their answers contrasted sharply with those of the fishermen. They did not respond by indicating which debris had the greatest effect on their activities – as the fishermen had – but, rather, they spoke about the debris that they perceived as being generally risky. For example, old herring weirs were at the top of their list of significant risks due to the potential navigational and safety hazards they represent in general to “boaters not knowing what areas to avoid – and even some that do,”²⁵ not because of any specific risk they pose to aquaculture activities. When asked if weir debris did pose any particular risks to their operations, one representative hypothesized that weir poles could break free, become mobile in the water column and then pose a risk of damage to their cages and netting. Yet, they were unclear as to if this has ever taken place. They also cited abandoned lobster pounds (ALP) as a type of risky marine debris: “...if you are going to talk about debris, you have to talk about lobster pounds,”²⁶ one representative offered. For them, the creosote and tar used in the construction of old ALPs posed a risk to the environment. When asked if ALPs posed any risk to aquaculture activities the representative said no “...it’s more about the environmental issues.”²⁷

There was an obvious difference, then, in the way fishermen and aquaculture were approaching risk. Fishermen were actively linking their experiences of particular impacts caused by specific types of debris with decisions about where they felt they could or could not fish; they were making calculations based on weighing understood or potential harms with what they could earn in catch and altered their actions accordingly. This kind

²⁵ Meeting held on September 23, 2015

²⁶ Meeting held on December 3, 2015

²⁷ Meeting held on December 3, 2015

of risk evaluation was not at all present in our dialogues with aquaculture. Indeed, with the exception of just one brief story given by an aquaculture employee of getting fetched up in floating rope, aquaculture's framing of marine debris risk lacked any kind of embeddedness in their practices or lived lives. Instead, the aquaculture representatives were almost entirely relying on subjective social schemata to construct a narrative of risk where direct experience was lacking or the probabilities were not well understood. Indeed, the lack of direct experience makes sense here; aquaculture is far less mobile on the water than fishermen are in their daily practices. So, even though fishermen were constructing risk narratives in similar instances as well (see above), there are some differences to note.

When fishermen were relying on the construction of risk schemata, they were doing so by, again, trying to shore up their certainty about objects at risk, objects of risk, and the possibility of human impacts to arrive at conclusions about actions that could be taken. Aquaculture, like the fishermen, were linking objects at risk and objects of risk, but were not connecting them to any evaluation about action, but, instead, to a moral conviction. The old herring weirs, for example, were identified as a significant navigational risk to boaters not familiar with the area. Notably, the object at risk in the narrative, unlike the fishermen's, was not specifically aquaculture or their activities, but, rather, 'boaters' more generally. Yet there are reasons to suspect that this emphasis on the 'other' is not entirely altruistic in nature.

Weir debris was, though, hypothesized as a possible risk to aquaculture netting and cages. This risk hypothesis, however, was only mentioned by one representative, came with no examples of having actually taken place, and was not something that the

aquaculture industry indicated they were even taking precautionary efforts to guard against. Conversely, when fishermen were constructing risk narratives they were usually accompanied with examples (“I’ve hit them cages quite a few times”) and precautionary actions (“I called them...”). This risk hypothesis, though, should not be entirely dismissed as hyperbole, for what it reveals is not the lack of a desire to manage risk, but instead just what risk aquaculture is interested in managing. The risk aquaculture was actively managing emerges most distinctly when these objects at risk and objects of risk were finally linked to a moral position.

Every time aquaculture stressed the risks associated with old herring weirs, they were linked to the moral ethic of ‘fairness’ by pointing out that they (aquaculture) are required to have navigation poles on their sites, while weir fishermen have no such obligation. This was labelled a “double standard”²⁸ where aquaculture was unfairly singled out. To be clear, there were no occasions during our discussions with aquaculture where navigation poles being attached to weirs were advocated *only* on the basis of their ability to increase safety and the management of navigational risks; they were never raised *independently* of this ethic of fairness. What this reveals, though, is not a lack of concern by aquaculture of the hazards old weirs could pose to boaters, but instead that they are focused on managing the *political* risks marine debris pose on *their* activities.

Similar to what was argued above for the fishermen, we should not expect, nor demand, aquaculture to weigh the risks of marine debris on behalf of all other stakeholders; they, too, need only be accountable for their own perceptions of risk. Here,

²⁸ Meeting held on December 3, 2015

unlike the fishermen, it is not primarily the risk of *direct* impacts marine debris may have on their specific activities that are in need of managing, but the political risks associated with being a source of marine debris. Like the fishermen, aquaculture sees the risk of marine debris as adversarial. ‘Fairness’, for example, is a value that is usually deployed during contests – where there are competitors, and where rules are needed to ensure equal opportunity for all participants.

5.1.3 Risk Perception, Representation and Politics

The deployment of subjective perceptions of risk are strategic. They make up part of a complex politico-strategical situation (see Foucault 1978, 93–95), where the ability to define and shape risk enables or encourages some actions while inhibiting or discouraging others. Boholm (2003, 168) argues that risk should not be regarded as “a property of things perceived but as an inherently dynamic relational order of meaningful connections between the terms included,” and that viewing it in this way “makes it possible to theorize the variation in the conceptualization and management of risks among different communities or organizations.” Indeed, both the fishermen and the aquaculture industry were actively engaged in establishing or resisting the “meaningful connections” of the terms – or links – related to marine debris precisely in order to affect how its associated risks are conceived of and, therefore, managed. They both stand to gain or lose in a variety of ways depending on how the risks associated with marine debris are stabilized (ie reaching agreement about what constitutes debris, what debris threatens, and how to deal with it). Access to better fishing grounds, avoiding the economic costs associated with cleanup/ remediation of debris, positive or negative

attention from the government or public, and beneficial or costly changes to regulations, for example, all hinge on how marine debris risk is framed. What emerged from the FGDs and meetings were three main ‘strategies’ or ‘tactics’ used by both stakeholder groups to affect the definition and management of risk:

1. To further implicate and make visible the ‘other side’ while deemphasizing and rendering less visible one’s own activities through finger pointing and a discourse of guiltiness.
2. Establishing or undermining the links between objects at risk, objects of risk, or the potential outcomes.
3. Establish or dispute responsibility.

Below I will describe how these three tactics were utilized by the fishermen and aquaculture, but towards very different ends.

1. Finger pointing and the discourse of guiltiness

First, the most noticeable strategy for framing risk was to simply point the finger. As I’ve shown above, the fishermen were attempting to define the risk of marine debris by demonstrating the direct impact aquaculture debris has on their activities, while acknowledging, but minimizing the potential impacts of their own debris. In their response as to what debris constitutes the largest risk, the aquaculture industry was making the very same move: emphasize the impact of debris from other sectors while skimming past your own. Rather than admitting one’s own guilt and taking responsibility for it – a politically risky and potentially costly move at the best of times – instead just show how your opponent is guiltier. If this is done effectively, the discourse of guilt can

shift, whereby one's own 'sins' become overshadowed by the other's, paling in comparison or perhaps even being forgotten. This is likely why attack ads are so heavily relied upon during an election; after all, what politician does not have at least a little dirt upon their hands?

In such an environment, where everyone has some dirt on their hands and the stakes are high, controlling the discourse of guilt and implications of guilt becomes an obvious and readily accessible strategy. What is clear with respect to these two stakeholder groups is that both of their hands are figuratively dirty, and they are both keenly aware that the discourse of guiltiness is very much in play. Here, the mapping of their respective perceived risks emerged as a site where this discourse of guiltiness became observable. The PPGIS map was a venue through which marine debris locations, types, potential sources, and potential impacts become visually represented. Having a say in just what is represented on the map and how becomes, then, crucial to the construction of perceived guiltiness. Looking at the risk mapping this way helps us make sense of aquaculture informant's immediate negative reaction to the map of debris we had begun under the guidance of the fishermen.

When presented with the fishermen's risk perceptions rendered into the PPGIS, every aquaculture representative took issue with it. For them, the map was full of data they felt would create the impression that aquaculture is the source of the marine debris problem. They felt that the map, thusly rendered, would lead to unfair finger pointing. They advocated for a mapping approach that was free of blame – neutral. Yet, as they were advocating for this “neutrality” on the one hand, they were, on the other, actively promoting derelict herring weirs and ALPs as constituting the riskiest marine debris.

The effect of all this finger pointing is that it can make it difficult to know exactly of what the problem consists. This, in turn, can make it difficult to take action. This lack of action, or, rather, the maintenance of the status quo, is surely more beneficial to the aquaculture industry than it is to the fisheries sector. While the fishermen were very specific in the FGDs about pointing the finger at the kinds of debris that were posing problems for them, the aquaculture industry was far more general. While they did point the finger often enough at fisheries related marine debris, there were several occasions when they voiced loud concerns over other kinds of debris. At both of the MDSAC meetings I attended, for example, representatives of the aquaculture industry took aim at the menace of coffee cup debris. In both these cases, breakout conversations took place that occupied approximately 20-30 minutes. Perhaps not too incidentally, the MDSAC, in its year or so of operation prior to stalling, was unable to claim any major remediation efforts (excluding the coordination of volunteer beach cleanups) nor any clear policy that took direct aim at so doing.

So, both the fishermen and the aquaculture industry were attempting to point the finger at other industries. The fishermen were doing so because marine debris from the aquaculture industry is having demonstrably negative impacts on their ability to fish and be safe. For them, the goal is to have actions taken to clean the area of problematic debris. The trouble is, the fisheries generates debris as well, and remediation of it is also costly. To that end, the fishermen acknowledge the presence of their own debris but attempt to make it appear less of a problem than debris from the aquaculture industry. One fisherman, for example, would argue to me in a later conversation about weirs that:

They haven't been a hazard to navigation in 150 years. How come now?

When you come into this area as a stranger, sailing, I am sure that it's written in some of the nautical books that you may find weir traps along the shore. Sailor beware. Everybody else knows they're there.

Yet, even some fishermen voice concern, as they did at the July 19th roundtable, about the significant navigational hazards these old weirs can pose. Again, these fishermen are aware that they might not be able to have their cake and eat it too.

The aquaculture industry, on the other hand, has much less advantage if action on debris is taken. They are a largely stationary industry – much less mobile than fishermen – and much of the debris being implicated as a problem is a result of their industrial activities. For them, finger pointing is not so much a way of directing blame and inciting action as it is an attempt to both silence those who would point the finger at them and to render confusing and uncertain any discussion about how to act and upon what to act. The threat that the aquaculture industry will point the finger right back at them is enough to make the fishermen politically cautious, and aquaculture seemed to utilize that leverage. Further, by pointing the finger at multiple sources and kinds of debris, aquaculture makes it harder to direct resources and actions upon the most problematic debris. Finger pointing and the controlling of the discourse of guiltiness, though, remain only the first and most obvious tactic.

2. Making or disrupting the links

Notice that what comes to be understood or defined as 'risk' by both aquaculture and fishermen is multiple. That is, risk is not a fixed concept; it does not have its own ontological foundation distinct from the way it is practiced within a particular relational context (see Law and Lien 2012). The way that risk comes to be enacted by any

particular stakeholder is, therefore, subject to the complex network of objects, experiences, politics, relations, and etcetera, that are assembled around it (for more on network assemblages see Law 2004; Li 2014; Müller and Schurr 2016; and Latour 2000). Tactically, then, having influence over how these networks are constructed would be advantageous to those who would like to see their particular deployment of risk taken up. It is the case here that both stakeholder groups were engaged in attempts to influence how marine debris risk is assembled.

Due to their inherent complexity and elusiveness, it can be difficult for a researcher to know when and where to stop investigating all the possible nodes that make up any given network assemblage (see Latour 2005). For my purposes, however, Boholm's (2003) risk schemata (described above) provides a relevant yet accessible means through which to explore how fishermen and aquaculture attempted to construct certain risk assemblages while disrupting the construction of others. The links that Boholm describes constitute a network assemblage or the 'ordering relations' of risk. The actions taken as a consequence of these links - the practices - are what gives risk, in any particular context, its shape; risk is enacted - it is *done* (Law and Lien 2012). The competition between fishermen and aquaculture to shape and influence how marine debris risk is *done* leads to what Mol (1999) calls an "ontological politics," where the *options* between different ways of conceiving of and doing the various links in the network assemblage have an impact on the practice of risk itself.

As has been observed, fishermen are motivated by a desire to see action taken by aquaculture to clean up marine debris that is: a) associated with aquaculture activities and b) is perceived as posing significant risks to their own activities. In order to arrive at their

desired *practice* of marine debris risk - one that involves the particular resultant action above - the fishermen were engaged in an effort to *construct* a particular network assemblage on the one hand, while deconstructing or disrupting other possible assemblages on the other. It is worth stressing here that there are multiple risks in play, and that any given risk is *done* differently. The risk that the fishermen want done is the one that leads to aquaculture cleaning up aquaculture debris. I have already illustrated how fishermen utilized a cultural risk schemata to better understand how to manage risks (see 5.1.1 above). What is important to note here, though, is that by assembling risk in a particular way, fishermen were not only attempting to better understand how *they* should act; they were also deploying their assembled risks in an effort to affect the actions of others.

Each node in this network assemblage gains its ontological foundation through its own set of practices and ordering relations - its own network assemblage. So, in order to have an impact on how risk is assembled and taken up it is necessary to intercede in the process of assembling that takes place at each of the significant nodes in its network. Both aquaculture and fishermen were attempting to stabilize in their own ways what they perceived to be the most important objects-at-risk - boaters, equipment, bodies - and both were making strong cases for the potential human impacts of marine debris - loss of useable fishing range, economic costs associated with damage to gear or downtime. The differences between how these nodes were assembled by each seemed to be, however, primarily a matter of emphasis and supposed severity and not out and out refutation. Neither side appeared to be too interested in calling out the other for inventing fictitious at-risk-objects or projected impacts. To be clear, fishermen did wonder in private

conversations just how “at-risk” an aquaculture cage is of being damaged by a 5 inch diameter floating weir pole, but I heard of no one going so far as to say that there was no way it could constitute a risk. So, the assembling of these two nodes of a risk enactment relied mostly on making a case that some objects or some potential impacts should be taken to be of lesser or greater priority. By making a case for why one set of perceived risks are of more concern than another can help in convincing other stakeholders to take up a desired risk enactment.

The process of making or disrupting links in the marine debris risk network was in this case most visible at the “of-risk” node. This is likely because this is where the stakeholders want to see or not see action taken. That is, managing risks explicitly depends on what is taken up by the various stakeholders as being “of-risk.” While the degree of probability and severity of risk can motivate or dis-incentivize action, that action must be targeted at the source of that risk. Defining what constitutes of-risk, therefore, is central to enactment. Both the FGDs with fishermen and the meetings with aquaculture began with a question: “what marine debris ‘out there’ poses the greatest risks?” It should be noticed that this is a very specific question. It suggested at once that respondent stakeholders make a distinction between what is marine debris and what is not. In fact, it became the case that this distinction rendered an of-risk object actionable or not. The defining of what constitutes an of-risk object became inextricably linked with the defining of what constitutes marine debris in the first place.

I have already discussed how fishermen sought to minimize the negative perceptions of debris related to their activities relative to that of aquaculture. It was also clear that in the construction of their risk perception they were aiming to have some types

of of-risk objects removed from being considered as actionable marine debris in the first place. One fisherman I interviewed, for example, drew my attention to the fact that the stakes used in constructing weirs are wood, and therefore, biodegradable: “Now aquaculture is calling these weirs all in the way. The weirs are biodegradable. Seven or eight years they will all be gone anyway. The worms will have a feast on them and they’re gone.”²⁹ The suggestion here is that we should not really be worrying about weirs, as they will decompose in several years anyway. A deeper connection that is trying to be established here, I think, is that biodegradable objects are not really debris. It turns out that just about everything that aquaculture puts in the water is non-biodegradable, so this move by the fishermen also serves as another way to contrast a ‘gentler’ fishing impact with a more permanent and, therefore, ‘riskier’ aquaculture industry.

That much of aquaculture infrastructure is, in fact, large, fixed, and inorganic means that a counter narrative of this kind was unavailable to aquaculture. Instead, in their attempts to disrupt the links the fishermen were making between risks and aquaculture-related of-risk objects they relied primarily on defining marine debris relative to ownership of lease sites, the location of objects relative to these sites, and the plausibility that these objects were still of some use. This was most observable at the July 19th roundtable. Here there were several times, as the conversation progressed from one potential point to another, when aquaculture would state that such and such a site was still under lease - was owned by one of the companies. Interestingly, once this assertion was

²⁹ Interview conducted on October 3, 2016

made any further discussion regarding that site ceased. There seemed to be some unspoken acceptance amongst the stakeholders that if an of-risk object was located within an actively leased site than it was no longer considered marine debris.³⁰ This way of interceding in the assembling of risk enactment was also used by fishermen who pointed out that many weirs are still on active leases as well. So, if an of-risk object is owned and on a leased site it is effectively excluded from the assembling of an of-risk object. Indeed, as one fisherman explained at one of the FGDs: “...if you pay for the privilege, even if it’s not built, it is still yours to do what you want to. So it’s not debris so long as you are paying the privilege.”³¹

So, as Boholm (2003) argued, arriving at a decision about what actions to take in order to best manage risk requires a clear understanding of the links between at-risk and of-risk objects and how they interact to produce the potential for particular types of negative human impacts. By way of interceding at the assembling of these network nodes, fishermen and aquaculture were attempting to influence how marine debris risk is taken up by other stakeholders and decision makers and how they are subsequently acted upon. There were times, however, while at committee meetings, interviews or the roundtable, when it became difficult for aquaculture or fishermen to gain momentum in favour of their particular risk assemblage. In these cases, a different tactic emerged: the questioning of responsibility.

³⁰ Government regulation seems to have been structured around this idea. Indeed, cleanup is not enforced until the lease is returned to the government. This in turn enables the loophole of “paying for the privilege.”

³¹ FGD held on March 12, 2015

3. Questioning Responsibility

It was made very clear by fishermen at the outset that the risks they faced while engaged in their activities on the water were a direct consequence of marine debris associated with the activities of the aquaculture industry. As far as they were concerned, if the debris is from the aquaculture industry then it is their responsibility to clean it up. It was also here that fishermen worried that the same standards of responsibility might be used to demand that they clean up derelict fishing gear and other debris related to their own activities. The linking of the source of certain debris with the responsibility to clean it up makes powerfully intuitive sense and is, for this reason, very hard to refute. This is why the aquaculture industry was upset that the data represented on the map could make it seem as though their industry was the overwhelming source of the marine debris problem. There are only two ways to handle this kind of link: responsibility can be accepted and action taken to remedy the situation, or else responsibility can be questioned and avoided. While it was the case that the former did occur (I will cover the reasons for this in more detail below), the latter emerged as a viable tactic for the aquaculture industry.

At the meetings with aquaculture it became evident that as a map now existed that revealed the types, locations and impacts of marine debris there was a possibility that they would be held responsible for the problem of marine debris. This is because much of the debris that was represented on the map had an aquaculture source and was often located within close proximity to current or past aquaculture lease sites. Aquaculture first responded to this by communicating their apprehension and disapproval of the map to us and by arguing that representing the data in this way would lead to finger-pointing and

would divert from the task of environmental remediation. What they argued for was a more *neutral* representation of the problem that was free of blame - that the problem was really “everyone's.” This call for neutrality would be echoed throughout the various meetings, conversations and, indeed, the roundtable. By calling for neutrality and the avoidance of finger pointing, aquaculture was attempting to distribute blame equally upon all the stakeholders; it was a suggestion that everyone’s role in the marine debris problem is equal in scale.

What was interesting about this tactic is that while aquaculture was advocating on the one hand that we should be ideally striving for neutrality and the avoidance of finger pointing - and thus the equal distribution of responsibility - on the other hand they were also trying to suggest who and what else might in fact be responsible for the marine debris. As highlighted in the previous chapter, aquaculture representatives suggested that the rationalization of the industry led to a situation where much of the aquaculture-related marine debris belongs to the past and is really owned by nobody in the present. They also suggested that lack of government enforcement of regulations allowed thrifty operators to sit on leases by paying the fee every year rather than paying the much costlier expense of clean up. They also intimated that fishermen were also possibly responsible for aquaculture debris. This, it was suggested, is the result of fishermen buying used aquaculture gear and then allowing it to deteriorate. Finally, one representative of the aquaculture industry suggested to me in an interview that some of the debris in our “backyard” was not “locally sourced” but was the result of the tidal patterns collecting debris from other places in the SWNB area.

The result of questioning the responsibility for marine debris in this way had an

observable impact on how others came to take up and assemble risk. Many participant stakeholders who attended the July roundtable observed that much of the debris didn't seem to belong to anyone. It was even the case that a significant amount of time was devoted to exploring the possibility that Farm Credit - a federal agricultural financing agency - may be the owner and, therefore, responsible for a significant amount of the problem.³² Crucially, no decision regarding risk management could be made without knowing who to bill, so-to-speak. In absence of a clear understanding about who was responsible for what debris, no direct course of action is easily arrived at.

It is necessary to point out that fishermen's role in questioning responsibility was much more limited than that of aquaculture. While it is certainly the case that fishermen and representatives were clear about their view that aquaculture debris is aquaculture's responsibility to clean up - a clear refute to the idea of neutrality and equal blame - it was not possible for fishermen to question who or what is responsible for fishing-related debris in the same way as did aquaculture. There are far more regulations governing fisheries equipment. Lobster fishermen, for example, must fasten registration tags to each cage they use, thereby clearly identifying whose cage it is, the date of issue, the LFA the cage is supposed to be in, and etcetera. Responsibility, for them, is on the whole a lot more straightforward.

5.1.4 Summary

At the beginning of this section I described how fishermen and aquaculture were

³² This is an issue that became quite widely taken up by all stakeholders I interviewed. I myself devoted some time into straightening this out. As it turns out, Farm Credit only had a stake in 2 sites in the area, both of which had undergone cleanup and remediation.

engaged in what they both considered to be an adversarial construction of marine debris risks. It was clear that both stakeholder groups had incentives to see some actions taken to mitigate certain of the variously constructed risks while at the same time desiring that some actions be avoided. To this end, both the fishermen and the aquaculture industry utilized the tactics of finger-pointing and guilt discourse, interceding in the assembling of certain nodes within multiple risk enactments, and the defining of just who or what is responsible for the marine debris problem, in order to encourage or discourage the connecting of risk assemblages with particular risk management actions. What must be stressed here is that within this subjective and adversarial environment it is the ramping up of uncertainty that has the most potential to impede action.

As both Rosa (1998) and Renn (1998) point out, something can only be considered a risk if there is an element of uncertainty. Boholm (2003, 166), building upon Rosa (1998), suggests that understanding risk as degrees of uncertainty allows us to ask “... how people identify, understand and manage uncertainty in terms of knowledge of consequences and probabilities of events.” As shown above, however, the “probabilities of events” being managed through uncertainty in this case is not exclusively, or even necessarily primarily, the direct negative impacts of marine debris upon specific human activities; rather, the degree of uncertainty is itself being managed with an aim to affect the probability of the enactment of particular management actions. When both aquaculture and fishermen engage in implicating the other through finger pointing and the assigning of guilt, they each introduce a greater degree of uncertainty as to what marine debris should be the focus of finite resources. When both stakeholders intercede in the assembling of risk schemata to promote the taking up of their own subjective risks,

they introduce a greater degree of uncertainty as to just what should be considered at-risk, or what even constitutes marine debris in the first place. Finally, if determining who or what is responsible for certain aspects of the marine debris problem is largely questionable and contested, uncertainty creeps in as to where to look for resources and direction on management actions.

What was clear early on in the mapping of risk subjectivities, then, was that too much subjectivity allowed for the scope of debate about the management of the problem to become too great. The competing political interests between aquaculture and fishermen led to such a high degree of uncertainty as to which risk enactment should be taken up that the schemata Boholm (2003) identifies as the method through which risk management actions may be reached became, instead, a network of contestations and confusions, with no obvious course of actions reached. In effect, it was the deployment of multiple subjectivities that became a main barrier to debris mitigation. Yet, as pointed out in the previous chapter, marine debris was in the environment and posed a risk of negative interactions, and both aquaculture and the fishermen agreed on that. Furthermore, if the exact form and layout of the map was contested, its usefulness in better understanding the problem of marine debris was accepted by both parties. With an agreement on that front, the question now became centered on just how the map might be useful in erecting a bridge for better collaboration.

5.2 Objectively Stabilizing

Reality, argue Law and Urry (2004, 395) “... *is a relational effect*. It is produced and stabilized in interaction that is simultaneously material and social” (emphasis in the

original). Taking this view, the problem of marine debris should be seen as an interaction between, on the one hand, the multiple subjectivities and socio-political deployments of risk, and, on the other hand, the material impacts and locatedness of the physical debris. The insertion of a PPGIS map of marine debris and its associated subjectivities into this relational field becomes an interface between the two, whereby the multiple subjectivities at once inform the assembling of the 'reality' of marine debris depicted on the map, yet are also constrained by those very depictions. In the previous section I argued that having too much subjectivity - too much uncertainty and contestation - makes it difficult to know what risk management actions to take. If the relational world of the marine debris problem were made up entirely of socio-political risk subjectivities it could only ever remain provisionally assembled, constantly susceptible to fast-decaying relations and shifting alliances, and, therefore, not likely to remain fixed long enough to take meaningful actions toward risk management. The discussion in this section will trace out and examine how the PPGIS map, as an actant, stabilizes marine debris and its associated risks, thereby rendering the problem actionable.

As noted, when aquaculture or fishermen desired to see actions taken they attempted to increase the degree of certainty in the risk assemblage, and when action was undesirable they attempted to decrease the degree of certainty. They did this by utilizing three main tactics: finger pointing and guilt discourses; interceding at the various links in the risk assemblage; and by questioning or assigning responsibility. The confusion these tactics created as to just what is the problem of marine debris and just what actions should be taken had, to a large extent, limited meaningful remedial progress being made over the previous 3-4 years (recall that the MDSAC was initiated in 2013). With the

introduction of both the PPGIS process and the resultant map into the relational field of marine debris stakeholders, the ability of any particular stakeholder or stakeholder group to deploy these tactics became more constrained. While there remained, of course, uncertainties - some of which were effectively magnified once taken up by other stakeholders - the data represented on the map also allowed for a collapsing of multiple risk subjectivities into a temporarily stabilized risk enactment. This stabilization allowed the stakeholders in attendance at the roundtable to link the problem with management actions. In the following paragraphs, I show how the PPGIS process and map constrained some tactical possibilities while enabling others, how some risk assemblages were taken up and some discarded, and how the stakeholder participants at the roundtable came to a common, however tentative, understanding of the problem.

5.2.1 Stabilizing the Points, Stabilizing Debris

At the beginning of the July 19th roundtable, it was aquaculture representatives that made the first move to control the discourse and introduce uncertainty. First, they questioned the validity of the map on the grounds that a meaningful amount of the data shown had yet to be ground-truthed. This, they suggested, made the map anecdotal. This portrayal was clearly an attempt to cast doubt upon the usefulness of the PPGIS map, to insert the idea into the minds of the various stakeholders and government representatives around the table that there was uncertainty as to whether the points on the map represent reality. Interestingly, more than half of the participants later interviewed made references to the validity of the map. On the surface, it could appear as though this tactic was successfully deployed - taken up by many of the stakeholders - some suggesting that the

points need to be validated, others suggesting that the map is lacking some points.

Tactically, the move to have the inaccuracy of the map taken up and questioned by the stakeholders was also a suggestion that we should not be making risk management decisions based upon it. Yet, if the map was being openly contested by aquaculture and the stakeholders had taken that up, the process of PPGIS - the very method through which the map was and continued to be constructed - constrained that uncertainty and rendered available the possibility of some management actions.

The act of questioning the data, instead of initiating a broad rejection of its ultimate usefulness, opened up the possibility that the data could be validated - could be ground-truthed. One of the research partners actually took the opportunity opened up by the challenge to point out that the whole point of bringing the multiple stakeholders into contact with the map was to work together towards making it a more useful tool. Here, then, a tactic that could be interpreted as the attempt to introduce uncertainty was taken instead as an opportunity to work towards *more* certainty; it allowed part of the management strategy to become *more* clear. Moving forward with the problem of marine debris now meant that points on the map that had not yet been ground-truthed should be. It is also worth noticing here, though, that this had the effect of deferring remediative actions until ground-truthing had been done. Furthermore, the question of just who would be responsible and accountable for the ground-truthing remained somewhat unclear.

The second thing that aquaculture did at the beginning of the roundtable was to assert that some of the debris on the map was not debris, but, rather, stored equipment on leased sites. Here, as described above, the aquaculture industry was attempting to assemble of-risk objects into things that fit within *their* definition of debris. Also noted

above was that this did work. Throughout the rest of the roundtable any conversation about the risks associated with any gear or equipment immediately ceased once it was declared that it was on a leased site. To suggest that something could pose a risk became a complete non-sequitur if it was on a leased site; references to that material ceased, and the conversation moved on; this despite the fact that such material did often break up and enter the wider environment and, thereby, become debris. What the roundtable participants accepted, then, was a definition of marine debris that did not include any objects contained within a leased site, or officially owned and potentially usable, and the crafting of a course of management action that did not include any such objects. Nevertheless, in this seeming consensus on what the group should be focusing and what should *not* be considered debris, a common understanding of the problem was beginning to emerge.

5.2.2 Stabilizing Neutrality

Another site of seeming consensus that is worth highlighting is the ideal of neutrality. Many of the participants of the roundtable mentioned that it would be particularly undesirable for there to be any “finger pointing” between the stakeholders. This ideal of neutrality had been greatly advocated for by the aquaculture industry in those early meetings, and much less so by the fishermen. The MDSAC meetings were also a place where neutrality was highly praised, to the point that this purported “committee of stakeholders” was described as one in which they [stakeholders] “... come to the table without their stakeholder hat on.” It must be pointed out that the greatest advocate of the ideal of neutrality was the stakeholder group that was also one of

the most visible contributors to the marine debris problem. What should also be noticed is that the declaration that neutrality has been taken up and embraced - and the expectation that everyone has done so - makes it difficult to notice that political positioning and tactical deployments are continuing to take place. In fact, the MDSAC could be considered almost a ground-zero for the development of many of the tactics and “party lines” that emerged throughout the FGDs, meetings and roundtables. So, then, why was this ideal so widely assumed and embraced by so many stakeholders?

One reason was offered almost as an afterthought during one of the interviews. Noting that it is in everyone’s best interest to move forward on the marine debris issue, one participant suggested that “... the finger pointing thing won’t do any good at all. It’s tempting, but [aquaculture] are the only ones that have the barges and cranes ... that’s why you don’t finger point ... they’ll walk away from the table.”³³ In fact, other participants have pointed out that engaging with aquaculture on the marine debris issue has been tumultuous and difficult at times. This history only adds credence to the possibility that they could simply walk away from the table at any time. This is not to suggest that the only reason why so many participants had taken up neutrality was the possibility of losing aquaculture participation; there are surely other plausible reasons (like, perhaps, wishing to be seen as having a high ethical standard). Yet it is in fact the case that without the engagement of aquaculture, much of what remains possible in terms of remedial actions is nominal at best; their equipment is simply necessary for meaningful action, and it is, therefore, unlikely that this has gone unnoticed by those who

³³ Interview conducted on September 30, 2016

have a stake in seeing debris cleaned up.

Even if the ideal of neutrality was taken up, at least in part, for fear of alienating resource rich stakeholders, it was at the same time the case that the active PPGIS process and the construction of a marine debris map made the likelihood that large and implicated stakeholders could walk away from the table far less likely - even if they wanted to. As Harley (1988, 129) argued:

[b]oth in the selectivity of their content and in their signs and styles of representation maps are a way of conceiving, articulating, and structuring the human world which is biased towards, promoted by, and exerts influence upon particular sets of social relations.

Walking away from the table, then, is also walking away from the ability to have a say in how the map is rendered and the influence it could thus have on the social relations bound up with marine debris. In fact, several participant interviewees highlighted the fact that the roundtable was quite singular in having both fishermen and production level aquaculture employees present and participating. I argue that, at least in part, this was due to these stakeholders' understanding that the map has an influential power and that it is, therefore, in their best interest to be part of its shaping and construction (a point I will return to in more detail later).

Significantly, while this declaration of neutrality seemed to have been taken up by many stakeholders, in practice this did not lead to active avoidance of labeling the source of debris. When asked early on in the roundtable to discuss risky debris, many stakeholders referenced risks associated with specific kinds of debris, such as herring weir stakes, semi-submerged aquaculture equipment, floating ropes, and sunken boats. At no time did the conversations about marine debris lose their specificity, their source, or

their types; there would simply have been no way to discuss marine debris otherwise. Finger pointing, then, should be more appropriately considered a euphemism for cordiality. It is the desire to acknowledge that “we all win if we remove it,”³⁴ and that working collaboratively is preferable to disparate and inefficient acts. The PPGIS process enabled such collaboration, while still making it clear what the focus of our attention really was - be it derelict herring weirs, abandoned lobster pounds, aquaculture mooring blocks, broken salmon cages, and so on.

5.2.3 Stabilizing the links

At-risk items became a site of competing emphasis by aquaculture and fishermen in early discussions. Here, having one’s interest taken up by other stakeholders was based upon how visibly severe the impacts of specific debris appeared to be on one’s activities. For their part, the fishermen emphasized how aquaculture related debris was a risk to their safety, their equipment, and their livelihoods. Aquaculture representatives stressed the damage that could be caused to boaters by derelict herring weirs and how troublesome navigation can become as a consequence. The competition between these two groups to have their concerns rise to the top of the discussion, I would argue, led to a confusion as to what debris should attract finite remediation resources. The ranking of priorities becomes uncertain and subject to rhetorical devices, volume and power. PPGIS and the map introduce elements that have the ability to stabilize this uncertainty.

Rather than just relying upon persuasive subjective accounts of what should be

³⁴ Interview conducted on September 30, 2016

the focus of remedial efforts, the capacity of the map to store and track data was seen by some participants as a valuable way to decide upon actions. “Because it’s a shot at ranking,” claimed one participant, “it gives you a way of trying to assess what’s most damaging.”³⁵ This participant also noticed that “... the only real criteria for clean ups pre-map has been negative interactions with debris.” This draws attention to the rhetorical accounts of those who have had a negative interaction with debris. The map, by way of storing, representing and tracking reported marine debris and remedial efforts, can take those reports and accounts, place them within a three-dimensional field of relations and interactions that can include variables like frequency of negative interactions, overlapping impacts, activities that are most at risk, geographic hot-spots, debris sources, etcetera, in order to make more effective resource allocations.

The process of PPGIS, itself, also has a role to play in stabilizing the competing subjectivities of negative interactions and reducing uncertainty in decision making. By including stakeholders that collectively have the capacity to speak to every aspect of the marine debris problem - from the measurable severity of human and non-human impacts, to the types and costs of equipment needed to address any particular of-risk object, to the feasibility or challenges associated with disposal after removal - the allocation of resources and the ranking of priorities can be examined in a more holistic manner. Here, we do not have to rely purely on the subjective accounts, nor solely on the ‘objective’ data captured on the map; it is the interaction between the two that avoids the “absolute relativism” of subjective risks as well as the completely decontextualized technical

³⁵ Interview conducted on September 12, 2016

objectivity of pure data.

Both the fishermen and aquaculture had been attempting to intercede at the ‘of-risk’ node in order to have their risk enactment taken up in a way that includes some objects while excluding others. It has already been pointed out that aquaculture was partially successful in having the roundtable group take up a definition of of-risk objects that excludes non-marine debris objects - those that are within leased areas or are otherwise owned. Yet, within the context of the multi-stakeholder roundtable, as one participant pointed out, “every site that they [aquaculture] own that there was debris [identified], they had an answer for it and that they were going to clean it up.”³⁶ So, while the definition of debris and of-risk items did not include objects under lease, aquaculture nevertheless found themselves having to acknowledge that some of their sites required intervention.

Fishermen, I had suggested, were insinuating that biodegradable objects like weir stakes should also not be considered marine debris. During the conversations around the table, however, one of the most vocal critics of old weirs was a traditional fisherman. For him there was a real risk of punching a hole in the bottom of a boat should that boat get caught up in a swell. This was also echoed in several of the interviews, where weirs were highlighted as being of concern. As a consequence of this, a representative of the fishing industry conceded to me, sometime after the roundtable, that fishermen might indeed have to deal with some of the most risky derelict weirs.

What both of these developments signal are the constraints under which both

³⁶ Interview conducted on August 26, 2016

stakeholder groups must operate. Even with the ability to influence discourse and direct how risk is taken up and assembled, no one stakeholder can be alone in the assembling of marine debris within a PPGIS process. First, Beck (2006) alerts us to the fact that risk has become a compulsory medium of communication between parties that otherwise would rather have nothing to do with one another. As has been noted by several of the participants, traditionally both on-the-water fishermen and production level aquaculture operators are usually absent from debris stakeholder meetings. Having them together at the July 19 roundtable, along with other stakeholders, indicated that there was a compelling need to participate. Second, the “boundary” objects located at the different nodes along the risk network come to serve as markers of differences as well as common points of reference (Harvey and Chrisman 1998). They are negotiated, and through that negotiation a stabilization of the risk network occurs and group coherence emerges. Once this coherence emerges, the group, in the words of one of the participants, becomes “a little more accountable to each other.”³⁷ It is this accountability that is the real constraining mechanism of PPGIS. It is the mechanism by which both fishermen and aquaculture were compelled to make concessions, to cooperate. Neither of them, as a consequence of their participation - a participation that they were compelled into - can escape the higher degree of visibility levied through the map or through the process of face-to-face collaboration undertaken to construct it. This visibility and accountability leads me to the final process I want to highlight in this section: the stabilization of responsibility.

³⁷ Interview conducted on October 4, 2016

5.2.4 Stabilizing Responsibility

One of the most potentially paralyzing uncertainties is that of determining who or what is responsible for the marine debris problem. Many of the participants at the roundtable were troubled by the seeming lack of responsibility for marine debris. “It seems like nobody wants to be responsible or accountable for that debris,”³⁸ exclaimed one participant. “Yeah, some of these sites that don’t seem to be anybody’s ... but somebody owns it. Even though they own it, they don’t seem responsible for it,”³⁹ puzzled another. Many of the participants became preoccupied with figuring out to what extent the lenders, Farm Credit, were responsible for the problem. Government representatives disavowed any meaningful responsibility, while for others it was a mystery what all the bewilderment was about. It was clear that the deployment of a discourse of uncertainty led to confusion over possible responsibility or actions and thereby increased the likelihood of finger-pointing.

Yet, even while, for many participants, the assigning of responsibility to particular marine debris appeared to be a tremendous barrier to remediation, the use of the map to capture the locations of marine debris and the presence of regulators and other in-the-know stakeholders at the roundtable combined in a way that made responsibility, in some cases, very difficult to contest. As already noted above, both the fishermen and aquaculture were compromising on previously rigid positions. Fishermen were recognizing that some weirs were going to have to be tended to, and aquaculture was acknowledging their role in the maintenance of aquaculture spaces - even if they remain

³⁸ Interview conducted on August 18, 2016

³⁹ Interview conducted on October 3, 2016

under lease. Having a PPGIS map that is capable of representing multiple layers of information, such as debris locations, perceived risks, location of leased sites and weirs, and so on, allowed all the participant stakeholders at the roundtable to make visual connections between these layers in such a way as to make refutation of responsibility seem absurd.

There were certainly cases where linking the different layers of the PPGIS did not render clear responsibility. The sites presumed to be under the control of Farm Credit, for instance, allowed for an open refutation of responsibility. For many sites, however, the map did stabilize responsibility. Interestingly, for those sites where responsibility did become visible during the roundtable, the aquaculture representatives became exceptionally cooperative. Every such site that was raised during the discussions led to proclamations from the aquaculture representatives that they would be pleased to go out and clean them up at their own expense. In fact, one participant felt that “the workshop was the clearest articulation I’ve seen from the aquaculture industry that they are willing to play ball with others and clean up.”⁴⁰ As noted, the fisherman also took more ownership of their own roles in the debris risk problem. Here, then, we can observe the movement away from the entirely subjective and contestable map-free realm with no accountability among members of the stakeholder “group”, towards a more constrained and visible notion of responsibility.

⁴⁰ Interview conducted on September 12, 2016

5.3 PPGIS and the Power of Maps to Mediate

Maps are political statements, located within specific relations of power, and are not, therefore, simply neutral documents (Crampton and Krygier 2005). The differences in purpose and tactics noted above were deployed in an effort to influence how objects of risk are first identified, then depicted on the map in order to shape the field of possible management actions. The point to emphasize here is that maps are the product of human decisions that are, themselves, based upon assumptions about representation, emphasis, shape, design, uncertainty, and so forth. As these decisions and assumptions have impacts upon and are impacted by force relations, maps become a locus of *power*, whether or not this is observed or desired (Wright, Duncan, and Lach 2009). Power, then, is where the crucial analytical turn is made. Examining whether or not the process of PPGIS - its methods and techniques - are helpful in dealing with the problem of marine debris is really a question about whether or not it is capable of sorting out conflict between stakeholders in a way that everyone can, at least in principle, agree to.

Kyem (2004, 38) argues that the successful use of GIS technologies within conflict resolution should aim towards the management of tensions between “the cooperative move to create values jointly and the competitive urge to claim rewards independently.” The observations I made during the development and then the public deployment of the PPGIS map of marine debris do in fact reveal the push and pull of these two forces.

5.3.1 Conflict

In the first section of this chapter I went over in detail how both the fishermen and

aquaculture were responding to the political risks associated with marine debris. Both of them, I argued, had viewed the problem of marine debris as adversarial in nature - a conflict between the interests of each side. As I pointed out, the presence of these political risks placed both stakeholder groups in a kind of double-bind, where their engagement with the problem of marine debris carried the possibility of both negative and positive consequences. Given this, it came as no surprise that it seemed stakeholders were reticent in dealing with the problem: “We’ve tried to engage the aquaculture industry the way the fishing industry was engaged, it just hasn’t really happened,”⁴¹ suggested one participant. “The fishermen, as a rule, don’t attend the marine debris meetings,”⁴² pointed out another. The question that must be asked, then, is: what is it about the PPGIS mapping that brought these groups to the table? One possible answer is one I have already hinted at; fishermen and aquaculture came to the PPGIS table because they were, in a way, compelled to.

The development of Public Participation GIS stemmed from criticisms that the technology was elitist, expensive and complex, and, therefore, marginalized and *disempowered* certain sections of the population that might otherwise benefit from its use (Mukherjee 2015). Emerging from this criticism, the initiative of PPGIS has as its foundational goal the empowerment of those who are less privileged by way of their inclusion in the process of GIS construction and access to the benefits of its use (Harris and Weiner 1998; Brown 2012; Kyem 2000). So, much of the PPGIS literature has been occupied with trying to solve the problem of how to include less powerful voices in the

⁴¹ Interview conducted on August 26, 2016

⁴² Interview conducted on September 12, 2016

process. In this study, however, the very opposite problem turned out to be the case. It was primarily aquaculture that avoided participation in the mapping. Aside from the early meetings described above, production and management level members of the industry were unwilling (prior to the roundtable) to engage in the PPGIS process. While we were periodically able to get in touch with aquaculture communications staff, there was silence from those members of the industry with the power to make real commitments in terms of policy, resources, connections and infrastructure. This was potentially a big problem for the project. There was real concern and time devoted to figuring out just how we might be able to move the project forward if aquaculture simply refused to participate.

We pressed ahead with the map, refining it and adding greater and greater resolution to it in collaboration with fishermen and our research partners. Interestingly, the more detailed the map became, the more interested the aquaculture parties became. By the end of May, 2016, the hiatus of the MDSAC and the continuing disengagement of aquaculture led the research partners to decide to assemble our own roundtable in order to publicly deploy the map and use it to engage with stakeholders representing all the diverse aspects of the marine debris problem. Once we had the details arranged we made yet another effort to secure the participation of production and management level aquaculture representatives. This consisted merely of inviting aquaculture communications people to come and see the map that we intended to release publicly. They could either continue to boycott the construction of the map, thereby allowing others to dictate what it would reveal and how it would be used, or they could participate in the roundtable, giving themselves a voice in the process. They chose the latter.

Resistance and struggle, notes Flyvbjerg (1998), perhaps offers the most stable

ground for the exercise of democratic freedom. The problem of inclusion and participation that PPGIS seeks to redress, though, is only one facet of the democratic struggle to influence how marine debris is approached. Indeed, the problem of inclusion is solved - at least in this case - precisely as a result of the conflict over the control over the process of inscription.⁴³ Taking the materiality of marine debris - its substance, temporality, locality, interactions, etcetera - and rendering it “useful” through PPGIS is a process of resistance and struggle. It is this struggle that brought traditional fishermen and aquaculture to the table in the first place. So, the PPGIS process, in attempting to level the field of opportunity to participate for all stakeholders, does so through conflict. Yet, even if conflict and the impulse to sustain or increase one’s own self-interest is what brings stakeholders together, it would be cynical to maintain that this was the *only* reason people continued to participate in PPGIS. Seeking to explain participation solely in terms of rational self-interest and power neglects the role that group expectations, relationships or collective sanctions may play in facilitating decisions about risk management actions (Flyvbjerg 1998; Kyem 2004).

5.3.2 Cooperative Creation of Values

Kyem (2004) argues that the formation of the values and beliefs that sustain conflict has its root in the access to information available to an individual. Consequently, disagreements might be thought of as not only being the result of a lack of information,

⁴³ An inscription device “... is any item of apparatus or particular configuration of such items which can transform a material substance into a figure or diagram which is directly usable” (Latour and Woolgar (2013, 51). The materiality of the marine debris, then, is transformed into the PPGIS map, and it is the map which become the “usable” device.

but also a result of misinformation. Indeed, it can plausibly be inferred that it was the uncertainty introduced by both aquaculture and fishermen that kept the marine debris problem on the table for so long. In situations like this, says Kyem (2004, 38), PPGIS “can help disputing parties get past initial misconceptions and work together to create joint gains.” This is because PPGIS provides the opportunity, during the process of inscription, to collectively generate and analyze data, investigate alternative scenarios, explore each other's values and beliefs, and see where those values and choices might lead (Kyem 2004). This process, then, is an opportunity to build the type of accountability to each other that participants highlighted. As one participant mused:

I don't think there would have been particular value or productivity to having a meeting about marine debris with all those people there without a map or without something specific, just to say ... that would have just turned into an argument. It would have been all hypothetical.⁴⁴

In other words, the map focused the discussions in such a way as to take what might be considered uncertain, subjective, ethereal, and make it more tangible, objective, and material. In doing this, the table is set for moving away from the purely conflictual, self-centered and defensive realm towards a more collaborative and cooperative one.

An analysis that only focuses on the self-interest of the stakeholders could only paint part of the picture. Most of the stakeholders at the roundtable live and work in the same towns, they cross paths at the local coffee shops and while working on the water. There are, therefore, many potential reasons why, for instance, aquaculture agreed to clean up risk-objects on their lease sites, only one of which is to protect themselves from

⁴⁴ Interview conducted on September 12, 2016.

government regulators or political fallout. When working within a group where stakeholders have more than one reason to interact or come into contact with one another, compromise may simply be an indication of adjustments in personal values to promote long-term relationships (Kyem 2004). Many of the participants noted the historical tensions between the traditional fishermen and the aquaculture industry. It seems as though, by harnessing and even heightening the adversarial differences between these two stakeholder groups in such a way as to bring them to a common table, PPGIS was able to provide the opportunity for them to engage with one another; once everyone was at the table together, cooperative and collective forces were introduced into an otherwise competitive-centric situation. As one roundtable participant observed:

I think it was very useful in the conversations that we had for the traditional fishermen to hear what the aquaculture industry has done in terms of clean up and vice versa. I don't think those are conversations that have happened in the past and I think, again, that puts a different light on the relations between the different groups.⁴⁵

Once this dialogue is established, it becomes morally permissible for both stakeholder groups to abandon their entrenched positions and find grounds for agreement.

Participants noticed this as well: "The aquaculture guys were on the water every day said 'yeah I saw that there, and this is this and that's that.' Traditional fisheries fishermen were there and saying the same things. They actually got into some dialogue back and forth ..."⁴⁶

So, what began as a primarily adversarial contest between fishermen and aquaculture gave way to the possibility of participation, dialogue and, through them,

⁴⁵ Interview conducted on September 12, 2016

⁴⁶ Interview conducted on September 12, 2016

collaboration. Both fishermen and aquaculture perceived the risk of marine debris differently, and both deployed those perceptions in an effort to influence the field of possible risk management actions. The PPGIS process effectively harnessed the self-interest of these two stakeholder groups to compel their participation. Once at the table dialogue was possible, whereby the sharing of experience and negotiations on representation coalesced into a collectively (though tentatively) stabilized marine debris risk. It was the magnification of the conflict between aquaculture and fishermen through PPGIS, then, that manufactured the conditions needed for the adoption of a more collaborative approach to mitigation.

Chapter 6: Conclusion

I began this research in order to investigate whether or not the methods and techniques of public participatory GIS to map subjective risk are helpful in dealing with the marine debris problem, to see if this participatory mapping process could assist stakeholders in overcoming their entrenched positions while also fostering a more collaborative environment. Brown and Kytä (2014) argue that there is an inherent tension within PPGIS between its two dominant components: the GIS technologies (GIS) and public participation (PP). This tension, the authors say, between technology on the one hand and social processes on the other, represent an uneasy merger between competing knowledge systems. In a similar observation, Boholm (2003) alerts us to the tensions inherent between the competing knowledge systems of a purely objective metrics for measuring risk, and the purely subjective experiences and perceptions of them. This research, first, confirms the presence of these tensions between the various stakeholders involved in the marine debris problem and, second, suggests that the PPGIS process provides an opportunity to overcome them.

In the early stages of the PPGIS mapping, both the commercial fishermen and the aquaculture industry were engaged in the deployment of subjective risk perceptions in a manner that sought to increase the stability and certainty of some aspects of the marine debris problem - such as how the other party's activities were riskier than their own - while at the same time seeking to generate uncertainty in a way that makes decision making on certain risk management actions more difficult. In effect, these stakeholders were engaged in a discursive competition with an aim towards protecting their own interests. Initially, this discursive competition was situated entirely within the social

processes that Brown and Kyttä (2014) refer to, and the subjectivities that Boholm (2003) refers to. This, I argued, did in fact generate a high degree of uncertainty and fostered an inability to reach a clear understanding of the marine debris problem. The increase in uncertainties also established a disincentive for aquaculture to participate in the PPGIS, as it was primarily debris from their own activities that were being captured by the process; provided there was sufficient uncertainty and room to point fingers, there seemed to be little aquaculture could benefit from in the mapping exercise, but much to lose. Yet, as I pointed out, the ability of either stakeholder to avoid engaging with the problem became increasingly more difficult relative to the increase in the resolution of the map. Here we can observe how the technological aspects of the map, along with the more objective material and spatial data it was recording, introduced an opportunity to bridge the barriers to collaboration.

Kyem (2004) suggests that competition between stakeholders can serve to facilitate cooperation. Indeed, my research demonstrates how it was the initial conflicts between aquaculture and fishermen, with their desire to influence and control how risk was assembled and enacted, that brought the various stakeholders to the roundtable in the first place. In this way, it was the initial conflict and motivated self-interest that brought about the conditions through which collaboration and cooperation could be established. For Kyem (2004, 50), the ability of PPGIS to effectively mediate conflicts can sometimes depend upon the need of some parties to “develop some basis of power (prior to mediation) in order to assert their influence during the process.” This power, he argues, might be developed in a variety of ways, such as through political or grassroots organization. Interestingly, though, Kyem does not include PPGIS in his list of ways one

could accrue a basis for power. In fact, he goes on to suggest that the application of GIS technologies might necessarily be postponed until “after the development of power or intense emotions” (2004, 50). It has been my finding, though, that by initiating the PPGIS mapping process with one willing stakeholder group - in this case the fishermen - this group attained enough influence and power to compel the engagement of the aquaculture industry, whom may otherwise have remained quite reluctant to do so.

Brown and Kytta (2014) point out that PPGIS has traditionally emphasized the quality of spatial data towards the enhancement of participation processes for better land use decisions; the generation of social capital or enhanced community identity have been of only corollary concern. Conversely, PPGIS methods, with their origins rooted in developing countries, have tended to focus on social learning and community engagement (Brown and Kytta 2014). In order for PPGIS to be helpful within an environment of vested interests it is necessary to, again, strike a balance between the emphasis on objective data and the subjective and social aspects. On the one hand, the data points on marine debris needed to be accurate and meaningful enough that they could not simply be ignored. Furthermore, in order for actual decisions to be made regarding risk management and remediation efforts the stakeholders needed to know that the data reflected some kind of objective reality. On the other hand, face-to-face participation was necessary within our model of PPGIS to ensure that social learning, and its offspring - the establishing of social capital, could take place. So, had we simply concentrated our efforts on the gathering of objective data, we would have failed to generate an environment of understanding and accountability required to generate a stabilized consensus as to viable courses of risk management action. Conversely, had we

only tended to the subjective perceptions of risk and experiences there would have been little reason for stakeholders to trust and work with the data in the map, thereby making it very difficult to arrive at effective decisions on appropriate courses of action.

In short, this PPGIS project was successful, insofar as it was able to harness, and even heighten, a conflict between stakeholders in order to bring otherwise reluctant stakeholders together. By finding a middle ground between the subjective and objective notions of risk, between the technological and social, and between individual and collective production of values, our PPGIS process was able to balance and stabilize uncertainties and subjectivities in order to generate a common understanding of the problem to which stakeholders can, at least situationally, agree. PPGIS does have the ability to help in bringing stakeholders off of their defensive positions.

What remain unclear, however, is to what extent the marine debris problem has been addressed. As noted, much of the actions agreed to amounted to little more than ground-truthing whether the debris is there or not. Aquaculture did agree to remediate or cleanup debris on their leased sites, and help where they could, but there has yet to be any follow up to determine the extent of what has actually been done. The \$12000 budget that the FNFA had requested help in allocating (the reason for the roundtable in the first place) was mostly used to drag the Bay for submerged fishing debris and fell far short of their initial high hopes and expectations of the what the roundtable would yield. Yet, as I have argued, the roundtable was successful in bringing stakeholders to the table, in providing

the necessary groundwork for successful collaboration and understanding, and in generating a level of accountability between the participants.⁴⁷

Directions for future research should continue to investigate the “middle way” approach we have taken here. If Beck (2006; 1992) is right in arguing that the world has entered a new political epoch centered upon the navigation and management of global risks, effective methods for doing so will be required. The tendency for developed nations to overemphasize the scientific and objective assessment of risks actually has the potential to lead to greater uncertainty and greater conflict. Methods, such as the one herein investigated, that are able to funnel inherent conflicts and uncertainties into collaborative environments will, therefore, be of increasingly greater social value. How the marine debris problem within the southwest Bay of Fundy area continues to unfold will offer greater insights into whether the overall usefulness of PPGIS extends beyond the assembling of stakeholders. Further questions that need addressing are: Does the assembled stakeholder group continue to cohere, or does it dissolve without ongoing PPGIS processes?⁴⁸ How long does the PPGIS need to remain active in order to see tangible results - if any? What role does accountability between stakeholders play in remediation, and in what way does it manifest? To be sure, this study only suggests a step in the right direction.

⁴⁷ At the request of many of the roundtable participants, I organized a second roundtable held on November 21, 2016. At this roundtable, the action items flowing from the first roundtable were reviewed, and it was agreed to by these participants that further meetings should take place in order to follow up on action items and tasks.

⁴⁸ It has recently come to my attention that the MDSAC has been resuscitated and is hosting a meeting in February, 2017. It is too early to tell whether they will want to work with the map.

Maps and Figures

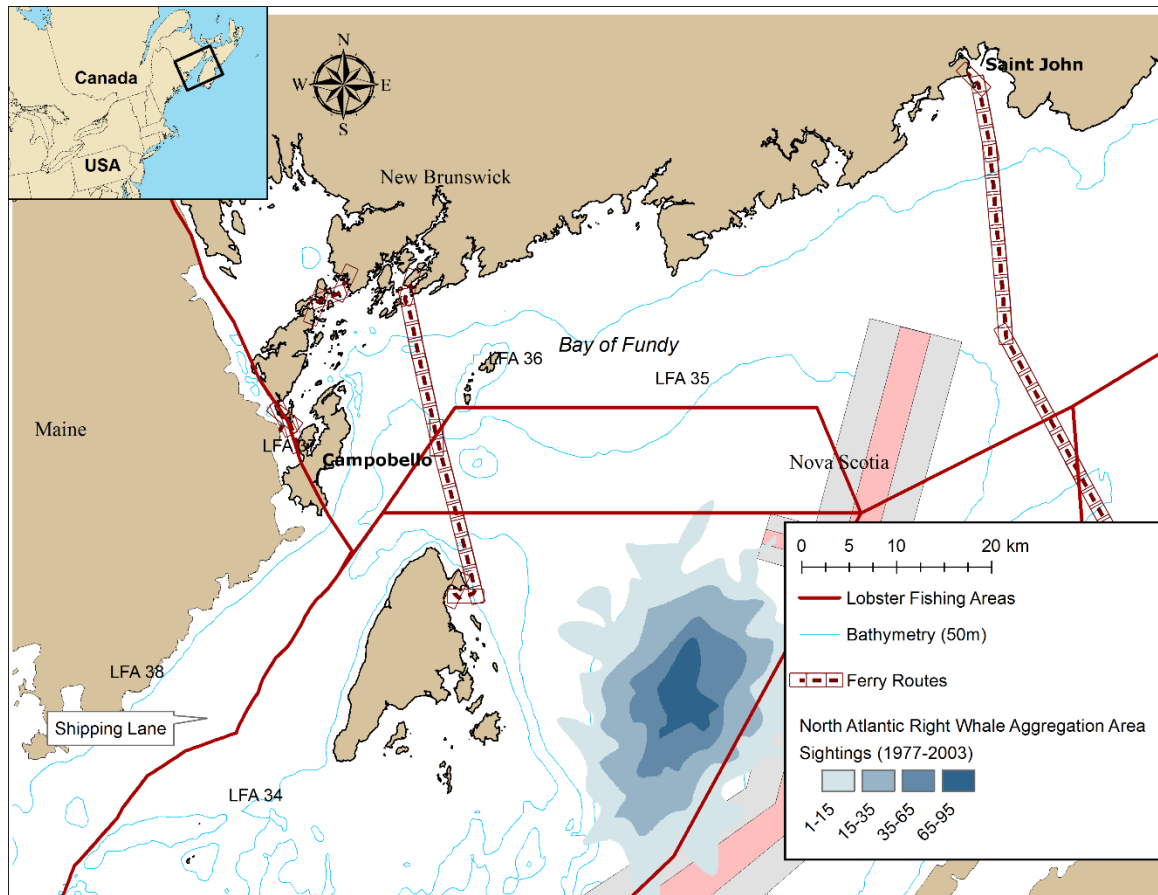


Figure 1: A map of our study area. We focused on marine debris found from the Southwest of Campobello Island extending along the coast to the Saint John Harbour.

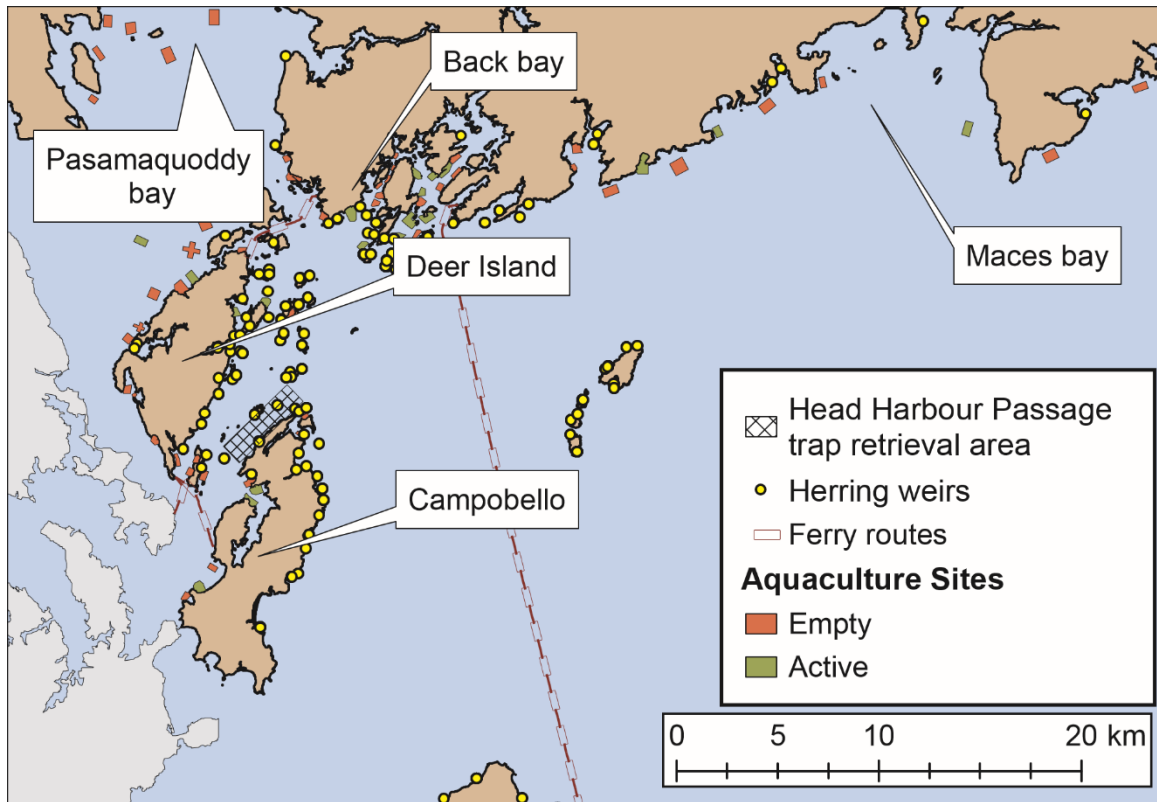


Figure 2: The focus group discussions with fishermen were held at Deer Island, Campobello, and Back Bay. As you can see, there is a high degree of activity in the area making it a particularly good place to gather risk perceptions.

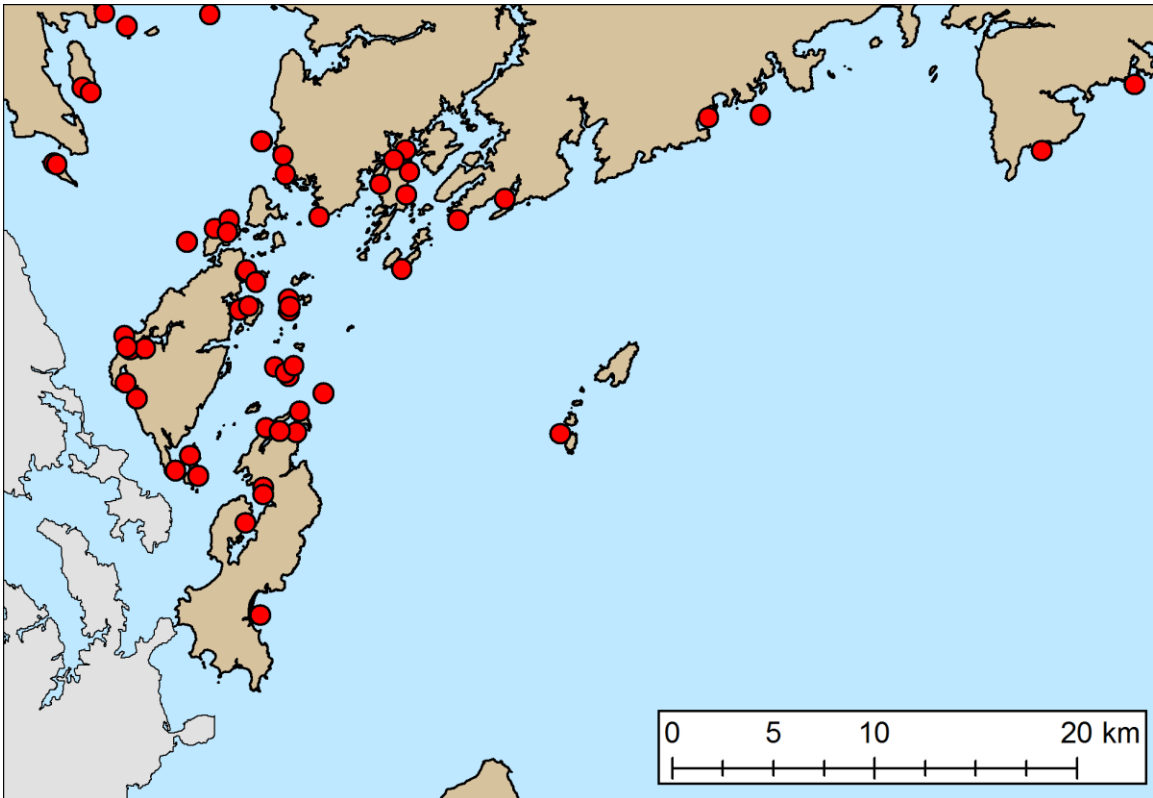


Figure 3: The red dots here represent 54 of the 63 unique debris points captured by the FGDs and the meetings with the aquaculture industry. For an online version of the complete map follow this link:

<https://www.google.com/maps/d/viewer?mid=1q9PlxtLr4GsqMWfyh0hEvTHFrY&ll=45.00892604366778%2C-66.86064430810546&z=12> (see also Appendix 3).



Figure 4: A map of the area of my marine debris survey trip with the Fundy Baykeeper on August 19, 2016. We left St. Andrews and travelled around the islands adjacent to Deer Island, especially noting the areas around Simpsons Island and Pendleton Island.



Figure 5: An exposed aquaculture compensator buoy near Simpsons Island.



Figure 6: Old herring weir near Simpson's Island, NB



Figure 7: Washed up aquaculture caging on Pendleton Island, NB (ABS plastic)



Figure 8: Custom made grappling hook used to retrieve lost lobster cages or other marine debris snarls.



Figure 9: Lobster cage snarl retrieved on November 2, 2016



Figure 10: Lobster cage snarl retrieved on November 2, 2016

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Appendix 1: Roundtable Interview Questions

1. To begin, tell me a bit about your perceptions of marine debris in the BoF prior to the workshop. (do you think it was a problem? - if so, why? Where?)
2. You attended the marine debris roundtable/ workshop. How did you find the organization of the workshop?
 - were the right people there?
 - Were there some people who, in your opinion, need not have been there?
 - *What role do you feel you played/ aimed to play/ could contribute*
3. So, a major theme of my work is based upon the GIS mapping that was used at the roundtable. Its construction has been based upon PPGIS. Are you familiar with this process (if not, explain)?
 - Given this ideal – and with this in mind – who do you think should help build the layers?
4. Moving on to the presentation of the map at the workshop now: how do you feel the map was introduced to the discussion?
 - Was it clear in what it purported to represent?
 - Was it easy to understand the different layers, etcetera?
5. So, are there any ways this map could have been constructed differently?
 - Who can tell us more about debris?
 - Are there other layers that should be included/ represented?
6. Did the map of debris accurately reflect your understanding of the situation?
7. In your view, do you think this map might change how people address the problem of marine debris?
 - Does it change how you view the problem?
8. In your view, what role did the map play in guiding the discussions? Was it informative? Distracting? Useful? Restrictive? Elaborate.
9. Do you have any concerns about the map or the mapping process?
10. Generally speaking, how do you feel the roundtable went? Do you feel it was productive?
11. What is your impression of the level of cooperation around the room. Do you feel a consensus was reached? If so, how/ why? If not, how/ why?

Appendix 2: Research Ethics Approval Board Approval

UNIVERSITY OF NEW BRUNSWICK	PO Box 4400 FREDERICTON, NB CANADA E3B 5A3	TEL 506 453-5189 FAX 506 453-3522 WWW.UNB.CA/RESEARCH	OFFICE OF THE VICE-PRESIDENT (RESEARCH)
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October 16, 2014

Melanie Wiber
Department of Anthropology
University of New Brunswick
UNBF - Campus Mail

Dear Dr. Wiber:

RE: An ethnographic study of risk assessment in coastal management: Resource sustainability and community resilience, **REB File # 2014-092**

The above project is approved as modified.

Approval is valid for a period of three years from this date.

Annual Reports for this project are due on the 15th January of each year, provided that this date is at least six months after the date of project approval. **Final reports** are due 90 days after project completion. Both of these reports can be found on our website at <http://www.unb.ca/research/ors/forms/index.php#ethics>.

Although your application was processed via Expedited Review, for your information we are providing a list of current Research Ethics Board members.

Sincerely,

A handwritten signature in blue ink that reads "R. Steven Turner".

R. Steven Turner, Chair
Research Ethics Board

REB Members:

- Joy Haines Bacon, Community Representative
- Barbara Burnett, Community Representative
- Jeff Landine, Faculty of Education
- Tracey Rickards, Faculty of Nursing
- Usha Kuruganti, Faculty of Kinesiology
- Aloke Chatterjee, Faculty of Law
- R. Steven Turner (Chair), Faculty of Arts, Department of History
- Renée Audet-Martel, REB Coordinator

Appendix 3: The Problems with a Living Map

The following link (live as of March 3, 2017) is for an online Google Maps version of the PPGIS tool generated in this study:

<https://www.google.com/maps/d/viewer?mid=1q9PlxtLr4GsqMWfyh0hEvTHFrY&ll=45.00892604366778%2C-66.86064430810546&z=12>

This online version of the map will give readers the ability to visualize how the different layers of the map interact with one another and how they can be turned on or off to better visualize specific relations. It is worth noting, however, that the inclusion of this link presents interesting problems on its own. As noted throughout this work, the social construction of the GIS object can only ever be stable for a specific moment and is susceptible to constant renegotiation. Its meaning, therefore, hinges not so much on its capture, but instead through stakeholder engagement. To decontextualize the map, then, renders it somewhat open to the reader's interpretations, and not those of the stakeholders'.

Technologically speaking, it is impossible to know for sure how long this link will remain active, and this raises the problems of just how digital media should be stored, who should store it, and who should have access to it. By placing it online, the integrity of the tool becomes subject to third-parties. Servers can go down, companies can fail, and digital containers (file formats like .mp3, .doc, or .pdf) can become obsolete. The map tool, under such circumstances, needs to be managed – to make sure it is accessible, is not lost/ deleted, and does not become incompatible with evolving technologies – but by who(m)? The researchers? The library? It is doubtful that Google or other similar services have any interest whatever in maintaining the integrity of the file for academic

posterity. Furthermore, how can/ should access to this digital tool be facilitated? Should access to it be guaranteed for the interested party, regardless of potential infrastructural barriers in the future? Unfortunately, there does not seem to be any clear answer for these problems.

Curriculum Vitae

Candidate's full name: A. Carson Rehn

Universities attended: University of New Brunswick, B.A. Hons, October 2015