LOCAL KNOWLEDGE MATTERS: KNOWLEDGE, TECHNOLOGY, AND POWER IN NEWFOUNDLAND COD FARMING

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Local Knowledge Matters:
Knowledge, Technology, and Power in Newfoundland Cod Farming

by

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Abstract

Aquacultural development is being pursued globally at a rapid rate in response to the depletion of the world's fish stocks through over-fishing. In Newfoundland, drastic declines in cod landings during the 1970s and 1980s through offshore harvesting and processing technology prompted interest in the inshore fishery. This resource crisis also spurred initiatives to develop cod farming during the mid to late 1980s. Early cod farming methods relied on the previously marginalised local knowledge traditions and technologies of inshore fishery workers. However, with the advent of the moratoria on fishing cod along the shores of Newfoundland and Labrador in 1992 and 1993, the trajectory of cod farming development in this province shifted. This shift could exacerbate preexisting inequities in Newfoundland fishing communities and further degrade marine resources. This thesis situates the Newfoundland development of cod farming in the global context of aquacultural development and analyses how the knowledge traditions and technologies developed by Newfoundland cultural groups have shaped cod farming initiatives in the province.

Table of Contents

Page

Abstract ii
Acknowledgements vi

Chapter 1 - Introduction 1

1.1 The Newfoundland Case 2
1.2 Organisation of Chapters 4
1.3 Choice of Research Topic 6
1.4 Description and Explanation of Method 8
1.5 Limitations/Challenges in the Study 12

Chapter 2 - Theoretical Perspectives for Studying Knowledge, Technology, and Power in Newfoundland Cod Production 15

2.1 Introduction 15
2.2 Knowledge and Technology 16
2.3 Concept of Power 17
2.4 Power and Commodity System 18
2.5 Commodity Systems, Knowledge, and Power................ 20
2.6 Local Knowledge 20
2.7 Scientific Knowledge 22
2.8 Commodity Systems, Technology, and Power 25
2.9 Consequences of Compliance and Resistance 28
2.10 Conclusion 32

Chapter 3 - Global Trends in Aquacultural Production: Holistic, Intermediate, and Prescriptive Practices... 35

3.1 Introduction 35
3.2 Global Aquacultural Production 36
3.3 Extensive Aquaculture and Holistic Practices 36
3.4 Intensive Aquaculture and Prescriptive Practices...... 39
3.5 Semi-intensive Aquaculture and Intermediate Practices.. 41
3.6 Intensive Aquaculture: Environmental and Social Concerns over Prescriptive Technologies 43
3.7 Aquaculture in Atlantic Canada 50
3.8 Introducing Aquacultural Production into Local Cultures: Implications for Newfoundland 55

3.9 Conclusion 59

Chapter 4 - Knowledge, Technology, and Power in
Newfoundland Cod Production.......................... 62

4.1 Introduction 62
4.2 Salt fish Production 63
4.3 Frozen Fish Production 70
4.4 Restructuring the Frozen Fish Industry:
The Consequences of Prescriptive Technologies 76
4.5 Conclusion 80

Chapter 5 - Newfoundland Cod Farming and
the Inshore Fishery 82

5.1 Introduction 82
5.2 Cod Aquacultural Production 82
5.3 Fishers' Local Knowledge and Holistic Practices 84
5.4 Using the Local Knowledge and Holistic Technologies of
Inshore Fishers in the Development of
Newfoundland Cod Farming 92
5.5 Conclusion 98

Chapter 6 - Newfoundland Fishery Workers and Cod
Aquacultural Training Courses: Aspirations rooted
in Local Knowledge 99

6.1 Introduction 99
6.2 Implications of the Cod Moratorium for Cod Farming .. 100
6.3 Training Programs for Cod Aquaculture 101
6.4 Cod Training Programs on the Bonavista Peninsula 102
6.5 Aspirations of New Aquaculture Recruits.............. 106
6.6 Conclusion.. 124

Chapter 7 - Conclusion 127

7.1 Global Aquaculture 129
7.2 Newfoundland: From Cod Fishing to Cod Farming 130
7.3 Social and Environmental Assets of Holistic
Aquacultural Practices 132
7.4 The Cod Moratorium and Efforts to Develop Prescriptive
Cod Farming Technologies in Newfoundland 135
7.5 Rethinking the Role of Families in
Local Fish Production 139
7.6 Lending Strength to Fishery Workers
and Local Knowledge 142

Bibliography 145
Appendix I 152
Appendix II 161
Appendix III 170

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Chapter 1

Introduction

This thesis critically analyses knowledge and technology from the perspective of power. It studies how the knowledge traditions and technologies developed by cultural groups shape power dynamics within fish production. Specific emphasis is given to illustrating how the knowledge traditions and technologies employed by cultural groups in Newfoundland are influencing the development of cod farming in this province.

In many regions of the world, aquacultural development has been undertaken in order to arrest declining levels of fish production due to the depletion of wild fish stocks through over-fishing. This resource crisis has been linked to the destructive fish harvesting and processing technologies associated with intensive fish production (Hutchings and Myers, 1995; Neis, 1991). Like the wild fishery, aquaculture could develop along various trajectories. A form of aquaculture based on scientific knowledge and prescriptive technologies is spreading rapidly at a global level (Franklin, 1990; Wilks, 1995). Intensive aquacultural models are marginalising local fisheries, knowledge traditions, and technolgies (Bailey et al, 1996; Wilks, 1995). These models also risk further degrading marine environments, thus undermining the wild fishery

(Nelson, 1996; Wilks, 1995). This trend is compounding pre-existing social and environmental inequities, especially those inherited from past intensive wild fish production models. The development of alternative aquacultural models which may prove more equitable for local fishing cultures and less destructive to nature is being restricted as a consequence. In this thesis, trends in global aquacultural development and fisheries management will illustrated through a case study of cod farming development in Newfoundland.

1.1 The Newfoundland Case

In Newfoundland, local fishing cultures have been involved in fish production for centuries. Through successive generations of fish production these cultures developed local knowledge traditions and technologies for the inshore harvesting and processing of cod. From the 19th to mid-20th century, families within these fishing cultures managed the household production of cod using these local knowledge traditions and technologies. However, with the advent of frozen fish production in the 1950s, governments and fish companies introduced new scientific knowledge traditions, as well as new harvesting and processing technologies for offshore and nearshore fisheries. These initiatives radically reorganised production practices in the Newfoundland fishery. This reorganisation of fish production marginalised but did not eliminate the knowledge traditions and technologies resident in Newfoundland's local fishing cultures, and reduced the control by fishing families over fish harvesting and processing. Furthermore, the technologies associated with frozen fish production depleted the resource at a rate unprecedented in Newfoundland history. During the 1970s and 1980s, the cod fishery was in crisis. In response to depleted cod stocks, attempts were made to restructure the frozen fish industry, but the fishery experienced an over-all collapse in the 1990s. In 1992 and 1993, moratoria on cod fishing in Atlantic Canada were declared, and the harvesting of wild cod on the northeast coast of Newfoundland ceased for the first time in centuries.

In the 1980s, on the cusp of the collapse of wild fish stocks, a renewed interest in the local knowledge and technologies of inshore fishery workers was ignited. A new type of cod production (cod farming) was associated with this interest. Newfoundland's early cod farming operations incorporated the local knowledge and technologies used by fishers who had maintained a reliance upon the inshore fisheries. Since the declaration of the cod moratoria, cod aquacultural development has accelerated and the interplay between the local knowledge of fishery workers and the scientific knowledge traditions of fish companies has shifted. The emerging dominant model favours intensive production models with high levels of scientific and corporate control. These models employ technologies that marginalise local fisheries and restructure nature. The outcome of these iniatives in aquaculture will structure power relations within fish production (both wild fisheries and aquaculture) in Newfoundland for generations.

1.2 Organisation of Chapters

Chapter 2 outlines a theoretical framework for critically analysing knowledge and technology from the perspective of power. It discusses two main knowledge traditions, the local and the scientific. It links these knowledge traditions to particular cultural groups. I then explore how cultural groups, by utilising local and scientific knowledge traditions, employ very different types of technologies (holistic and prescriptive). This theoretical framework will inform discussions in subsequent chapters on how local and scientific knowledge traditions and technologies shape power relations within fish production in both the wild fisheries and aquaculture.

Chapter 3 examines global trends in aquacultural development using the theoretical framework introduced in Chapter 2. This chapter discusses how local and scientific knowledge traditions, embedded in holistic and prescriptive technologies, can be associated with very different aquacultural production models. It argues how these knowledge traditions and technologies shape power dynamics in fish production (both aquaculture and fisheries) globally. It also provides a backdrop for analysing the history of the cod fishery, and the development of cod aquaculture in Newfoundland.

Chapter 4 documents the history of Newfoundland cod production from the 19th century to the moratorium which was declared on fishing northern cod off the North-east coast of Newfounland and coast of Labrador in 1992. This chapter illustrates how cultural groups through local and scientific knowledge traditions (and associated holistic and prescriptive technologies) shaped social and natural environments vital for cod production, especially those events which, I argue, led to the present cod moratorium and early developments in cod farming.

Chapter 5 examines the interplay between local and scientific knowledge and subsequent technologies employed in early cod farming operations in the mid-late 1980s. Chapter 6 discusses the cod aquacultural training programs which introduced Newfoundland fishery workers to cod farming in the early 1990s. It examines how fishery workers discerned information about cod aquaculture, and assessed cod farming methods in relation to local social and environmental inequities. I then discuss the perceptions, aspirations, and concerns these fishery workers/aquacultural recruits have with regard to the development of cod aquaculture in Newfoundland in the future (especially issues surrounding knowledge, technology, and power).

In the concluding chapter, I contrast the aspirations and concerns of these fishery workers with a number of cod aquacultural initiatives recently pursued by personnel in government, scientific organisations, and fish companies in Newfoundland during the mid-1990s. I also discuss the social and environmental issues associated with different cod farming production models, as well as issues that have been raised by my own research and which warrant further study.

1.3 Choice of Research Topic

I chose my research topic for two main reasons. Firstly, fishery workers, like the fish they rely upon for their livelihoods, have been a resource without which commercial fish production (and certainly the profit of fish companies) would cease to exist. However, the local knowledge of fishery workers, their warnings about resource degradation and their concerns about fish production models have been marginalised (Neis, 1992; Neis and Felt, 1995; Hutchings et al. 1995). Secondly, my interest in relating the local "knowings and ways" of fishery workers to aquacultural development arose when (as an adolescent) at my home on Campobello Island, New Brunswick (a small island in the Bay of Fundy) I witnessed the development of intensive salmon aquaculture in a number of local harbours and coves during the mid-1980s. At a time when hard economic times had fallen upon the traditional herring fishery, intensive salmon aquacultural development was greeted by many local fishery workers as a mixed blessing. The construction of salmon farms in prime herring spawning grounds conflicted with the traditional user-rights of local inshore herring fishers (Stephenson, 1990, Phyne, 1996). However the commercial feed operations in the region provided these fishers with an increased market for herring (Phyne, 1996). The industry's salmon processing sector provided much needed employment to displaced herring plant workers.

In recent years, the mixed blessing of intensive salmon aquaculture has proven to be a curse on a number of social and environmental fronts. The amount of detritus due to faecal and feed waste from intensive salmon farming is smothering the benthic sea floor in these marine environments (Strong and Buzeta, 1992). This is negatively affecting local fishers who harvest clams, lobsters, and scallops (Wilbur and Harvey, 1992). Salmon farmers have been plagued by a water quality problem that fuelled a sea lice epidemic. The epidemic has been combatted by salmon farmers with strong bio-chemicals that are further comprising water quality. Furthermore, this financial expense (coupled with exorbitant feed costs) has driven a number of salmon farmers to near bankruptcy and some into contractual agreements with larger fish companies (Wilbur, 1995).

Upon moving to Newfoundland for graduate studies at Memorial in the summer of 1994, I heard about the development of Newfoundland cod farming. My curiosity was peaked. Would this development take into account the negative and positive experiences of other local fishing cultures (like those in New Brunswick and in many other parts of the world) with aquacultural development?

1.4 Description and Explanation of Method

My work is part of a larger inter-disciplinary project, the Eco-Research Project on sustainability in cold water environments at Memorial University of Newfoundland. Researchers affiliated with the program have focused their efforts on establishing indications for sound resource management on the Bonavista Peninsula and the Isthmus of Avalon in Newfoundland. The program's goal is to study the social and environmental events which have occurred in the area from the pre-conquest period to the present in order to identify the prerequisites for sound resource management. My research falls under a sub-section of this larger project which has undertaken the collection and study of fishery workers' local ecological knowledge.

I carried out 3 background interviews with individuals (1 manager and 2 fishers) who were involved with Seaforest Plantation Co. Ltd.'s early experiments with cod farming in Newfoundland during the 1980s. However, the majority of my interviews were with 19 fishery workers (13 fishers and 6 plant workers) who lived on the Bonavista Peninsula (see Figure 1, Appendix III) and who had completed cod aquaculture training courses organised in the region by the Marine Institute and Seaforest Plantation Co. Ltd., which pioneered cod farming in Newfoundland. Most of my respondents were men. Nevertheless, I did interview 3 women who interestingly enough were inshore fishers. The aquaculture unit at the Marine Institute provided me with the names of course instructors who live in the study region. During interviews with 2 of these instructors, I gathered a list of trainees. I asked instructors to identify the recruits as fishers or plant workers, as well as to highlight those who might be enthusiastic about my research and being interviewed. I then telephoned these recruits and set up interviews.

I began interviewing people in the area during the summer of 1995. I arrived in mid-June and stayed until mid-August, living with a team of project researchers in Elliston, a small community near the town of Bonavista. In gathering my data, I used qualitative semi-structured, audio-taped interviews of roughly 90 minutes in duration. I felt that this method of interviewing would encourage a rapport with my respondents during which a relatively smooth exchange of ideas and information could take place, and would urge respondents to lead the interview and do most of talking. Furthermore, this method of inquiry also relied upon people's own words, sentiments, and recollections, as well as their active involvement in the transmission of knowledge. I use excerpts from my interview transcripts in Chapters 5 and 6. They have been edited for style in that I have omitted pauses, repetition, sighs, laughs, and groans which are found in conversational speech. Names and descriptions were removed from the transcript excerpts because I did not want to compromise anonymity.

In constructing an interview schedule, I considered the types of information most appropriate to my research interest. I was compelled to collect information on how these respondents understood social and environmental aspects of cod production both within aquaculture and the wild fishery. I prompted respondents to discuss social and environmental issues they felt had greatly affected their livelihoods, communities, and marine resources. I also asked these fishery workers to reflect upon how various knowledge traditions and technologies had affected social and environmental aspects of fish production within the wild fishery and aquaculture industry.

Interviews were structured to generate discussions about respondents' aquaculture training. I was interested in understanding how their knowledge and experiences in the wild fishery meshed with the aquacultural knowledge and skill acquired in the cod farming courses. Also, I asked questions that required respondents to reflect on their aspirations for the industry. For example, I asked respondents to discuss how governments, scientists, and fish companies shape fisheries and aquaculture development, especially through knowledge and technology.

Since this was a first attempt at gathering information that links the local knowledge of fishery workers with aquacultural development in Newfoundland, the interview process was adaptive and somewhat fluid. The conversational method allowed me to make alterations to my interview schedule, especially to obtain information my respondents felt was important, but that I had failed include in the schedule. This schedule also changed somewhat as I learned more about the fishery. One such example, was the addition of questions asking the respondents to describe how the return of the wild cod fishery would affect developments in cod farming.

In addition, since I was dealing with two different groups of fishery workers (fishers and plant workers) - two different sets of interview questions were constructed (see Appendices I and II). This was done in order to capture the different dynamics which exist in the fishing and processing sectors of fish production. Fisher interviews were geared to providing information on respondents' knowledge of fish habitat, patterns of change over time in the ocean environment, distribution of fish assemblages, abundance, migration and spawning, species and gear combinations, knowledge and technologies, as well as fishing strategies. Interview schedules with plant workers were designed differently. In these interviews, I collected local knowledge by asking them to discuss the processing history as they knew it, including the tasks they had performed, types of fish processed, as well as changes over time in the quantity of fish processed, fish quality, production techniques (like shifts from frozen fish to fresh products), managerial initiatives (like incentive systems), and markets. In effect, I hoped to generate discussion on how processing dynamics had changed in the plants over time prior to the closure of the wild fishery. As with fishers, I prompted them to discuss how such changes affected the fishery resource and their lives.

I attempted to explore the cognitive shifts that fishers and plant workers felt are required for moving from the wild fishery into aquaculture. This was done to form an understanding of the possible ways their local knowledge of fishing and processing would mesh with various aquacultural models. I was also interested in what kind of fish production models they contend best address local social justice and environmental issues. All interviews were geared to prompt respondents to discuss how the cod moratorium had affected their lives, especially insofar as it led to their pursuit of cod aquacultural training. I also asked respondents to communicate their views about the social and environmental issues related to the state of the wild fishery and the aquaculture industry. Specific emphasis was placed on prompting their views on what constitutes sound resource management, as well as their views on how aquaculture will fit with management of the traditional wild fishery.

1.5 Limitations/Challenges in the Study

This was a complex, exploratory research study. It focused on only one type of aquacultural production in Newfoundland and sought a relatively small sample of respondents, who were not yet active in cod farming but hoped to make the transition. I was initially apprehensive about bringing a tape recorder into the homes of my respondents. I feared it (I) might be too intrusive, and in some cases the use of the tape recorder may have been just that. However, any resistance to being taped (even on my part) was usually quelled by reassurances that, at any time, either myself or the respondent could turn the recorder off. In fact, many of the more interesting discussions (some related to fish production and some not) took place when I turned the tape recorder off. The tape recorder was infinitely preferable to note-taking on my part. In my first interviews, I noticed that respondents found my note-taking more distracting than the tape-recorder, and that this interrupted the flow of information. Note-taking may have made me appear disinterested and even evasive. Therefore, I stopped taking notes during my interviews after my second interview and recorded any additional impressions later, after had I left their homes.

In some instances, I found myself struggling to interpret the local dialects of the Bonavista Peninsula. My ears eventually adapted, however, especially with time in social settings (like local bars, kitchen parties, and dance halls) and through my efforts to transcribe the interview tapes.

Challenges were presented on another front as well. Although I am from a small fishing community myself, many of the harvesting and processing technologies and strategies were somewhat foreign to me. Likewise, localised terms for fish species, wind, currents, and gear were unfamiliar. In addition, since most of my interviews took place around the kitchen tables in the homes of my respondents, there was an unavoidable invitation to young children, teenagers, and pets to participate. Two of my of respondents were busy with household chores. I recall one woman busily baked bread during the interview. Nevertheless, all of my respondents gave freely of their time, graciously offered food and drink, and offered large amounts of hospitality during a busy summer season of work and household tasks.

Chapter 2

Theoretical Perspectives for Studying Knowledge, Technology, and Power in Newfoundland Cod Production

2.1 Introduction

This chapter outlines theoretical approaches for critically analysing knowledge and technology from the perspective of power. I discuss why the study of commodity production systems globally, including Newfoundland's cod production, requires the application of a number of theoretical approaches that critically analyse how cultural groups use knowledge and technology to shape power relations within commodity production. It is my position that .critically analysing knowledge and technology from the perspective of power challenges the orthodoxy upon which contemporary production systems are based, and thus creates a space for proposing alternatives.

I begin this chapter by defining knowledge and technology. I then discuss why the study of power is central to understanding the roles of knowledge and technology in shaping commodity systems. I underscore that the issue of power is an important element in studying commodity production. From the perspective of power, I will illustrate why some kinds of development models for commodity production are accepted more readily than others by governments, corporations, and societies as a whole. I examine how cultural groups use knowledge and technology to develop production models that colonise social and natural environments, and consolidate power. I also examine how other cultural groups use knowledge and technology to establish symbiotic relationships in social and natural environments, and to resist colonisation by decentralising power.

2.2 Knowledge and Technology

Knowledge can be defined as a practical or theoretical understanding about the world. All knowledge exists in a social context; varying traditions of knowledge are associated with the beliefs of different cultural groups. Because they relate differently to social and natural environments, knowledge traditions can also be differentially associated with power. The knowledge traditions of some cultural groups are constructed in ways that attempt to colonise other social and natural worlds, creating orthodoxies and consolidating power. Other cultural groups use knowledge to seek a more symbiotic relationship with social and natural environments embracing diversity while decentralising power. Technology is the knowledge of a cultural group embedded in practice. Defining technology as practice underscores its deep cultural links and its relationship to power (Franklin, 1990). However, before either knowledge or technology can be understood in relation to power, power has to be placed in perspective as well.

2.3 Concept of Power

Power is the capacity for action or the ability to initiate will. In its widest sense, the power of people or cultural groups rests in their ability to produce intended effects upon the world around them (Beetham, 1991). Power is unequally distributed in society: some people or cultural groups have greater power than others. Throughout history, one of the ways humans have achieved and maintained power is through influencing or controlling the actions of themselves and others. This is accomplished through the acquisition of resources such as strength, knowledge, material goods, or a combination of these. With these resources, humans have influenced each other through physical coercion, manipulation, threatened deprivation, and persuasion through reciprocity (Beetham, 1991).

Power is socially organised into systematic relations of dominance, subordination, symbiosis and resistance. The possession of power can be equated with the possession of resources that allow some cultural groups to have greater discretion over or insulation from the practices and competencies of others in a society (Barnes, 1988). Power dynamics involve disparate exclusion from and access to control over necessary material resources. As well, these dynamics are shaped by the control of those routine activities that permit the possession of knowledge, skills, and positions of command within production. Thus, power lies in the resources used to strengthen one cultural group's capacity for discretion. The 'powerful' are not simply those who can enlist or dominate others and nature into rallying behind their cause (Murdoch and Clark, 1994), but also those who can accommodate others and nature for their cause. The resources of the powerful are many, including knowledge and technology.

2.4 Power and Commodity Systems

There are general frameworks for studying power relations within food production systems and how these relations affect social and natural environments. Such frameworks focus on the distinct production characteristics of commodities in modern food industries. These characteristics include the labour process, technological factors, and environmental issues (Heffernan and Constance, 1994). Friedland (1984) outlines five foci for studying power in commodity systems: production practices; grower organisation; labour as a factor of production; marketing and distribution systems; and knowledge production and technology. Such studies help the researcher understand the dynamics of modern food production by raising questions of power, delineating the social organisation of food production, critically analysing knowledge production, and investigating the role cultural groups have in development. These studies have also emphasised the importance of aggregating social, economic, political, cultural, and environmental aspects of production.

Much political economic research on commodity production has examined the ways cultural groups attempt to reduce risk and uncertainty and concentrate power within production. Other research has studied how cultural groups seek symbiotic relations or insulation from domination. Likewise, research on commodity production has focused attention on the means used by organisations (like food corporations) to ensure their own survival, their control over external events, and the power of their personnel (Heffernan, 1989).

Several cultural groups in powerful public (government) and private organisations (food corporations and banks) have a stake in the development of knowledge and technology that increases their control over other cultural groups and natural entities within production. Through knowledge and technology, they seek to control factors in social and natural environments that could dramatically further their interests. Other cultural groups seek to insulate themselves from these dominating forces, aiming to maintain discretion over their own practices and not the practices of other groups. From this, knowledge and technology become not only agents in the production of food commodities but also tools of power. Therefore, studying commodity production entails critically analysing the development of knowledge and technology. It is on these aspects of commodity systems that my research will focus.

2.5 Commodity Systems, Knowledge, and Power

This section distinguishes between two knowledge traditions: the local and the scientific. I will illustrate how these two knowledge traditions can be associated with the interests and beliefs of particular cultural groups. Finally, I will illustrate how these cultural groups use their knowledge traditions as the means to very different ends within social and natural worlds. It should be noted that all knowledge traditions, regardless of their epistemological underpinnings, can be used to establish dominant, resistant, and symbiotic relations. I underscore this point because the following discussion focuses on the tendencies which arise in social and natural worlds when cultures employ local and scientific knowledge traditions. My aim is not to constrast these two knowledge systems as strict dualisms, but rather to contrast the stark power differentials associated with these knowledge traditions within modern food production models.

2.6 Local Knowledge

Many local cultures often construct their knowledge according to their needs and beliefs, as well as the physical environment in which they live and produce. Therefore, production is guided in part by not only a regard for the particularities of local environments, but also for issues regarding social equity within that locale. This creates local understandings for social and natural dimensions of production and the way these in turn affect how people in local cultures relate to each other and nature.

Local knowledge is "local" in the sense that it is derived from the direct experience, beliefs, and needs of those who labour locally. Furthermore, it is shaped and delimited by the distinctive physical characteristics of a particular place (Kloppenberg, 1991). Therefore, local knowledge is intricately bound to place. It makes no claims of universality, and thus is applicable only to the locale where it germinates. It rarely enables those cultures who construct it to claim knowledge of and control over social and natural entities outside of the locale. However, local knowledge can be used to control power between social groups within local cultures.

Like all knowledge traditions, local knowledge is grounded in beliefs and world views (Berkes, 1993) that dictate production practices as well as relations between genders, and between different ethnic groups within local cultures (Franklin, 1990). However, the practices of local cultures give greater indications for symbiotic relations between social and natural actors in local areas than do traditions of knowledge that are constructed solely for the interests and beliefs of external cultures. Even when local cultures have exhausted resources, the scale of destruction is smaller and local response is less precluded than when production practices are directed for the benefit of external cultures.

Cultural groups in sedentary fishing and agricultural societies that depend on local resources are likely to have accumulated knowledge important for sound resource practices because of their need to sustain and maximise the resource. Self-regulatory systems evolve in such societies. When people depend on a limited resource area to provide a diversity of resources, their practices often reflect active roles in enhancing, conserving, and restoring bio-diversity (Gadgil et al., 1993). This is not to say that all local cultures have the same awareness about these relations. In fact, some local cultures have exhausted resources through over-zealous practices. Furthermore, other local cultures over time may even have such understandings eroded by external cultures who penetrate local cultures masking the consequences of social and environmental relations of production.

2.7 Scientific Knowledge

Unlike local knowledge, scientific knowledge has been used to derive explanations for particular situations from universal laws, separating knowledge from experience. This orthodoxy and disregard for context has enabled cultural groups using scientific knowledge to exercise control from a distance (Murdoch and Clark, 1994). Questions surrounding the associated reductionism and loss of context have given rise to critical analyses of scientific knowledge as a power variable.

The conventional view of science holds that it accurately represents the natural world and is independent of social impingements that might create bias, which are an acknowledged part of local knowledge. However, various academics and activists are challenging the notion that science is insulated from power, control, and bias. Kloppenberg (1991) holds that the scientific method and scientific disciplines gained a hegemonic position in our lives, partly because they convincingly claimed to be the sole source of objective and universal truths about the world. Scientific knowledge has been employed by powerful cultural groups to further their control over social and natural entities within production. Powerful institutions use the hegemonic premise of the scientific method to increase their control and legitimise their vision of nature and society.

Through scientific knowledge, many powerful institutions de-legitimise other forms of knowledge that could challenge their agendas. Scientific knowledge can be used as a powerful tool for colonising and exercising control over social and natural environments (Murdoch and Clark, 1994).

In fact, science, including modern agricultural and fishery science, has been organised and introduced into many cultures of the world as a means of colonial domination (Deo and Swanson, 1991). An important element in the spread of scientific knowledge is the tendency to depict local cultures as possessing inferior knowledge and practices, and thus in need of rescue from themselves. Instead of addressing local cultures as possessors of comparable knowledge and advantageous production practices, they are depicted as backward, and contrasted to the "progressive" mind set of those external cultures practising scientific knowledge.

With regard to power, through scientific knowledge external cultural groups seem able to insert themselves quite readily into various local environments and make their production practices indispensable to local cultures. However, foreign cultures can only successfully colonise if social and natural entities are forced into accommodation, allowing scientific knowledge to 'nest' in the new locale (Murdoch and Clark, 1994). This accommodation usually entails reorganising nature. It also entails marginalising traditional methods of knowledge transmission within local cultures by establishing new institutions staffed by scientific experts and by introducing new production practices. Through these measures, local cultures often find themselves deskilled, tied into scientific networks, and intricately subordinated to external cultural groups for whom science is a mainstay. These structures extend far beyond the local environments and beyond the effective control and experience of local cultures (Murdoch and Clark, 1994).

Unlike local knowledge, the scientific knowledge utilised by dominant cultural groups often pursues indices that advance the colonisation of social and natural entities for the benefit of cultural groups from outside of the locale. These different knowledge systems are associated with the development of very different technologies.

2.8 Commodity Systems, Technology, and Power

Technology, as a social construction and a tool of power, can be used to control how cultural groups interact with each other and nature. Technology is an important mechanism that facilitates the nesting of scientifically constructed production models of external cultural groups within local cultures and environments.

Just as one can distinguish between two types of knowledge, it is also possible to distinguish between two types of technology - holistic and prescriptive (Franklin, 1990). The categories of holistic and prescriptive technologies involve distinctly different specialisations and divisions of labour. Consequently, they are means to very different ends in social and natural environments.

Holistic technologies are normally associated with the notion of craft. They are artisanal and give those who use them control over the knowledge and practices of production and therefore do not require standardisation. Holistic technologies rely upon a respect for the social and natural particularities of local environments. Holistic technologies draw upon knowledge based on the experiences of local cultures. Therefore, holistic technologies can be seen as local knowledge embedded in the practices of particular cultural groups.

Unlike holistic technologies, prescriptive technologies are designs for compliance. Prescriptive technologies are used to control the social activities of other cultural groups, as well as to harness nature for the commercial interests of dominant cultural groups. These technologies are the tools used by cultural groups employing scientific knowledge to dominate over other cultures. When prescriptive technologies are introduced into local cultures the stage for the domination of one cultural group's interests over another's is set. Modern industrial production is dominated by prescriptive technologies (Franklin, 1990). Prescriptive technologies are implementations of cultures using scientific knowledge to colonise and standardise. They require the restructuring of social and natural aspects of production within various local environments. Furthermore, they help external cultures redefine the rights, responsibilities, and control of local cultures. Prescriptive technology muddles or even destroys the traditional social compass which historically has been rooted in addressing the concerns of members of local cultures.

Globally, holistic technologies have been increasingly supplanted by prescriptive technologies. Similarly, the knowledge of local cultures has been supplanted by the scientific knowledge of foreign cultural groups. Today, the orthodoxy associated with scientific knowledge has heightened the temptation to design production systems in prescriptive ways. Prescriptive technologies are applied to even those tasks, like resource management, which should be conducted in a holistic way (Franklin, 1990).

The relationship between these two technologies or production practices and nature is quite different. Under the direction of local knowledge and holistic technology, a tendency of human intervention in the natural world is the discovery of the best conditions for long term resource use in any local environment. Prescriptive technologies (or the practices of cultures who use scientific knowledge for domination) are employed for quite different reasons. Their principle aim is not only to dominate other cultures, but also to harness nature. If such control is not complete, the implicit assumption is that more prescriptive improvements should be achieved, so that all parameters or spheres can be controlled. The application of prescriptive technology demands standardisation of previously diverse social and natural environments in order that the technological process can be duplicated in a number of locales (Murdoch and Clark, 1994). Production models employing prescriptive technologies are constructed without regard for their impact on local environments. In fact, because the knowledge and technology utilised in these production models are generated independently from local experience they are quite inflexible for addressing local concerns.

Local knowledge is so irrevocably rooted in the experiences of those who labour that it is possessed by local cultures regardless of the production system employed. Therefore, although the knowledge of local cultures has been formally excluded from management practices, it exists even in the most scientific and prescriptive of systems. At the same time, the scale and scope of local knowledge differs between production systems. The scale and scope this knowledge entails is partly dependent upon the skills and practices associated with the production system. As production systems, through scientific knowledge and prescriptive technology, become fragmented and standardised, so too does the knowledge of local cultures. However, these fragments can be studied in a systematic fashion. Even in the most prescriptive production systems, they can indicate how changes in knowledge and technology, and thus power, impact on social and natural environments.

2.9 Consequences of Compliance and Resistance

Cultural groups who embed scientific knowledge in prescriptive technologies can exercise control at a distance, and this has placed them in a powerful position. These cultural groups are associated with institutions like governments and food corporations. Furthermore, there is growing recognition that these cultural groups, through introducing prescriptive production practices, have caused grave disruptions in the power dynamics of social and natural environments (Murdoch and Clark, 1994). Their colonisation of the holistic practices of other cultures and the reorganisation of local environments have resulted in the irrevocable loss of precious social and natural resources (Norgaard, 1992).

Due to resistance from social and natural entities, the orthodoxical influence of prescriptive technologies has been uneven. In many societies around the world, the holistic practices of local cultures have persisted on the periphery of prescriptive production systems. Likewise, local knowledge and holistic technologies have been tapped, especially in times of resource decline, in a search for alternative commodities and types of production. In some cases, production using prescriptive technologies has plateaued. This has resulted in the development of intermediate technologies. Intermediate technologies represent mid-range practices between holistic and prescriptive technologies. In these cases, many social and natural aspects of production are controlled by scientific knowledge and prescriptive technologies for the commercial interests of powerful cultural groups. However, local cultures still rely upon their knowledge for survival and to discern scientific information.

Although considerable variation can be found within and between commodity systems with respect to knowledge, technology, and power, there have been a number of disturbing social and environmental trends as a result of cultural groups utilising scientific knowledge for prescriptive technologies in order to dominant social and natural worlds. The application of prescriptive production models demands standardisation of previously diverse social and natural environments so that the principles of production can be duplicated in a number of locales (Murdoch and Clark, 1994). This, in effect, concentrates power into the hands of governments and food corporations, because scientific knowledge and prescriptive technologies are controlled by them and have been useful tools of compliance. This also poses a threat to biodiversity and resource resilence.

A repercussion of the spread of scientific knowledge and prescriptive technology has been the reconstruction of the world's many local cultures. This, in turn, has altered the way in which people in these cultures labour and produce. The scientific agendas of corporations and governments have pursued research that disregards or de-emphasises local alternatives to prescriptive production. Through scientific knowledge, commercial interests have detached local cultures and individual species from the rest of nature. They have also disregarded multi-purpose uses inherent in most local environments while capitalising on mono-cultures and single resource industries. Local cultures often employ labour-prescriptive practices of cultivation, and biological means of disease and pest control, as well as practices which enhance bio-diversity. The dominant method of commodity production globally is prescriptive. It is stratified and dictatorial. As well, it is subservient to bureaucrats, state governments and corporate interests. In short, it fails to address both appropriate environmental issues and social justice issues for the majority of the world's cultures (Kloppenberg, 1991).

Local knowledge and holistic technologies are supplanted as scientific knowledge and prescriptive technologies are imported. However, the resilience local cultures maintain through their knowledge traditions and technologies, now offers viable alternatives to our present destructive production models.

Interest in these resistant or alternative production models has arisen with the belief that the outcome of human intervention into the natural world is a mixture of the expected and unexpected (Murdoch and Clark, 1994). Throughout history, intervention by local cultures in nature has tended to lessen the burden of and enhance sustenance for kin and family through holistic practices. Prescriptive methods, on the other hand, have not aimed to help local cultures further co-relationships with nature. Under prescriptive production, nature, like local cultures, is severed from the production and management of resources and labours for the commercial interests of governments and corporations. However, nature and local cultures have proven formidable adversaries because they continue to act in unexpected ways which attempt to counteract such impositions and construct alternative relations within production.

2.10 Conclusion

I have argued that various knowledge traditions, or ways of knowing and relating to the world, exist. A knowledge tradition can be seen as a social construct for defining reality in the world. As a social construct it represents the way a particular cultural group relates to the world around it. I defined technology as embedding the knowledge of a cultural group in practice. I also illustrated that cultural groups, through different knowledge traditions and technologies, relate to social and natural environments differently, and therefore construct very different power relations.

Knowledge traditions can be used to dominate other cultures and nature. However, they can also be used to resist colonisation, and used for establishing symbiotic relations among social and natural entities. I argued that scientific knowledge is a tool of domination when it is used to aid the development of prescriptive production practices that separate knowledge from experience, thus marginalising local knowledge and control. However, I also suggested that the users of local knowledge and holistic technologies are not passive. I have also emphasised the importance of challenging a major assumption of those cultures which employ prescriptive technology - that nature is a passive object which can be controlled. Instead, I have conceptualised nature and local cultures as capable of actively maintaining resistant and symbiotic power relations. The argument that they can actively engage external forces is one that has opened space for giving attention to other forms of knowledge, technology, and production.

Critically assessing knowledge and technology from the perspective of power reveals social justice and environmental issues that are often masked by the orthodoxy which equates the scientific knowledge of particular cultural groups with truth and progress.

Finally, I argued that global trends in commodity production suggest that the dominant technologies supported by governments, scientists, and corporations have been prescriptive. These technologies have significant impacts that are socially and environmentally negative. The dominance of prescriptive technologies is tending to concentrate power within commodity production systems in the hands of governments, scientists, and corporations. These technologies are causing environmental disturbances in many locales all over the world. However, the application of prescriptive technologies has been uneven. This has resulted in intermediate technologies which integrate holistic and prescriptive technologies. Furthermore, the knowledge and technologies of local cultures often remains resilient and resistant, and continues to hold indications for more equitable and less destructive production, as well as the regeneration of degraded resources.

Having examined how situations of compliance, resistance, and symbiosis arise from the local and scientific knowledge traditions of different cultural groups, I will now analyse how these traditions of knowledge have shaped aquaculture practices globally, and in turn refashioned social and environmental aspects of fish production around the world.

Chapter 3

Global Trends in Aquacultural Production: Holistic, Intermediate, and Prescriptive Practices

3.1 Introduction

This chapter examines trends in global aquacultural development. I discuss three general aquacultural models using the theoretical perspectives on knowledge, technology and power I presented in chapter 2. I also address the social and environmental issues associated with these models. I illustrate how external cultural groups use scientific knowledge to develop prescriptive technologies that displace the holistic fish production practices of local cultures, and restructure nature. As well, I emphasis that nature and local cultures do not respond passively to these impositions. Local cultures develop intermediate technologies that co-exist with prescriptive practices, and sometimes offer alternative production models that are less destructive. This chapter provides a backdrop for understanding how knowledge and technology have shaped Newfoundland cod production historically, especially Newfoundland cod farming in the 1980s and 1990s.

3.2 Global Aquacultural Production

Generally, aquaculture researchers have distinguished between three kinds of production: extensive, intensive, and semi-intensive (Muluk and Bailey, 1996; Phyne, 1994). These categories have been used to address differences among aquacultural production models according to patterns of technological advancement, capital investment, and social and environmental relations of production (Muluk and Bailey, 1996). In chapter 2, I presented a theoretical framework for studying knowledge traditions and technologies from the perspective of power. This framework can be used to address differences among these models from the perspective of power as well. Extensive production models can be associated with local knowledge and holistic technologies that are symbiotic with social and natural entities. Intensive production models are characterised by the use of scientific knowledge for the development of highly prescriptive technologies which consolidate power and restructure nature. Semi-intensive production models are loosely located between extensive and intensive models. Therefore, these mid-range hybrids consisting of combinations of local and scientific knowledge traditions utilise intermediate technologies.

3.3 Extensive Aquaculture and Holistic Practices

Extensive aquaculture models depend on fish raised from seed or young fish collected in the wild which are kept in ponds, lagoons, or inshore areas. Almost all of their nutritional requirements are derived from natural sources, primarily through tidal action. Other practices using slightly modified versions of these traditional practices (Muluk and Bailey, 1996) involve the use of a series of ponds or inshore areas for different stages of the fish culture development where the capture of young fish, intentional fertilisation, protection from predators and competitors, and the use of supplemental feed expedite growth.

Researchers have argued that extensive aquaculture models because they incorporate bio-diversifying methods, are not only more environmentally sound in that they reduce excess waste and contagions, but also limit vulnerability to market forces by relying on a number of key species (Bailey and Skladany, 1991). Likewise, Gadgil et al. (1993) have argued that the traditional fish rearing systems like those practised by peoples on the Pacific Rim, are based on holistic practices for enhancing, conserving, and restoring bio-diversity. These researchers have argued that such practices use a variety of local species, utilising the biological and economic characteristics of each by drawing on local knowledge and practices. Extensive aquaculture models recycle waste for food, and thus enhance the natural potential for ecological stability in local areas. This eliminates the need for chemicals applied to kill parasites and to prevent disease. It also facilitates micro-level ecological monitoring.

Extensive production models which rely on local knowledge essentially shift nature's and labour's productivity to satisfy the needs of local cultural and natural environments. These needs include increasing rural income, sustenance foods, and efforts to plan diversified household production based on the natural capabilities and attributes of different locales. Thus, such models complement local biological events and strengthen the position of local cultures. From these characteristics, extensive aquacultural models can be seen as employing holistic technologies.

It can be argued that holistic aquaculture production practices can be used by fishers as a strategy for economic diversification, and income supplementation, by taking advantage of fuller resources. Foss and Aarset (1996) argue that diversification is a strategy practised in Norway, where cod farming has been adopted by fishers as a way to protect themselves from fluctuations that occur in wild cod stocks and market prices. The role local knowledge traditions maintain for bio-diversity and the inter-related flexibility which insulates practioners from market forces have also been studied (Eythorsson, 1993). However, other production practices have been developed by cultural groups who are concerned about developing aquaculture models for less intrusive reasons.

3.4 Intensive Aquaculture and Prescriptive Practices

In many fishing nations, aquaculture's image is one of high entrepreneurship in a boom industry. It is often conceptualised as a source of regional employment, enhancer of local resources, and a utiliser of local knowledge and skill. However, some social and natural science researchers argue that with the encroachment of prescriptive production these positive roles for aquaculture will be superceded by corporate interests (Bailey et al. 1996; Wilks, 1995). This is partly due to government policies and corporate initiatives which pursue technological packages that drastically reduce manual labour and employ, instead, a host of costly mechanical and biotechnical inputs. Although commercially viable and suited to corporate profit margins, such development is not viable in the long term for rural communities or societies as a whole. These production methods often aggravate socioeconomic disparities, jeopardise the health of the public, and degrade the coastal ecosystems in which they are practised. Similar to industrialisation within agriculture, this loss of control represents not only a decline in economic power, but also a loss of control over vital aspects of production. The leverage local cultures have to gauge the effects of production on their ecosystems and on the well-being of their families decreases. Local knowledge and holistic skills required for more sensitive production methods spiral into perdition.

Emerging patterns in aquaculture production parallel a number of prescriptive technological tendencies in modern livestock production (Skladany, 1996). These include mono-cropping for global luxury markets, biogenetic engineering, hormone enhanced growth, and the use of vaccinations and antibiotics to fight disease resulting from the caging of a great number of the same species together.

Intensive aquaculture models which are highly scientific are revolutionising the aquacultural production process around the world. Such models have displaced the holistic fish rearing methods practised by local peoples for hundreds of years in many Pacific rim countries (Bailey and Skladany, 1991). Intensive aquaculture models depend on hatcheries which supply large amounts of genetically altered fish fry and stock large densities of fish together. Also, they can achieve superior growth rates through regular use of commercial feed and the systematic monitoring of disease. Prescriptive methods have been refined through scientific research resulting in the introduction of growth enhancers like steroids and hormones, and disease fighting agents like antibiotics.

Governments and fish companies have initiated aquacultural research with the goal of intensive development. Heavy infrastructure expenditure in such areas as bio-genetics, disease control, and veterinary services has been pursued. Great attention has been given to the standardisation of production and to market promotion (Coull, 1993). While productivity from intensive aquaculture models is high, the purchased inputs are very costly compared to less intrusive fish rearing practices which rely on local capture fisheries for starting stock and feed. Thus, these aquaculture models often rely on high value luxury species that satisfy production costs (Coull, 1993; Bailey and Skladany, 1991).

Investors in intensive operations are often members of local elites with business interests in corporate organisations which may be vertically integrated through ownership of hatcheries, feed mills, as well as processing facilities (Muluk and Bailey, 1996). Corporate owners are rarely if ever present for the day to day on-cage operation of these farms; instead they hire managers and technical staff. Employees hired by the corporate farm operations tend to be recruited from distant communities rather from local areas (Bailey et al, 1996). Labour is highly specialised and hierarchical within both aquacultural farming and processing sectors. For example, certain labourers are responsible for feeding, others work feed storehouses, in processing plants as filleters and packers, or as clerks and supervisors (Muluk and Bailey, 1996).

3.5 Semi-intensive Aquaculture and Intermediate Practices

Semi-intensive aquaculture models maintain a mid-range position between the holistic practices associated with extensive production and the prescriptive practices of intensive models. For instance, semi-intensive models may rely on hatchery fish and some combination of home prepared and pelletised commerical feed is used to fullfil nutritional demands. The stock density of semi-intensive models also represents a mid-range between the stock density of extensive and intensive models (Muluk and Bailey, 1996). Distinctions between ownership, management, and labour are not as pronounced as they are within intensive models. Labour, within semi-intensive models, as in extensive, is often recruited from members of the family or immediate community. The owner of semi-intensive operations is also the farmer. In contrast to extensive aquaculture which meshes with other types of household production, semi-intensive farming is often a full time commercial activity. However, like those within extensive aquaculture models these owners and their families play an active role in the day to day management of the farm. The environmental implications of semi-intensive models, although less destructive than intensive ones, none the less raise some concern. Unlike extensive models which use locally captured wild fish, recycle waste, and adopt biological means of pest control, semi-intensive models may employ genetically altered hatchery fry and chemicals to eliminate pests. These practices are associated with intensive aquaculture, and their negative consequences will be addressed below.

3.6 Intensive Aquaculture: Environmental and Social Concerns over Prescriptive Technologies

The social and environmental effects of intensive aquaculture production can be startling. Concerns have been voiced surrounding the possibility of viral epidemics in human populations caused by the practice of integrating fish farming with other types of food production such as pigs and poultry (Skladany, 1996). Fears have been raised that prescriptive production practices disperse disease and parasites, promote resistance to antibiotics, foster toxic algal blooms, and smother the benthic sea floor, thus depleting native fish stocks when introduced into local environments (Nelson, 1996). Many researchers fear that prescriptive production involving the farming of genetically altered hatchery fish may result in genetic disturbances and destroy traditional patterns of migratory behaviour (USDA, 1988).

Intensive aquaculture often comes into conflict or direct competition with the world's wild fisheries and local peoples who depend upon these. Development agencies and governments claim that yields from aquaculture will supplement those taken from wild fish stocks. However, concerns are being voiced about the strain commercially favoured carnivorous species production may exert on the world's wild fisheries. Such production systems consume large amounts of fish meal, and therefore, often negatively affect wild fisheries and aquatic ecosystems (Fischer et. al, 1997; Wilks, 1995). Residents in many regions where prescriptive aquaculture practices are taking place have reported disturbing levels of uneaten fish feed, chemicals, and faeces in their bays (Wilks, 1995; Wilbur and Harvey, 1992).

Other environmental concerns about prescriptive production practices have also been raised. These practices involve crowding large numbers of single species fish or prawns together in small areas and employ large amounts of feed. This results in water quality problems that increase the incidence of disease and parasites. Poor water quality can be compounded by the strong chemicals and antibiotics used in treatment.

Water is a perfect medium for the transmission of disease organisms and parasites which spread rapidly and affect neighbouring locales (Bailey et al., 1996). Over the past decade, intensive production models in Chile, the U.S., Israel and Taiwan have experienced outbreaks of an invasive bacteria which has sometimes wiped out half of the salmon, trout, and tilapia in the infected farms (Wilks, 1995).

Some of the most disturbing reports about prescriptive practices are coming from Asia, where that region's people have had a long history of involvement with holistic methods of aquaculture. During the 1970s and the 1980s, the World Bank, the Asian Development Bank, the United Nations

Development Program, and other large aid agencies, in concert with Asian governments, heavily promoted intensive aquacultural development through millions of dollars in loans. This development has been responsible for massive ecological damage, as well as increased poverty (Wilks, 1995). In Thailand, the destruction of many hectares of mangrove forests for intensive prawn production has deprived local cultures of traditional wild fish harvests, agricultural fields, building poles, thatching material, medical products as well as flood protection for houses (Wilks, 1995).

In 1988, Taiwan began experiencing widespread outbreaks of viral diseases among shrimp due to water quality problems created by the adoption of prescriptive production practices (New, 1990). Unable to avoid problems of water quality, the Taiwanese industry has essentially collapsed (Bailey et al., 1996). Similar disasters have occurred as intensive aquacultural development has been pushed into the Phillipines, Vietnam, and China by both fish companies and aid agencies. Despite the deforestation of mangrove areas and the collapse of the shrimp industry due to disease, prescriptive prawn production has moved on to Cambodia, Burma, Bangladesh, and southern India. Once again, aid agencies, fish companies, and governments are investing heavily in the development of prescriptive prawn production.

Bailey (1989) argues that input suppliers like feed companies may be in a position to increase prices to the point where they capture most of the aquaculture industry's profit. He considers the interest feed suppliers have in developing prescriptive production practices for rearing species like shrimp.

> Ralston-Purina established the industry in Panama as a means of developing its primary product line, and subsequently sold its successful hatchery and grow-out operations. In Sri Lanka, the first business to invest in shrimp mariculture was a company primarily concerned with formulating feeds for hatcheries, not the production of post larvae. In the Phillipines, San Miguel Corporation, the nation's largest corporation, is involved in shrimp mariculture development primarily to promote its line of feeds (Bailey, 1989).

Bailey concludes that these companies realise that the greatest long-term profit potential in intensive aquacultural production is in the supply of feed.

Intensive aquaculture uncannily mirrors broiler production in the United States. Control over broiler production - from chicken hatcheries, to feed production, to branded products at supermarkets - can be seen as an effort by poultry processors to secure a market first for the chicks, then the feed, and so on, all the way to the consumer (Heffernan and Constance, 1994). At present, the scientific advances allowing for prescriptive aquacultural methods appear to be an attempt by fish companies to extend their control backwards into all aspects of production. One way control is sought is through the employment of technology that generates new markets for commercial inputs like feed and hatchery fry, as well as patented growth hormones and antibiotics. All of these require large financial commitments by small fish farm enterprises. For example, the cost of starting stock and feed constitutes a large percentage of the production costs in the Irish salmon aquaculture industry (Phyne, 1994).

The dramatic rise in dependency on "technological advances" also correlates with the consolidation of capital. The result is the increased market strength of the processing and marketing corporations. Priced out of the industry from the start, or faced with payments on high interest loans which are required to cover annual over-head costs for inputs like fry and feed, fish farmers, like their fellow producers in agriculture, feel the tight pinch of this power.

Like many agribusiness companies, fish companies often control the resources needed for intensive production. Direct control of productive property and technological inputs gives such companies enormous influence over prices and matters of discretion within production. These companies can draw on their own subsidiary companies' inputs, use contractual or hired labour and maintain such control through prescriptive production methods. These inputs are expensive for smaller farm operators, and corporations can easily produce more cheaply than the average grower. This low production cost can then be negotiated with the independent farmers. In many cases, the contract price is lower than the farmer's costs of production. Since these companies maintain a powerful position in the market, farmers have to sell at that price, and because the price is lower than cost many often go out of business.

Corporate control over supplies and equipment goes well beyond encouraging words to contractors or growers. Often, if the grower does not comply with the company's demands, the company reserves the right through the contract to buy products elsewhere, and any extra cost, expense, or charge has to be paid for in full by the grower in the following season.

With intensive production, one of the methods by which aquacultural companies, like agribusiness corporations, maximise their control over production and profit margins is through contractual agreements with growers. Although contracts vary, most stipulate that farmers must adopt the company's intensive model. This entails consuming the company's technology. Farmers must buy their feed from the company and sell their fish to the same company. The farmer becomes dependent on the company's feed and veterinarian services, as well as other inputs, while bearing all the risks, both financial and environmental. The fish farmers agree to buy all their feed from the company which often accounts for an exorbitant amount of the expense involved in this type of fish rearing production. In some cases, access to feed is restricted to farmers who signed a contract to buy fry from the feed companies hatchery and sell them the final product (Wilks, 1995). Two examples illustrate the point.

Thai farmers under contract to a leading Thai feed and prawn company, Charoen Pokphand (CP), agree to buy all their feed - which accounts for about half the expense of raising prawns - from the company (Wilks, 1995). In the Phillipines, the San Miguel Corporation restricted sales of its prawn feed to farmers who signed a contract to buy prawn fry from the company's hatchery and sell them the final product (Wilks, 1995). The control in this relation is obvious. These companies exert control in all aspects of production. The decision about what and how to produce is not the farmer's to make. Oligopolies, achieved through prescriptive technology, similar to those which have festered in agribusiness, may emerge within the aquaculture industry.

Coull (1993) contends that the shift to purchased inputs will skew economic power in the aquaculture industry. Similarly, concern has been voiced that Third World societies which have been dependent on fish for protein will be excluded as aquaculture policy becomes oriented towards high value species for foreign markets and fish meal production rather than the needs of indigenous populations (Wilks, 1995).

Despite the effects of intensive aquaculture on local cultures and natural environments, aid agencies, fish companies, and governments continue to support it. Wilks (1995) notes that multi-lateral aid agencies have encouraged this kind of production with large loans. From 1988-93, aid to aquaculture accounted for a third of the total monies committed to fisheries (UN Food and Agriculture Organisation, 1995). The majority of the money now flowing into aquaculture is for intensive corporate projects which generate foreign exchange, high economic returns for investors, and disrepect for the world's many diverse local cultures and marine environments. Incentives for investors often include 100 per cent foreign ownership of farms and repatriation of all profits, halving corporate taxes, and the designation of large parcels of productive property for high value market species (Wilks, 1995).

Within aquaculture, governments have gone so far as to over-turn legislation which in the past gave appropriation rights to co-operatives and local resource workers with historical user rights. For example, the Mexican government has passed legislation which assists private sector involvement in highly profitable prawn farming. It overturned previous legislation which had given cooperatives the sole right to utilise eight fish and shellfish species (Wilks, 1993).

3.7 Aquaculture in Atlantic Canada

During the 1970s, aquaculture was just beginning to be recognised and accepted in Canada as a viable route to increase fish production on a long term basis. In Canada during the early 1980s, the role extensive fish farming could have played in providing new sources of protein for local cultures was of less concern than the economic success intensive aquaculture models were obtaining in countries like Norway. The increased production of valuable export commodities (like salmon) caught the eye of federal and provincial governments, as well as fish companies in the region.

During the 1980s, federal and provincial governments (like New Brunswick) concentrated their efforts on establishing intensive aquaculture production of luxury species by importing foreign technology, developing hatchery networks, and market promotion (Canada and New Brunswick, 1988). Intensive salmon aquaculture operations were supported through regional development programs (Canada and New Brunswick, 1988). Legislation delegated aquaculture licensing control to provincial governments. Legislation also provided intensive aquaculture a definitive place alongside traditional fisheries, namely aquaculturalists have been provided with a property right for parcels of inshore areas which have been usufructary for inshore fishers (Phyne, 1996). Both of these measures were unconventional at the time. Provincially controlled licensing systems and the legal property right given to aquaculturalists over leased parcels of inshore coastal waters departed from the federal management rationale for traditional fisheries which were based on federally controlled licensing and common property access. These legislative decisions also conflicted with local management systems based on traditonal user-rights. In addition to these legislative changes, education and training for aquaculture came under the control of provincial governments as well.

In Atlantic Canada, aquaculture training increasingly involves prescriptive practices developed through scientific knowledge traditions. Provincial fisheries officials helped establish the region's first undergraduate program in aquaculture at the Nova Scotia Agricultural College in Truro, Nova Scotia. Erwin Judson, Director of Aquaculture for the Nova Scotia Department of Fisheries commented in an interview with Strowbridge of The Sou'Wester, an Atlantic Canadian fishing and marine industry newspaper:

"What we in aquaculture are doing is applying farming principles to fish ...Agricultural principles in genetics, farm investment, veterinary services, nutrition, all those things are being applied to fish in the water..."(Strowbridge, 1995)

The Nova Scotia Agricultural College officials are equipping students for managerial positions in hatcheries or fish farms, and in lucrative spin-off industries such as feed companies, equipment suppliers and drug companies, as well as for jobs as consultants to governments and financial institutions.

However, the adoption of prescriptive technologies associated with intensive production has not gone unchallenged in Atlantic Canadian coastal communities. As early as the mid-1980s, coastal residents along the Passamaquoddy Bay region of New Brunswick voiced objections when intensive salmon aquaculture was transplanted into prime herring spawning areas with little or no consultation with local inshore fishers (Phyne, 1996). One could also cite the defeat of intensive aquaculture development in Nova Scotia due to local protests from fishers and other coastal residents in the 1980s and 1990s (Dwire, 1996).

After a decade of government and corporate support for intensive salmon production in Pasamaquoddy Bay, many have accused the industry of having destructive environmental and economic implications. Scientists at the St. Andrews Biological Station have raised concerns about the combined impact of detritus coming from fish meal plants and aquaculture sites, and the eutrophication of Lime Kiln Bay and Blacks Harbour, New Brunswick. Strong and Buzeta (1992) have used under water diving and photography to document the effects of underwater pollution over a twenty year period. They observed:

> ...sedimentation to the extent that the light is being blocked off to a depth of fifty feet so that there is no longer enough light to keep the kelp beds going. The kelp beds have all died off ... There is virtually nothing left there. There are no urchins, no lump fish, kelp - it is a marine desert (Strong and Buzeta, 1992).

Similarly, they and other residents of Passamaquoddy fishing communities are disturbed by the retreating frontier of lobster and scallop fishers with increasing acreage taken up for prescriptive aquaculture (Wilbur and Harvey, 1992). Herring weir fishers fear that the presence of nearby salmon farms deters juvenile herring from entering weirs (Canada, 1989; Stephenson, 1990). Some fishers in the Bay of Fundy also believe that aquaculture feed pollution may have contributed to the decline of the clam fishery in New Brunswick (Wilbur and Harvey, 1992). Like other coastal residents in the area, they blame government for supporting such practices. As one inshore fisher I spoke with put it, "From what I can see, these people (officials in the Dept. of Environment) see what is happening and won't act."

New Brunswick's intensive salmon farm industry was afflicted with a sea lice epidemic during the summer of 1995. The scourge brought with it a huge financial burden. The high cost of drugs, an estimated $100,000 per cage, sent New Brunswick's 40 plus fish farming operations reeling and some faced bankruptcy as a result (Wilbur, 1995).

In the face of this financial and biological blow, the New Brunswick Salmon Growers' Association noted that a good number of farmers were considering contract growing for bigger operators (Wilbur, 1995). Under such arrangements, the fish farmer provides the labour and equipment, while the bigger and better heeled operators supply the starting stock, the feed, the market, and the insurance costs.

Considering that a normal year's purchase of 100,000 smolts costs at least $350,000 and insurance (before the latest sea lice problems) could run from $60,000-$80,000) it's little wonder that some growers, especially those who started up within the last few years are in serious financial trouble. (Wilbur, 1995)

One of the biggest players in the New Brunswick industry is a fish processing corporation, Connors Bros. Ltd. which owns two cage sites, a hatchery, and a feed mill operation. The company is a subsidiary of Galen-Weston Maple Leaf Foods, which has also invested heavily in fish farming on the west coast of Canada (Nelson, 1996).

Unfortunately, Canadian companies have also been a part of ecological and economic disasters globally. Intensive aquaculture development has been increasingly conducted by multi-national fish corporations that include Connors Brothers Ltd.'s intensive salmon production in New Brunswick (Phyne, 1996), National Sea Product's Ltd's scallop production in Nova Scotia (MacIssac, 1995), as well as Fishery Products International's fish procurement operations for shrimp in Thailand, India, Ecuador, Indonesia, and more recently Mexico (Nelson, 1996).

3.8 Introducing Aquacultural Production into Local Cultures: Implications for Newfoundland

The effects of aquacultural production on the domestic economy and the natural environment represent a primary concern for local cultures (Foss and Aarset, 1996). Local producers are likely to adopt new aquacultural production systems or technologies that reduce risk (Bailey et al. 1996). Some fishery workers are likely to reject those innovations for intensive production which pose large financial risk, dramatically alter local and diversified fishing practices, or may not be very well understood especially with regard to their effects on the environment.

Aquaculture has existed historically and continues to exist and to be introduced into cultural structures. The method of aquaculture production, and the extent to which it germinates, becomes successful or is resisted, is in part influenced by the cultural context in which it develops. Part of this context includes the knowledge traditions of coastal resource workers at local or community levels (Holm and Jentoft, 1996).

Bailey et al. (1996) contend that the success of fish farming is often dependent on the extent to which it becomes co-operative or communal in that it involves local people and their knowledge in a participatory manner. Failure to do so poses the possibility that aquaculture may not be widely adopted or, at least, will face resistance and skepticism.

In contrast to the related problems which have resulted from the highly prescriptive aquaculture systems, alternative production systems may embrace local knowledge. They also may aim to integrate aquaculture within the lives and production of fishery workers. These aquaculture production models require little capital, and do not displace other forms of production; indeed they often enhance it (Wilks, 1995). They do not require costly industrial inputs. Therefore, they can be integrated into local fishery cycles by relying on local fish for starting stock and feed (Bailey and Skladany, 1991; Wilks, 1995). Therefore, unlike the economic and environmental problems arising from prescriptive aquaculture practices, holistic methods and some semi-intensive practices are less intrusive. Such methods rely on starting stock and nutritional requirements that are derived from locally based natural sources. Although cages or ponds are selectively stocked with fish fry or post-larval species, and receive at times supplemental feeding, they remain for the most part ecologically benign, enhancing social and environmental aspects of local production (Bailey and Skladany, 1991).

Fish farming is feasible as a holistic activity which does not necessarily require large investment. It can often be planned and organised so that it fits with the seasonal production of other commodities and household work patterns. Bailey et al. (1996) explain that raising fish is frequently an off-season, part-time activity, either for the local fishery workers or for members of their households. Under these conditions, adopting aquaculture as a work activity does not require major reorganisation of the household as a production unit. Likewise, it often can be practised by utilising existing skills, equipment, and ecological knowledge. This is not to say that cognitive shifts from existing fish production practices to fish farming need not take place. However, such cognitive leaps can be lessened by integrating production of salt water fish farming with the knowledge and cultural practices of local wild capture fisheries.

Bailey et al. (1996) contend that as aquaculture production systems become more intensive, we can expect the power of those who control capital to increase greatly relative to the power of those who labour. Similar to other intensive production systems, a number of ecological and social problems become evident, including loss of self-sufficiency, genetic erosion, loss of local knowledge and production, and permanence of rural poverty and unemployment (Altieri, 1990). Keeping in mind these destructive trends, ensuring that newly emerging aquaculture models in Newfoundland do not adopt the prescriptive practices associated with intensive production globally is precedent. This goal can be advanced through studying fishery workers' ecological knowledge and establishing alternative management regimes and production models directed in part by local knowledge.

Given the fragile state of the world's marine life in general the introduction of new human interventions like aquaculture into our various local cultures and environments should be done with a great deal of hindsight and forethought. Since aquaculture is practised in local bays and estuaries, where local fishers and fish farmers may have reliance on a number of fisheries, micro-level data collection and local ecological monitoring through holistic and those intermediate practices that do not employ destructive prescriptive practices will prove more appropriate for sound production. In the local bays of Newfoundland where formal biological information about seasonal events is weak, it will be important to establish aquaculture production models that mesh with the different fishery cycles of various Newfoundland regions. This will require not only establishing more holistic or intermediate production practices, but also challenging conventional prescriptive practices.

3.9 Conclusion

In this chapter, I argued that global trends in aquaculture suggest that the dominant model held by governments, scientists, and fish corporations in this current era of aquaculture development is the intensive model. This model has significant impacts that are socially and environmentally negative. The dominance of this model relies on prescriptive technologies and tends to concentrate aquaculture in the hands of fish corporations and scientific managers thus marginalising local knowledge and holistic practices associated with alternative production systems - like extensive fish farming. Furthermore, prescriptive aquacultural technologies are causing environmental disturbances in local marine environments and in the world's wild fish stocks and coastal ecosytems. Unlike, the prescriptive practices, holistic and intermediate methods of aquaculture are less destructive and offer their practitioners greater insulation from the power of external cultural groups. They also provide indications for more symbiotic relations with natural entities. If the development of cod farming in Newfoundland is to be viable, then a new rationale of fishery management and alternative models for aquaculture development will be required.

The next chapter utilizes the same theoretical framework for critically studying knowledge and technology from the perspective of power that was presented in Chapter 2 and used in this chapter to analyse differences among aquacultural models, as well as to discuss how cultural groups have used knowledge and technology to shape power dynamics within Newfoundland cod production. Emphasis is given to illustrating the interplay between scientific and local knowledge traditions during various stages in Newfoundland cod production, including the relatively early stages of cod aquacultural development. Newfoundland presents an interesting case study because not only has its local fishing cultures maintained a long history of extensive fish production, they have more recently contended with the intensive and semi-intensive production models of fish companies. As well, unlike New Brunswick's importation of the intensive salmon aquaculture model that existed internationally, I will illustrate that Newfoundland's early cod farming operations, were, for a number of social and biological reasons based on a more extensive model.

Chapter 4

Knowledge, Technology, and Power in Newfoundland Cod Production

4.1 Introduction

This chapter discusses how knowledge and technology have shaped power dynamics within Newfoundland cod production from the 19th century to the present. Using this framework, I examine four phases of production: salt fish, frozen fish, the restructured modern fishery, and the moratorium. I will argue that salt fish production employed local knowledge and holistic technology. This gave inshore fishery workers autonomous control over production. It also meant production was meshed with the natural cycles of various seasonal fisheries. However, this did not prevent over-fishing in a number of local bays. Second, the transformation to frozen fish production in the post War World II period was dependent upon the introduction of scientific knowledge and the transfer of prescriptive technologies from industrialised fishing nations elsewhere. These marginalised salt fish production, especially onshore curing activities, however, the local knowledge and holistic practices associated with the inshore fishing remain important element in the lives of many Newfoundland fishing families. In addition, frozen fish production shifted power away from inshore fishery workers and proved destructive to nature, thus generating a crisis in the wild groundfish fishery in the 1970s. The extension of the 200 mile limit, conservation initiatives, and an associated renewed interest in local knowledge and holistic technologies of the inshore fisheries resulted in new production practices (like cod farming) in the 1980s. However, these measures did not prevent the collapse of the groundfish stocks including cod populations in the early 1990s. I will argue that this collapse and subsequent initiatives of government and fish companies are influencing the direction of cod aquaculture in Newfoundland in the 1990s.

4.2 Saltfish Production

Historically, a variety of production techniques and skills have been used in Newfoundland cod production. From the late eighteenth century to the 1950s, fisher families depended on the production of salt cod for their livelihoods. Inshore cod catches were light-salted, sun-dried on shore and sold to local merchants.

In the mid-1800s, for those who were prepared to carry a debt with the local merchant that was considerably larger than normal, or for those who had accumulated sufficient capital, the cod trap became the most important component of their fishing gear. Invented in 1871, the cod trap was swiftly adopted in many parts of Newfoundland (Sinclair, 1985). The cod trap was widely adopted by Newfoundland fishers on the Bonavista Peninsula in the late 1880s.

Prior to the collapse of the cod stocks in the 1990s, cod struck inshore areas between late May and early June, later in the north than the south, and remained for three or four weeks. At this time the cod trap could be highly productive compared to the old cod seine or nets (Sinclair, 1985). The trap fish tended to be smaller on average than those caught by other gear in deeper waters. Cod traps were also relatively expensive to purchase and immobile. If for any reason fish stayed offshore, the season would prove bleak for those dependent on the trap fishery. In addition, the work of setting and hauling the trap at the turn of century, and before steam engines and hydraulics, required a team of four to six fishermen and two boats. Thus, the trap fishery required more labour and capital than other inshore techniques like handlining, jigging, seines, and nets.

Line trawl and hand lines were used throughout the season in the inshore fishery as well. Some trap fishermen would turn to these technologies when cod moved off to deeper waters in late summer and fall or before they arrived at the coast in the spring. Whereas the trap crew would spend only a few hours on the water each day, since the trap is not checked or hauled more than twice a day, a crew with several fleets of trawl lines could be hauling and baiting these lines almost continuously. The advantages of the line trawl over the trap were that it could be moved relatively easily, it could be placed in deeper water, and it was less expensive to purchase (Sinclair, 1985). On the debit side was the amount of heavy labour involved in trawling and the problem of maintaining a supply of bait (Brothers, 1975; Firestone, 1967). In addition to cod, other species like caplin, herring, lobster, crab, and squid were harvested for bait, agricultural fertiliser, and other non-commercial household uses in the 19th century (Cadigan, 1995). In the 20th century, these other species have been sold commercially.

During the salt fishery trade, the production of cod was heavily dependent on family labour through household production (Sinclair, 1985). These family operations were made up of fishers and on-shore curers. Harvesting and processing work was decentralised operations carried out by various members of fishing families.

Prior to World War II, the majority of the cod fish was salted by fishers and their families. After being left in salt bulk for eight to ten days, the split fish was washed in sea water and then dried in the sun on flakes or spread out on the beach, the total process taking about thirty days, depending on the number of good drying days (Ferguson, 1996). The amount of labour time required to produce the cure inevitably reduced the fishing time in summer and prevented a late fall fishery since curing was usually impossible after the beginning of November and the changes in weather on the northeast coast. Women and children participated greatly in the curing process. Men, too, participated in shore labour.

According to Found (1963) the typical salt cod fisher spent 30 percent of his time processing the catch.

During the summer months, these families were consumed with harvesting, processing, and selling their catches. They developed intricate knowledge about fishing and curing aspects of this production (Ferguson, 1996). This craft was orally and observationally transmitted within these fishing households. The knowledge and skill for fishing and curing cod were retained by fisher families. For the most part, they controlled their own labour, the practices of production, and management of this fishery for generations.

Both fishing and curing aspects of production were artisanal, and therefore relied heavily upon local knowledge and holistic technologies. Fishing families accumulated detailed knowledge about how gear types, curing techniques, weather conditions, and biological events affected fish production. The knowledge of inshore fishers about local biological events (like spawning cycles) environmental occurances (like ice flows and tides) affected fishing success. Furthermore, successful inshore fishing often rested upon local variations in basic fishing technologies and netting techniques for cod traps, gill nets, seines, hand lines, jiggers and trawl lines of the time (Hutchings et al. 1995). The design of inshore fishing boats (like dories and trap skiffs) was determined in part by aesthetic preferences, but more generally by the intended use and physical conditions in the local bay where the craft would generally operate (Taylor, 1989). Likewise, various curing techniques arose in response to the weather conditions and variations in raw material in local areas (Ferguson, 1996). The local knowledge retained by these inshore fisher families included not only emphasis on cod and its production, but also its relation to other species and household activities. Depending upon the geographical area, many families integrated fishing activities into other household activities such as farming and logging (Cadigan, 1995). Therefore, this knowledge provided an understanding of how production practices related to other household activities and community dynamics. Intricate local knowledge and skill in fishing and curing fish were linked quite literally to the survival of these families because both aspects of production were reliant upon the seasonal events of nature and the knowledge and skill of these fishing families influnced successful production and home incomes.

There were vulnerabilites associated with household saltfish production. Production was limited by such factors as family size, weather, and of course the availability of raw material (Sinclair, 1985). In addition, salt fish produced for merchant markets implied economic poverty for these fishing families (Cadigan, 1995). Demanding physical labour, the uncertainty inherent in any dependence on seasonal raw materials, as well as lack of alternative education and employment actitivies can be associated with life during the era of the salt fishery (Ferguson, 1996).

Local household production of saltfish was also influenced by the external market forces of merchants and world fish traders. Because most fishing families incurred debt through the mercantile system, production practices that increased catches, shortened production time, and lessened the labor burden of family members were coveted, as were opportunities to sell products (like fresh and pickled fish) that yielded higher prices (Sinclair, 1985; Ferguson, 1995). Fishing families were mindful of how changes in fishing and processing activities affected the welfare of their households and those of their neighbors. Members of local fishing communities also debated the implications production practices held for the health of fish populations.

Fishing practices, outside of being determined by natural conditions, were influenced by concerns related to social equity and the environment. Fishing gears like cod traps, seines, and inshore trawl (so called bultows) intensified fishing and were usually more expensive than the hand lines used by most inshore fishers in the 19th century. They also held the possibility of creating or exacerbating problems of fish shortages. As well, these technologies meant that wealthier fishing families who could afford them would be able to take more of a scarce resource, leaving less for their poorer neighbors (Cadigan, 1995).

In 19th century Newfoundland, some fishing people vehemently opposed the adoption of these technologies. In their opposition, they hauled up and damaged seines and trawls, as well as physically intimidating those who wanted to use them. Those who opposed these gear types argued that they were contributing to the disappearance of cod inshore, thus further impoverishing local fishing people. Many fishing families held that low catch rates in local areas were indicative of natural limitations or shortages of fish and not of inefficient technologies as argued by the government officials, merchants, and wealthier fishers who supported these gear technologies (Cadigan, 1995).

Regardless of these sentiments for restraint, local bays showed signs of being over-fished even in the early 19th century. The bay cod which had morphological characteristics adapted to the particularities of local bays, and upon which fishing families depended for production, represented a fraction of the number of cod that migrated in from offshore waters (Hutchings and Myers, 1995). The mortality of these bay cod rose as the coasts of Newfoundland became increasingly populated with people whose main economic opportunity concentrated on fishing. As a consequence of fish shortages along the coasts of Newfoundland in the mid-19th century, the Newfoundland inshore fishers expanded their fishery to the coastal waters of Labrador (Hutchings and Myers, 1995).

In the late 19th century, concerns over declining inshore cod catches prompted members of the Newfoundland Fisheries Commission to fund the construction of a cod hatchery in Dildo, Trinity Bay. Proponents of the hatchery hoped that it would restock depleted bays, while the Commission decided upon better modes of regulating technology and protecting these stocks. Some local fishers lent their co-operation to the hatchery by obtaining spawning fish from Trinity Bay, as well as providing information about local fishery cycles (Newfoundland Fisheries Commission, 1892). Some attested to increases in cod populations in local waters that they attributed to the influence of the hatchery, but their "heresay evidence" was not convincing enough for Commission members to fund the project beyond 1896 (Gagnon and Haedrich, 1992). Members of the Newfoundland Commission chose instead to institute regulatory regimes for allocating access to common property based on increasingly scientific stock assessments as a way to stablise cod populations.

From the turn of century to the 1950s, the number of cod in inshore waters declined dramatically, even though these catches of cod still exceeded those in offshore waters (Hutchings and Myers, 1995). The raw material for salt cod production (particularly large cod) became scarce. The Newfoundland economy was heavily reliant on the fishery, and declines in production of salt fish and technological innovations in the U.S. and Europe spurred the development of a new type of fish production.

4.3 Frozen Fish Production

Between the 1950s and the 1970s, Newfoundland's cod production was restructured from household-based production of salt fish to mass production of semi-processed blocks of frozen fish (Neis, 1991). Scientific knowledge and prescriptive technological innovations contributed to changes in social and natural aspects of production.

Unlike the salt cod fishery, production of frozen fish employed technologies transferred from industrialized fishing nations. These technologies facilitated the intensification of fishing in both nearshore and offshore waters. Processing was industrialised and concentrated in plants. Large volumes of cod and other groundfish were harvested in trawl and gill nets for processing using air-blast plate freezers, mechanised filleting equipment, and cellophane wrapping machines into products destined primarily for the American market. Frozen fish production needed little skilled labour and did not require a consistent size or quality of raw material. Such innovations centralised control over fish harvesting and processing into the hands of newly emerging fish corporations. The decentralised household production of the salt cod fishery was eroded as developments in frozen fish technology increased and as inshore landings declined in the 1960s. Intensified fishing practices further depleted the availability of raw material in inshore waters and eventually in the offshore as well, and curing skills were supplanted by packaging and filleting technologies in the plants (Ferguson, 1996).

Government hired growing numbers of fishery scientists and organised training programs to direct fishery workers into offshore fleets and frozen fish plants (Wright, forthcoming). Getting fishery workers to join the trawler crews and seek employment in processing plants was an integral part of this transformation to frozen fish production. In the 1950s and 1960s, the Newfoundland and federal governments extended every effort to encourage fishery workers to take these opportunities. Up to this time, fishery scientists had played a minor role in informing fishery policy within the Newfoundland cod fishing industry (Neis and Felt, 1995). Furthermore, in the 1970s, government support of an offshore fishing fleet and scientific fisheries management was encouraged by requirements in the United Nations Convention on the Law of the Sea to establish Total Allowable Catches (TACs) (Underwood, 1995). TACs became the basis for calculating the surplus to a nation's harvesting capacity and thereby quantifying the amount available for other states. These requirements allowed nations to exclude foreign fishing only if they could demonstrate capacity to utilise the TACs. This, coupled with the expansion of Canadian fisheries jurisdiction in 1977 to 200 miles, and an increased development of a Canadian offshore fleet pushed back but did not eliminate foreign trawlers fishing off Newfoundland shores (Neis, 1991, Sinclair, 1985).

The fishing technologies developed for mass production of low quality frozen fish product were aggressive in their appropriation of the resource when compared to inshore technologies like hand lines and traps (Hutchings and Myers, 1995). Probably the most aggressive components of this new technology were offshore trawlers belonging to fish corporations. This technology entailed a strong separation of work from community, severed conception from execution, and produced highly fragmented jobs through the standardisation of tasks and mechanisation in both harvesting and processing sectors (Neis, 1991). This technology was also highly destructive and wasteful. Profitable production required huge amounts of raw material. Factory trawlers combined electronic and mechanized harvesting technologies for finding and catching groundfish with fish processing equipment at sea. These vessels could move from stock to stock, and follow fish migration routes. Furthermore, they operated year-round and with more continuity than local technologies of inshore fishing families. The operation of these trawlers depended in a fundamental sense on the rupturing of past relationships among fishing families, their communities, and fish production (Neis, 1991).

Government subsidies allowed fish corporations to pursue the offshore fishery, and also encouraged inshore fishers to adopt more intensive fishing technology (Sinclair, 1985). This intensification resulted in the acquisition of gill nets and longliners. These nearshore technologies were intermediate between inshore and offshore fishing technology (McCay, 1976). Thus, longliner technology permitted exploitation of wider fishing grounds and more species than the inshore cod fishery. It marked a shift from a largely passive inshore fishery dependent on the arrival of migratory cod and other species to hunting any and all marketable fish species available as long as the weather and sea conditions permitted. Boat size and gear, amount of capital investment, location of grounds, length of fishing season and relationship to fish processing sectors were mid-range between those of inshore and offshore fisheries in Newfoundland (Sinclair, 1985). This increased productivity and higher levels of capitalisation in combination with destructive offshore fishing effort exacerbated problems of over-exploitation. These operations became increasingly dependent on the volume of their fish landings, and had little choice but to increase fishing effort. The nearshore longliners joined the offshore trawlers in resource depletion.

Other technological innovations also increased the harvesting ability of inshore fishers. Mechanical means of hauling, baiting, and setting trawls, and the introduction of hydraulic winches to haul gill nets, greatly increased the number of trawls and nets that could be set by an inshore fishing crew (Sinclair, 1985). In the 1970s and especially in the 1980s, modifications in the cod trap, including the introduction of the Japanese cod trap design, increased trap harvesting capabilities by reducing escapement and permitting trap deployment across an increased range of bottom types (Hutchings and Myers, 1995). Advances in radar and the development of echo sounders in the 1960s, and the establishment of Loran C navigational systems in the 1980s increased fishing capability as well. Sounders reduced the time spent hauling empty traps, and Loran C allowed fishers to determine and record exact co-ordinates of fish assemblages. However, offshore catch allocations were substantially higher than inshore allowances. The drastic decline in inshore landings of cod that occurred throughout the 1960s and 1970s was a consequence of the massive catches of the offshore trawler fleet (Hutchings and Myers, 1995)

Until the 1950s and 1960s, the northeast coast cod fishery had been based on the household production of saltfish. In this production, the volume of saltfish was limited not only by the amount harvested but also by the labour and space available for processing catches (Sinclair, 1985). The holistic technology of inshore salt fish production, based on fixed gear and onshore curing, was such that it helped match labour to supplies of fish, minimising both effort and waste (Neis, 1992). Although signs of overexploitation have been present throughout the history of the inshore fishery, the holistic practices associated with inshore fish production sustained fishing families and caused less disruption to cod stocks than offshore fishing technologies (Hutchings and Myers, 1995). Offshore trawlers fished year-round often on spawning concentrations of cod, and processed massive amounts of fish for corporate profit. Discarding and waste were also common.

4.4 Restructuring the Frozen Fish Industry: The Consequences of Prescriptive Technologies

In the 1970s and 1980s, crises stemming from environmental destruction by an industry based on the prescriptive technologies of the frozen fish industry occurred. The over-exploitation of fish stocks created a depletion so great that fish companies no longer had access to a vast resource of raw material from the offshore. Thus, this crisis could be not remedied by expansion of prescriptive technologies for offshore production. Instead, restructuring pushed fish harvesting and processing technologies and labour processes away from de-skilled and rigid production lines to alternatives that were more flexible, less wasteful, yielded higher prices in niche markets, and were more reliant on skilled inshore fishery workers (Neis, 1991).

During the 1970s and 1980s, fish companies restructured and adopted new processing technologies. There was a shift to higher quality products processed with stricter control measures for niche markets. More parts of the fish were processed in latter years when cod fish got smaller and more scarce. As well, previously under-utilised species (like caplin) gained new prominence on processing tables. Catches from the inshore fishery in the early 1980s increased. These increases reflect the vast amount of intensified effort that was pushed towards shore in order to maintain production in the face of the crisis offshore production had caused in the cod fishery (Hutchings and Myers, 1995).

Since the 1950s, with the exception of the late 1970s and early 1980s, the prescriptive innovations in fish harvesting and processing have marginalised the inshore fishery. Likewise, with technological developments of the Newfoundland frozen fish industry came an institutionalised fishery science that separated knowledge from fishing experience. Scientific mangagment of these fisheries was governed by a hubristic belief that prescriptive production could be sustained through the direct manipulation of fish stocks (Finlayson, 1994). Furthermore, the rise of scientific expertise discounted the experiences of fishery workers even though their closeness to the resource equipped them with an important source of knowledge. Thus, local systems of resource management were eroded and fishers' concerns (like those of plantworkers) about the state of the cod stocks were largely dismissed (Matthews, 1993; Finlayson, 1994).

Once offshore technology had been developed through scientific innovation, standardisation of fish production occurred. Ultimately, this production model was associated with economic consolidation among fish corporations. Prescriptive technology which facilitated external management and control reduced reliance on inshore skills and autonomy. However, this technology's relation with nature turned problematic as estimates of abundance which were generated through stock assessment programs influenced by catch rates in the commercial trawler fleet proved grossly over-optimistic in the 1980s.

The data used in state scientific assessments of northern cod stocks were from offshore areas and did not include the knowledge of inshore fishery workers (Neis and Felt, 1995). When this neglect was brought to the attention of state personnel by inshore fishers and plant workers, who probably felt stock decline acutely and sooner than those involved in the offshore, their protests were discounted (Neis, 1992).

The inshore fishery generally catches only those fish available close to the communities where fishery workers reside. Because stock assessment science was severed from the production practices of these fishers, it was handicapped in terms of its capacity to interpret declining inshore landings when they occurred in the 1980s. Inshore fisheries have developed complex gear combinations and practices in order to respond to natural fluctuations in ecosystems. Scientific knowledge of government and fish corporations de-emphasised the importance of these seasonal fluctuations not only in the inshcre, choosing instead to fish year round offshore. However, in recent years it has been acknowledged that these fluctuations and uncertainties are characteristic of marine environments (Hutchings et al., 1995).

Trawler technology had the capacity to eliminate a reliance on natural migratory patterns, whereas such patterns have been central to the economic survival of Newfoundland inshore fishers. Therefore, they have maintained detailed knowledge concerning the spatial and temporal distribution of at least those components of their marine ecosystem on which they have depended (Neis and Felt, 1995).

The negative ecological impacts of prescriptive technologies, which had been designed in part to increase the fish companies' control temporarily over production and nature, forced these same companies to restructure production. Restructuring for more flexible production shifted control in favour of fishers and plant workers (Neis, 1991). However, it was not enough to turn the tide against an exploitative technology and institutionalised scientific knowledge ill-tuned for avoiding the collapse of the Newfoundland cod fishery in the late 1980s.

Over the past decade, it has become increasingly evident that serious social and environmental problems have resulted from the ever decreasing quantity of cod obtained in the waters around Newfoundland as a result of over-zealous resource appropriation encouraged by intensive fish production through the the use of prescriptive technologies. The moratorium placed on cod fishing in Newfoundland in 1992 is the most obvious example. While the cause of this decrease in cod stocks is debated by politicians, marine scientists, social researchers, and fishery workers, one thing is undisputed: its effects have been felt across the board in an increasing number of coastal communities where fishing boats lie idle, processing facilities have closed, and the future of many fishing families is uncertain. With this decline in groundfish stocks and in the context of the current moratoria, many in the fishery are seeking alternative methods to increase production. Similar to the social and technological reorganisation pursued by government and fishery entrepreneurs when the salt fishery declined, and after the 1970s' crisis in frozen fish industry, government and fish companies are looking at a new form of cod production that they hope will resurrect cod fish production, namely cod aquaculture. This will be discussed in the following chapter.

4.5 Conclusion

In this chapter, I illustrated how knowledge and technology shaped Newfoundland cod production over the past 150 years. I have also examined how this, in turn, has affected power dynamics in social and natural environments.

I highlighted the following themes. First, the household production of the salt fishery allowed the acquisition of sensitive local knowledge about the ecology of fishing and onshore curing. Second, practices employed by fishers and onshore crews gave them autonomy over various aspects of production. However, saltfish production required hard physical labour and implied poverty and indebtedness to merchants. It also did not prevent localised over-fishing. A decline in raw material, the transfer of intensive fishing and processing technologies, and the development of new markets prompted a shift to frozen fish production. With the transformation to frozen fish production this knowledge was marginalised. Perhaps most affected was knowledge about processing salt cod. Generational local knowledge about curing salt fish faded as government and fish companies restructured for offshore frozen fish production.

I discussed how scientific management systems and prescriptive technology of the offshore fishery linked fishing families to the commercial interests of fish companies and proved dangerously inflexible given the particularities of local fisheries and therefore fell short of maintaining a viable and equitable resource. I also illustrated how science and prescriptive technology have aided in the concentration of cod production into the hands of a number of governmental, scientific, and corporate organisations. This production exhausted cod stocks at an unprecedented rate in Newfoundland history. The fishery was restructured again with a renewed interest in inshore production in the late 1970s. The knowledge and skills relevant to the inshore fishery, have remained resilient and are an important resource for many commercial fishing family operations. I argued that such practices have endured because of the importance such knowledge retains for complex fish production and for insulating its practioners from the prescriptive practices of fish companies and uncertainities in nature.

Chapter 5

Newfoundland Cod Farming and the Inshore Fishery

5.1 Introduction

This chapter examines how the development of early cod farming methods in Newfoundland were shaped by and drew upon the local knowledge and holistic technologies of the inshore fishery. Using data from my interviews with inshore fishers/cod farming recruits, I examine the dynamics of the inshore fishery to illustrate the nature and extent of the role local knowledge of inshore fishers and their cognitive relationship to the holistic technologies of the inshore fishery. Then, through the use of data from interviews with a number of personnel employed by a company that pioneered cod farming in Newfoundland, I discuss how the involvement of local inshore fishers shaped the development of a semi-intensive model for cod aquaculture in Newfoundland.

5.2 Cod Aquaculture Production

Although over-shadowed by the commercial wild fishery, in the 1980's, experiments in cod farming were tried in Newfoundland. The first cod aquaculture operation was developed in southeastern Newfoundland by Seaforest Plantation Ltd. (referred to as Seaforest), a company established by a number of Newfoundland businessmen who saw great potential in adopting Norwegian cod farm technology. The company began production in the summer of 1986, and with the aid of fishers and financial support from government and private organisations, developed cod farming practices grounded quite literally in the inshore fishery.

Their cod farming model depended upon the natural runs of small cod and caplin commonly caught in the inshore fishery during the spring and summer trap fishery. Small cod were caught in traps, and transferred to net cages in a number of inshore areas along the southern and north eastern coasts of Newfoundland. During the summer months, the fish were fed frozen male caplin, caught by local fishers during their inshore spawning migrations and purchased from local fish plants during the summer months where they were discarded by plant workers processing female roe. When they reached desirable market size, the cod were sold as a high quality fresh product in the fall and early winter, when a fresh supply of cod was not readily available, to markets in the United States. The results of the first few summers showed that these late juvenile and early adult trap fish were tough and resilient, and could double their weight after a few months of regular feeding. Fishers' local knowledge played a central role in these early cod farm experiments. The relevance of inshore fishers' local knowledge for these early cod farm operations can be illustrated using data from interviews with a number of inshore fishers who were aquacultural recruits and results with fishers conducted as part of the TEK (Traditional Ecological Knowledge) component of the Eco-Research Program.

5.3 Fishers' Local Knowledge and Holistic Practices

Although local methods for curing salt cod were eroded by the 1980s through advances in frozen fish production, local knowledge for inshore fishing has remained a staple for many fishing families along much of the northeast coast of Newfoundland.

Inshore cod fishing technology has been used by successive generations of fishers in the same locales with limited changes. The inshore fishery has remained largely passive, in that they have remained dependent on feeding migrations of cod. Thus, these fishers trap natural runs of fish instead of actively hunting and corralling them throughout the whole marine ecosystem (Neis, 1992).

In addition to setting and hauling seines, nets, traps, jigging and handlining for cod, many inshore fishers have continued to use such gear to fish other species like caplin, herring, lobster, crab, and squid. Furthermore, these fisheries are highly diverse in that inshore fishers continue to fish multiple species, sometimes consecutively, altering gear and technique according to local conditions including natural migratory cycles.

The gear combinations of the inshore fishery have distributed effort over a fairly wide range of sites and species of fish during seasonal fisheries (Neis, 1992). Knowledge about particular seasonal fisheries and gear combinations was local in that there was considerable variation from place to place. Fishing success was less dependent on gear than on fishers' knowledge about local conditions. Oral knowledge transmitted intergenerationally equipts inshore fishers with vital biological information including the diet of fish, their morphological characteristics, the timing and direction of cod populations into and out of the arms of bays, as well as the availability and location of other fisheries including over-wintering activity (Hutchings et al., 1995). This knowledge has been used for complex fishing practices within local bays involving the use and combination of gear types to fish species such as caplin, herring, lobster, crab, turbot, and squid.

In general, the local knowledge traditions of inshore fishers developed and changed through direct and built up experience from their fishing operations and through exchanging observations with fellow fishers, as well as with elders in fishing households, communities, and on the fishing grounds (Hutchings et al. 1995). These fishers measured changes in the inshore fishery on the basis of deviations from known and previously observed patterns in feeding and spawning aggregations of fish. For inshore fishers, accumulating local knowledge about the direction and timing of cod migrations and other species (such as bait fishes like herring and caplin) has remained central to the success of their fishing operations. Inshore fishers have detailed knowledge of the relationship of winds and tides to fish movements (Neis and Felt, 1994). The back and forth movement of fish around headlands and between subregions of bays has often been closely associated with particular winds and seasons (Hutchings et al., 1995). This knowledge allows fishers to determine where and when cod will aggregate, as well as to predict the size and quality of the fish they will catch. Knowledge for cod movements and feeding habits also influences bait choices and gear design.

These claims about the local ecological knowledge of inshore fishers and the complexity of their fishing strategies (Hutchings et al. 1995) were supported by information from my own interviews with fishers involved in cod farming training courses. To illustrate, one husband and wife fishing crew from Old Bonaventure, Trinity Bay organised their seasonal fishing activities this way:

> Usually if the ice don't come in then you start the lobster at the latter part of April. The lobster pots, I'd go and put some out here and some around where my cabins to on (one of the two making up Ragged Islands in Trinity Bay). We had some along the shore here and right into the tickle. Well usually around the middle part of May you'd have a strong easterly wind and you'd get a jump of sea. Off here around the islands and like near the shore

> down here. It would be too rough for pots, you'd lose a lot of pots. So you wouldn't put the pots out there until after the sea. It would heave up against the rocks and you wouldn't be able to get to your pots anytime.
>
> Anywhere from the first to the middle of May, whenever lump season opened, we'd put out the lump nets. The lump nets were down here on the lower corner of the island and out on the back part of the island. We had lobster pots out around here. Lump on the outside of the island there and lobster on the inside of the island...we'd put lobster and lump close so we could tend to it all at the same time.
>
> About in the middle of April you'd put out some herring nets and that would be bait for your pots. Down around the first part of June you'd go to work and put your (cod) traps out. That would be latter part of May first of June up until the middle of July or end of July...The caplin would run except for the couple of past years anytime between the 15th and 20th of June. Then you'd have the caplin season ... Latter part of July, the first part of August you'd be handlining, cod jigging, baited hook and line. Usually the latter part of July the first part of August you'd use cod jigger and anytime after the middle of august it would be baited hook. September or October, you'd probably be using baited hook then, and you'd be at the squid. I used to do a bit of gillnet fishing between 100 and 200 fathoms, 6 knots steam sou'east of Green Island, fished turbot, cod and flounder. Gillnets would be out from the first part of May to October. End of the season baited hook, handline, gillnets. Latter part of August or first part of September you might get a week or so when the squid wouldn't come, you'd get mackerel, but usually if you were at squid you weren't at mackerel (Inshore fisher, Old Bonaventure).

Many of the inshore fishers I interviewed described how important knowledge of the interplay between tides, weather, ice conditions, gear types and the cycles of various seasonal fisheries were for their fishing operations.

Fishers' knowledge sometimes challenged basic fisheries management assumptions including the assumption that all cod move from offshore to inshore following caplin in the spring, then return offshore in the fall to reproduce solely on offshore slopes and banks, and that cod are undifferentiated biologically (Hutchings et al, 1995). Some of the inshore fishers I interviewed described harvesting distinct runs of cod in spring, summer, and fall, and discussed how the above conditions influenced fishing success. For instance in Princeton, a fisher described the practice of harvesting cod (that had overwintered in the bay) during late March and early April while seining herring to be used for bait in lobster fisheries.

> There would be fish under the ice all winter long - cod and herring. There's years I've used my pick (to get the gillnet) through the ice, and there's some years that you don't get any ice at all, and the bay stays free all winter long. It is all according to our winds, if we get northerly or nor'east direction wind and it hits the slub in the bays, and once the slub freezes ... well you are going to have standing ice in your bay up till spring, until that outside ice moves away. The trouble is when your prevailing winds are northerly, you've got your ice flow pressing in on the land and you can't get any sea then to break up the ice up in your reaches, up in your bay... There are only some winters where you can fish. If the arctic ice comes in and stays in the bays then you can't get your nets through it. Yeah, there's times that you take a break 'cause you've got no choice'. There's more years when you can go right on and fish right through it (Inshore fisher, Princeton).

Inshore fishers also described movements of fish. An inshore fisher from Plate Cove West described the movement of a run of cod in his area:

> When we started out in the spring with the cod traps we'd catch the bay stock of fish that was in the bay. That came in the bay at the fall of the year, and stayed in the bay the whole fall because we could see it in the bay the whole fall...It would end up bay stock because it come in the fall of the year, we see it in the fall of the year, stay in the bay in fall, stay there all winter, and leave the bay, and start drolling out around the shore probably April month or early May, and we'd start getting them in cod traps, and have a good three weeks fishing (Inshore fisher, Plate Cove West).

A second Plate Cove West fisher:

> ...round here, a good indication of what kind of fishing it was going to be in the spring, the early spring, would be how much fish was up there under the ice in Charleston. We used to monitor Charleston more than anywhere else. There'd always be fishermen up there with holes cut through the ice with nets out, or with jigging or something like that getting a few to eat, or a few to sell. So, if there was a lot of fish up there we'd say that we've got to be ready by whenever, the earliest we can, because the fish were going to come down, and if we were too late we'd miss it.
>
> You see we'd put the herring nets out in the spring, and then we'd get some bait, and when the season opened we'd put some lobster pots out, and if the conditions were good enough for cod traps - no ice, not storming, then the cod traps would go out and we'd see if there be any fish out there. Then we'd do that until the caplin come for another run of fish (Inshore fisher, Plate Cove West).

As identified by other researchers (Hutchings et al., 1995) fishers I interviewed often distinguished between different types and runs of cod fish on the basis of size and colour. For instance, sunburnt fish or blackbacked cod, deepwater or paler cod, shoalwater or browner cod, as well as mother fish (large old cod with large roes), and foxy fish (reddish coloured cod). They also distinguished between different runs of fish associating them with influxes of different bait fishes (like herring, and caplin, even squid) in bays. An Old Bonaventure fisher made this distinction:

> Usually in the spring when you put the herring nets out and stuff - a scattered fella would put his trap off a bit deep, 20 or 25 fathom water and he might get a few fish ... what we used to call herring fish. Now that would be the fish that chased the herring. That would slack off and you'd wait for the caplin scull. What the old fella's called the caplin scull. What the caplin fish would come with that, you'd get your fish (Inshore fisher, Old Bonaventure).

A Princeton fisher described distinctively different runs of cod through their movements and physical characteristics:

> That fall cod will migrate into shoaler water over a period of time until about December month, it will reach to about Princeton, and right on up past Princeton, and it will over-winter up in the bays in Princeton and up towards Charleston. In the spring, when the ice breaks up, that fish will go right to shore, right in two and three fathoms of water and that will leave, go out along the shore, right in close to the shore until it gets out to the headlands, and then that is the last we see of it until next fall. Then there is another migration of fish, of cod inshore, one chases herring sometimes, or if it don't come in with the herring it will come in with caplin. That fish is skinnier and more slender because it's been off the

> Hamilton Banks somewhere so naturally it is not in as good of shape as the cod that's been up in the bays feeding all winter... The second run of fish have even had shrimp, and crab in them, and the fish that over-wintered you'd notice conners in their bellies (Inshore fisher, Princeton).

Another quote illustrates the importance of inter-generational fishing knowledge about local wind, tide, and bottom type for fishing success:

> There is places where fish tend to travel more than other places, and that's why you've got traditional trap berths because they run in there, the depth of water is there, the channel of water or shoal is there. The fish run in those channels and hit land in certain places, and it's called a traditional cod berth... Some times the worse bottom, that's the best berth. A real tough bottom, probably there's a glut of rocks or something like that, you know if it is too rough then you can't put a cod trap there. You'd tear off the bottom.
>
> We found that nor'east wind is a bad wind on this shore... and western, we always said it would drive the bait across the bay to our side and the fish would follow it. All round winds you need to catch cod fish. Sou'west wind is a good wind for cod fish because it thickens the water up, it cleans out the water. The sou'west wind and sunshine. But northerly winds dirties it up, the water, chills it. Then it's not so good for fishing ... the plankton near shore moves off to cleaner water (Inshore fisher, Plate Cove West).

Although most of these fishers used electronic fish finding equipment, these were generally used to supplement their experiential knowledge rather than replace it. Some were skeptical about these technologies:

> Yeah, I had a sounder, but I didn't use it much

> though. We found, there was one guy in the bight and he had four traps. He used to come up and go over one with the sounder, and go over the other one, and go in and say 'it's only a pan, not worth hauling.' He don't realise that if you'd haui the four traps and get a pan or two pans out of each one, well you've got 1000 or 1500 pounds of fish. Over the course of 10 or 15 days you've got a nice bit of stuff. So like I said, if we were up there probably in an hour or half hour - haul our trap. I don't really put much trust in the sounders for the bights. So we used to haul the trap anyway (Inshore fisher, Trinity).

5.4 Using the Local Knowledge and Holistic Technologies of Inshore Fishers in the Development of Newfoundland Cod Farming

From 1986 to 1990, Seaforest developed and patented its cod farming technology. Interestingly, some of this technology had been adopted from the Norwegians, while much of it was partly developed through innovations informed by input from Newfoundland inshore fishers. Inshore fishers deal with so much variation in the material and natural environment that they must constantly rely on experience to adapt and repair gear as well as adopt new techniques to maintain fishing success. The company's innovation process drew upon these skills and aptitudes.

The innovations of fishers and their skill with traps and knowledge of local fisheries were very important to the initial success of the company. Seaforest's early production model was heavily rooted in the local knowledge and holistic technologies of the inshore fishery. For instance, the company's starting stock depended upon the local knowledge and technologies of inshore trap fishers. Local inshore fishers used their trap skiffs and gear as well as their constructing and harvesting skills to catch and transport small juvenile fish in towing pens (which they constructed) to company farms. Other farming practices were also honed through the aid of fishers. For instance, in the early years of production, the company experienced high mortality rates during the collection of cod from the trap. The company manager noticed that one fisher's trap fish had a consistently higher survivor rate than the others. Through observing this fisher's method of collecting the fish from the trap, the company learned valuable information:

> I went out on the collector boat one day and paid close attention to what he was doing. I went up alongside of his trap, and there were no fish to be seen. Then he'd haul up a bit a twine and there they'd be swimming on their backs and normally they'd be on their side. I said, what exactly did you do. Your fish are in great shape. And he said, "I work with divers and these fish need to be decompressed. So what I do, if I have a trap ... I pull up my trap until they are two fathoms down, I stop, then pull them the rest of the way. That way they get decompressed." After that, we made that an operational tool for all of our collection crews. Even adopted that simple operational technique of "don't haul your trap too fast." You only had to rest them just below the surface for only 5 or 10 minutes until they are decompressed. And that made all the sense in the world ... It was a very astute observation (former Seaforest Manager).

One of the key individuals involved in the early development and operation of this cod farm technology was an inshore fisher from Bay Bulls (a fishing community on the southeastern coast of Newfoundland) who had worked as a trap fisher for 24 years before his full-time employment with Seaforest. Like other fishers who worked with Seaforest, he knew a tremendous amount about traps, netting, constructing equipment, and fish migrations. These were the keys to overcoming many of Seaforest's technological impediments (former Seaforest manager, personal communication). These fishers knew little about fish in captivity and had poor record keeping skills. However, they observed fish behaviour on the farm for hours at a time, day after day, and these fishers came up with some astute observations, and incorporated science into their reasoning about cod behaviour. The combination of their skills and some basic science about fish physiology was very powerful:

> Over the years we had a number of young engineers and scientists come in - but these fishers helped us out more. Their skills were extremely useful and their knowledge for our operation was more crucial at the time than that of scientists (former Seaforest manager).

This cod farm production model depended upon seasonal production in the inshore fishery and natural migratory rhythms. Production relied heavily on fishers' local knowledge of gear, nets, weather, ice conditions, and seasonal rhythms of local fisheries. These skills for trapping fish were transferable and brilliantly meshed with this kind of fish husbandry. Seaforest's success depended in part on taking advantage of the local knowledge of fishers in different locales and using it to help the company adapt its operations to the particular area.

A former Seaforest manager explained that through working with local inshore fishers on a daily basis during the development of these early cod farms, he had acquired a great respect for their knowledge and the dynamics of the inshore fishery. This respect, coupled with the increasingly negative effects that declining inshore cod catches were having on farm production, prompted him to become an advocate for the inshore fishery and to work with the Newfoundland Inshore Fishermen's Association (NIFA) organised during the late 1980s and early 1990s. NIFA was an early vocal critic of overly optimistic scientific assessments of the size of the northern cod stocks. Inshore fisher observations informed NIFA's criticisms (Neis, 1992). This former Seaforest manager explained that it was an interesting experience to travel around a number of Newfoundland outports with inshore fishers and to observe fishers as they exchanged fishing information on different areas.

> Unlike a government scientist, probably, they (the inshore fishers) didn't go from bay to bay assuming knowledge and authority about that the fishery in that area. No, when they got talking with fishermen in another community, especially if there was older fishermen around, there was a lot of thought going into their conversations. It was a serious matter when they talked about fish. We're

> talking about guys who put their life ... some fishermen maybe 40 or 50 years into observing these bays knowing that his life and his family's were dependent on him accumulating knowledge methodically. They trusted their minds to remember so they didn't put much stock in record keeping (former Seaforest Manager).

This former Seaforest manager tried to bring to the public forum aspects of this cultural transmission and criticisms of the scientific knowledge traditions of government and fish companies that have over-ridden the traditional management systems of inshore fishers. He also became an advocate for collecting and incorporating fishers' local knowledge and management into fisheries science and management.

The inshore fishers involved with Seaforest maintained such a keen interest and support for the company's experiments because they were advancing an activity that made use of their own knowledge and skills within the inshore fishery (Bay Bulls fisher, personal communication). Cod farming also provided a welcomed opportunity to learn about a species upon which they relied for their livelihoods. These inshore fishers have come to integrate some aspects of scientific information about cod with that based on their own experiences. A former Seaforest manager described the knowledge base of the fishers he worked with this way:

> Their style of thinking is highly adaptive. It is a problem solving culture. I was surprised. They deal with enough physical variation in physical and biological environment they have to take their skills and knowledge and constantly be applying it to situations and solving problems. We were

working with limited funds and they were talking something and converting it to one thing or another...recycling material alot. It was obvious that it wasn't a strain. It was a utilisation of what they do everyday. The stuff we did, we did with limited funds and the boys (fishers) were coming up with short cuts. We made some mistakes and some fish might die. But they (the fishers) would figure out why... They had to solve so many technical problems with some very technical and sophisticated answers. Like in transporting farmed fish, they figured out how the fish floated and that we had to stop feeding them (so their bellies would be empty, they wouldn't be glutted).

People talk about the demise of rural Newfoundland and the inshore fishery. I like to talk about the set of finely tuned skills for problem solving. These skills are not endemic to just Newfoundland, but to the hands on time spent with the physical environment (former Seaforest Manager).

With regard to the expertise scientific knowledge offered during this early period of cod farming, one inshore fisher from Bay Bulls noted:

Many scientists said you couldn't over-winter fish. Some said you couldn't preserve your feed through salting, but we did. Some others said the fish wouldn't eat the bait and commercial feed was more nutritional, but our fish ate it and got fat. Others said you couldn't keep fish in this temperature or that temperature because it was too warm or too cold but we tried it from the Southern Shore to Fogo. We did what we could ... changed this here and that there. See, the fishermen who worked with Seaforest knew their bays - the weather, the ice flow, the bottom type, the run of fish - we knew the gear too. So we tinkered with stuff a lot. I figured a lot of people around Bay Bulls and even in the aquaculture industry were skeptical of what we were doing and said it was a waste of time, but what we did with Seaforest worked, and they even used what we developed in their training programs (Inshore fisher, Bay Bulls).

5.5 Conclusion

I have examined how the development of the province's first cod aquaculture operation came on the heels of the crisis in the cod fishery in the 1970s and 1980s. I discussed how this operation adapted Norwegian cod farm technology with the aid of local inshore fishers' knowledge to produce high quality fresh cod fillets targeted for American markets. I demonstrated that the local knowledge of the fishers meshed so well with the early production system of Seaforest because it relied heavily upon the knowledge and skills these fishers had acquired in the inshore fishery and familiarised them with some basic scientific information about fish behaviour and physiology.

Having established the context for the development of Newfoundland cod aquaculture, I will now focus on fishery workers experiences in the moratorium-related training programs. I will underscore their visions and concerns about the future of the wild fishery and cod aquaculture, as knowledge and technology for cod farming continues to develop in Newfoundland.

Chapter 6

Newfoundland Fishery Workers and Cod Aquacultural Training Courses: Aspirations rooted in Local Knowledge

6.1 Introduction

This chapter discusses how the crisis in the cod fishery in the 1980s and subsequent moratorium in 1992 affected Newfoundland's early cod farm operations. I provide a brief history of the cod aquaculture training courses which were spurred by moratorium related income adjustment programs for fishery workers in the early 1990s. These training courses are important to study because they not only encapsulated Seaforest's holistic production practices and transmitted them to fishery workers, but they also sustained the company's place in the cod farm industry. I discuss the organization of these training programs, and critically examine the interplay between the local knowledge of fishery workers' and scientific information about fish physiology. I then discuss fishery workers' perceptions and the aspirations they hold for the cod farming industry. Basically, I illustrate that aquaculture recruits see cod farming as an extension of the local knowledge and holistic technologies used in the inshore fishery. I discuss why many of these fishery workers hold that an aquacultural production integrated with the inshore fishery will be responsive to local social and environmental issues. Finally, I explore how the desperation generated by the cod moratorium and the state of the wild fishery in general, during the mid-1990s, has aided proponents of intensive aquacultural models and their quest for prescriptive cod farming technologies.

6.2 Implications of the Cod Moratorium for Cod Farming

To the delight of Seaforest, wholesale customers like supermarket and fish restaurant chains in the United States had expressed interest in a guaranteed supply of a high quality fresh product from Newfoundland cod farms. However, in the late 1980s, when the cod fishery collapsed, Seaforest's production model, which had been heavily reliant on the wild fishery, could no longer provide a steady supply of fresh fish to US markets. Thus, buyers refused to offer higher prices when production proved "unpredictable" like in the wild fishery. Since the announcement of the cod moratorium in 1992, and the related closure of the cod fishery, the company's practice of trapping small juvenile cod for use as starting stock in cod farms has been at least temporarily limited and the markets for fresh farmed cod have gone untapped. The company survived by reinventing its role in cod farming. Seaforest shifted its efforts to capturing the finances for moratorium related training initiatives.

6.3 Training Programs for Cod Aquaculture

During the moratorium, Seaforest, as well as federal and provincial governments, took an active role in training fishery workers for cod aquaculture. The company entered into a partnership with the Marine Institute and organised cod training programs. They recruited various fishery workers who qualified for training through the federal government's Human Resource and Development initiatives, which were prompted by the crisis in the cod fishery. These included the Northern Cod Adjustment Recovery Package (NCARP), which later (1994) evolved into The Atlantic Groundfish Strategy (TAGS). These programs provided financial assistance and training to displaced fishery workers. While the short-term goal was to provide emergency financial assistance, the federal government also made it clear that these programs would demand "active" participation in return for income support. The affixed preconditions for receiving NCARP/TAGS assistance required that those recipients of income support had to enroll in one of the various training programs. Therefore, the company and the province had a large number of fishery workers eager for training. Thus, recruitment and training of fishery workers for aquaculture began.

Aquaculture education and training are carried out primarily by the Marine Institute (MI) in conjunction with a number of industry partners. Seaforest is one such partner.

Industry partners like Seaforest have played a major role in identifying program participants and determining what knowledge and skills students receive.

The cod aquacultural program offered by MI and Seaforest provides general cod aquaculture training. The 16-week course offers a combination of classroom theory and on-site training. It has been organised so that graduates can obtain the training credentials required for license eligibility as well as the chance to set up their own aquaculture enterprise. To date (1997), an estimated 40 courses have been organised and about 500 to 600 students, the majority of whom are fishers and fish plant workers, have been trained.

The cod training program incorporates knowledge and technology based around Seaforest's aquacultural model. This includes tasks such as capturing starting stock from cod traps, fish transport, cage construction, fish husbandry (including physiology), feed practices, monitoring of disease, harvesting and processing techniques, quality assessment, and business development.

6.4 Cod Training Programs on the Bonavista Peninsula

Cod aquaculture training on the Bonavista Peninsula began with Seaforest and MI's programs in the late 1980s. MI, client driven in its extension service courses, had previously identified a need for comprehensive aquaculture training, especially with the onset of the moratorium.

However, MI had to wait for a specific request from an industry client before a course could be organised. With Seaforest's request for such a training program, members of MI's aquaculture unit sat down with company administrators.

Curriculum manuals were written by MI's aquaculture unit, with the goal of assimilating both Seaforest's identified skill levels and the broader-based aquaculture knowledge to which MI was committed. Course instructors came from the regions in which the courses were taught. They were selected in part because they lived in the area, had received MI's graduate diploma in aquaculture and were involved in the industry. These instructors were also selected for their experience in fish farming in the private sector. A number of the instructors on the Bonavista Peninsula had both an academic background in aquaculture and/or past work experience with Seaforest. Thus, they had tangible, hands-on working knowledge of the company's production methods, as well as a feel for the learning needs of fishery workers in these communities.

After consultation between Seaforest and MI, target aquacultural training participants were chosen, primarily by the company. In short, the criteria centred around those individuals with best prospects of working with the company, either as hired hands or contractual farmers.

Initially, the course was promoted to fishers, but plant workers came to be included after many expressed strong interest at the information meetings held by Seaforest in a number of Newfoundland outport communities. Fishers had the highest hopes for recruitment because of their knowledge about inshore cod fishing. They possessed many of the skills like netting, mooring, boat operation, and fish capture methods that were useful in the company's operations. The fact that these fishers also owned the boats, nets, and fishing licenses boded well for them in keeping startup costs to a minimum for both the company and themselves. Plant workers were not initially considered potential participants in the training program, because they lacked this start-up gear and fishing skill. Nonetheless, they added unique insights to the course, especially in regard to the many processing components needed for production - components which many of the instructors and fishers knew little about.

Seaforest expressed a keen interest in trained fishery workers who had the knowledge and skill to operate small farms based on the company's model. Many of the recruits noted that Seaforest was interested in recruiting farmers for company production. As one fisher put it:

> Seaforest, I think they were trying to recruit people into basically saying they'll supply you with the cages and fish and feed and vet stuff and we'd pretty well get to manage it and sell everything to them. That's more or less their idea or their way of thinking. ... I think Seaforest was into us selling our gutted farm fish and they'd do all the processing. They were real keen on buying the fish off of us. I didn't tell them at the time, but if I had to get into that much expense, and I couldn't catch the fish myself ... I wouldn't be all too anxious to get caught up in the racket (Inshore fisher, Trinity).

A number of instructors and recruits mentioned that the company often had private conversations with some of the participants about possible production arrangements with Seaforest. It should be noted that some recruits expressed regret that the course did not include enough marketing information. These recruits felt that the course primarily concentrated on cage operation, and only secondarily upon processing methods. Marketing principles were not covered thoroughly. This shortfall may be indicative of the role Seaforest hopes to play in the industry as purchaser, processor, and marketer of fish.

In general, the course encapsulated a working knowledge of the inshore fishery and its inter-relation with Seaforest's cod farm production model. This model was easily understood by most of the recruits, regardless of their formal educational background or past fishery work. The fact that these courses were 6 months in duration and were often organised around the fishing season also boded well for fishery worker participation. This cod production model was familiar and attractive to fishery workers, insofar as it offered opportunities for continued employment within the fishery and for renewed importance of inshore fishery knowledge and skill.

6.5 Aspirations of New Aquaculture Recruits

Training participants had similiar ideas about ideal conditions for cod aquaculture production. For the most part, these recruits were interested in cod farm production as an extension of the inshore fishery. They hoped that they could make use of the fishery knowledge and skills they had acquired from fish production. In addition, it was hoped that cod farm operations would be owner-operated, labour-intensive, family-oriented, and combine both fishing and processing components.

Fishers foresaw aquaculture as involving an adaptation of their fishing operations. Production would utilise many local fishing and processing skills, as well as maintaining their reliance on local fish populations for starting stock and feed. One inshore fisher explained how cod farming would mesh with his fishing operation:

> Well, I have the boat, and the license for cod. It's no good having the license for cod if you don't have the license to catch the bait. You can't buy the ... well, probably could buy the bait, but for myself, if I had to buy the bait then I'd lose a lot of interest in it. I intend to catch most of my bait, if not all my bait. This is what I intend to do - I'd catch my cod fish. I'd have my cod trap out and the small fish that was a low price fish. Years gone by we dumped that fish. You'd keep that and put it in your cage, and you just let that sit there until the trap fishery opened. Then you'd go to work and get your caplin or herring, or squid during the rest of the season depending on the time of the year. You'd feed them (the caged fish), then you'd keep them there until the fall and you'd double or triple their weight. You could stockpile

> your bait in a reefer, and that's what you'd do if the caplin or herring or whatever was on the go. I could even catch fish under the ice in winter to use for bait (Inshore fisher, Princeton).

Another inshore fisher commented:

> A trap crew or something should be involved. I see it as a supplement, more or less, rather than just full-time cod farming. It should be part of your fishing routine (Inshore fisher, Trinity).

Plant workers saw cod farming as an opportunity to secure employment either through partnerships with fishers in farm operation or in processing. Both fishers and plant workers expressed interest in operations that would combine their knowledge and skills. Some even hoped these operations would involve fishing, farming, processing, and marketing functions. One plant worker explained a possible organisational face for cod farm production:

> 50 or 60 fishermen or cod farmers are going to have to get together and have their own processing and marketing co-op... The fishermen could look after the fishing (obtaining fish and feed) and family members or plant workers look after his farm if he don't have time. He don't have too much time to be out looking for markets so he's got to have a manager. This is where a co-op comes in--where 50 farmers take on a manager and he could look after the marketing, the plant workers look after processing.
>
> If they sorted it out that way, fishermen would bring the fish in and then the plant workers, well you'd have packers there and fishermen aren't used to packing fish and a lot of them aren't used to cutting fish but you'd have plant workers that would do that part of it. Usually there's a lot of families where someone in the family is a cutter

> and someone is a fisherman and some of them is probably a book-keeper and everyone could use their skills in the business of the co-operative (Plant worker, SweetBay).

Most fishers and plant workers acknowledged the importance of fishing and processing skills for cod aquaculture production. Fishing and processing expertise were felt to be invaluable for successful production, because "after all aquaculture is more than just the farming quality fish, its about processing quality fish too" (plant worker, Bonavista). I have previously underscored the relevance of knoweldge and holistic technologies of inshore fishing, but the above sentiment warrants a closer look at the usefulness of plant workers' local knowledge as well.

Recent research on fishery workers local knowledge has argued that plant workers hold valuable information for understanding how various production models (and associated fishing and processing practices) affected raw material, product quality, and fishery workers' livelihoods (Power, 1996). Such research has been supported by my data as well. Plant workers often spoke of how seasonal conditions like weather, different types of fishing gear, and various on-board fish preservation techniques affected the quality (texture and size) of fish. For instance, one plant worker observed variations in fish according to the bay and time of year in which they were caught:

> One thing that changed the variation of fish (size

> and colour) was if you got fish from different bays. One bay would have an average size fish and they you'd go to another bay and there used to be a different size fish. It all depends on when the fish came (the timing of it). That happened even when the moratorium was called. You'd get fish from different bays, and it would be different sizes and coloured fish (Plant worker, Sweet Bay).

Another plant worker distinguished between inshore and offshore fish by colour:

> The colour of inshore (fillet), to me is more of a eh, yellow type of colour. But not a yellow you'd look at and say 'that's spoiled.' A yellow that was rich made the flesh look rich, but in terms of the offshore it was a bright white, and had like a gloss on it (Plant worker, Bonavista).

Plant workers noted that fish quality varied according to the length and method of preservation, as well as whether it had been caught with inshore or offshore gear:

> You could tell some differences in the fish that was iced in boxes compared to the suctioned dragger fish. When it went through the suction it was beat up and bruised up pretty bad. But the fish that was iced when they brought in the new draggers and they had to be iced in boxes, you could tell the difference. The difference was in the quality of the fish, the quality of the fillets. Where you'd get a lot of block out of the suction fish ... you'd get top quality fish out of the iced in fish that was in boxes (Plant worker, Elliston).
>
> Dragger fish is thicker than inshore fish. It's not so soft. It holds together better than the inshore fish. The inshore has a tendency to get softer, so you have to produce it faster. If we had a load of dragger fish and we had a load of inshore fish or longliner fish (gill net fish) we'd have to do that first before we did the dragger fish (Plant worker, Bonavista).

Plant workers also have information about how changes in raw material affect processing techniques and fishing effort. For example, many plant workers attested to decreases in the amount and size of cod processed, to processing multi-species and more parts of fish, as well as to processing higher quality products during the restructuring of frozen fish production. They attributed the collapse of the wild cod fishery most generally on destructive offshore fishing technologies.

> After they did the expansion in the early '80s in Catalina, when they put in the 14 million dollar plant that they've got over there now, when they put that there was a lot of fish coming through. I mean every dragger then was bringing in 400,000 (lbs.) a trip. It was on their decks and that, it lasted for 3-4 years. This is when the questions were asked. You know, this was when we met with the unions ... we met with the companies, we met with F.P.I. We used to have meetings with them over at the Sea View Inn in Catalina. We used to tell the big shots in F.P.I. that 'if you guys don't stop what you are doing then we won't get a fish to eat.' And we were laughed at. We were told we didn't know what we were talking about and we just told them 'ok', that was in '84 and '86, '84 to '86 them years, eh. And they laughed at us, you know. They said you guys don't know ... and then even they could see because then it started to decline. The fish wasn't there (Plant worker, Elliston).

Plant workers were also aware of how harvesting and processing techniques, as well as managerial initiatives, affected labour tasks and employment within the plants.

This plant worker discusses how his plant worked changed from 1970s to the early 1990s, years before the moratorium:

> For the first ten years I worked over there (Catalina plant) the only week we got off was your Christmas break which was probably a week to ten days and your summer holidays... For the first ten years that's what we did. That was the only time we got off. After that... '89 was the year that started the decline. Where we got about 12 months shift we were down to 40 weeks, then 35 weeks, then we got down to 30 weeks like that, then we was down to 20 weeks in the early '90s. Then, she (the fishery) was gone (Plant worker, Elliston).

Fishers and plant workers benefitted from exchanging their experiences, knowledge, and skills from fish production during the courses. Fishers contributed their knowledge about nets, boats, trap operation, and bait fishing. Plant workers shared their knowledge of processing components like filleting, freezing, packaging, and shipping. One instructor commented on the dynamics of these exchanges:

> ..., it was usually broken up, mostly fishermen and fish plant workers. I had a couple of guys who worked on the trawlers that went offshore, right. Mostly the inshore fishermen they were interested in the site survey and general husbandry part. But the fish plant workers liked that too but when it came down to the processing, the marketing, and the sanitation that's where they were really keen. So everyone had their own different specialisation, but they all benefitted from being around each other. They learned something and so did I.
>
> They were always saying 'wouldn't it be better if you do it this way, or wouldn't it be better to do it that way, and wouldn't the cage be better off if it ... would the quality of fish fillet be better if we ... ' They're always coming up with

> their own ideas. I had them do up a project where they would design their own cages and make up their business plan about how they would do it, and some of these guys just came up with some great ideas. They were always using their minds to try to think 'what if we did it this way, what if we did that way.' They're innovative and their work in the plants and on boats is of benefit. ... Like out on the farm like some people just got right on, walked around the farm. Even showing them fish physiology or whatever they were really quick. Fishermen knew about mooring and mending nets, and plant workers knew about filleting. Often times fishermen and plant workers paired themselves up and divided tasks - that partnership worked really well. If these folks wanted to learn a whole new skill they wouldn't have taken the course they'd be doing something else. These guys want to stay in their communities and stay in the fishery and use the skills and materials that they've got. That's why they have an interest (Course instructor, Bonavista Peninsula).

A plant worker put it this way:

> Everyone of us were different, in different areas right. Like, for example, a fish plant worker and somebody's a fishermen each by trade. Somebody who didn't do filleting say under a boss or under incentive haven't got the technique as a fella who did and that's the same way as I haven't got the technique of a fisherman for mending nets or trapping fish, because he's used to it and I'm not right (Plant worker, Bonavista Peninsula).

Plant workers are quick to acknowledge the advantages of combining their knowledge with fishing expertise and the knowledge of fishers. In speaking about his aspirations for a partnership with a husband and wife trap crew, this plant worker highlighted the benefits of such alliances:

> I told them (the husband and wife crew) that if they wanted a partner, to let me know, because they know the area and they know where they can go to set up a farm. They know the area and the fishing aspect. See if you go into partnership with a fisherman you've got access to the fish and you've got access to the bait. Where I'd be working the farm - they'd be out working their traps and catching bait. So all they'd have to concentrate on is their trap where my responsibility is to run the farm and make sure the cod is fed and the water temperature is checked everyday and the other tests are done, and the fish are healthy, and the nets is all checked, and cages. It would be an ideal set up, I could even process some if I got the chance for extra money (Plant worker, Bonavista).

Fishers also recognised the importance of the processing component of aquaculture. As one fisher put it:

> You need someone to fillet the fish. I fillet herring and mackerel and that stuff, but cod, that's one thing I've never mastered. I managed to rip a fillet off. There's a skill and a knack to it, and in cod farming that skill is pretty well as important as farming the fish (Inshore fisher, Trinity).

A plant worker described the importance of his filleting skills this way:

> In the course, we did learn how to bleed a cod, how to fillet it, and package it. I was asked to do the filleting because I was the only one in the course who had worked at the fish plant and filleted... If you're going to process your fish, the key then right, is the best yield product right. So if you're going to process let's say access 100 lbs. and their processing say 45 lbs. out of every hundred, and someone could show them 'listen boy, I can instead of 45 lbs., I can show you a way to get 60 lbs.' you'd be crazy not to look into it right. Because the idea is profit, nobody goes into business to lose or waste. So if

> you're going to process it, it is a make or break situation (filleting is important)... There's a few little tricks (to filleting) and it just comes natural to me (Plant worker, Bonavista).

Participants learned from each other. Most agreed that ideal cod farm production would need to be responsive by drawing on the local knowledge and skill of fishers and plant workers in rural Newfoundland outports. As one plant worker explained:

> Well, we had a couple of girls there and they were office people and they were pretty good with the book-keeping part of it. Then we had the fishermen there who fished all their life with the net and knew mending and mooring and the catching of the fish, that came easy to them. Then you had plant workers, who like myself was into refrigeration and the handling of the fish. Other plant workers knew filleting and shipping. Like me, for instance, I know what to do with fish when it was brought to the plant and how it should be handled and how it should be froze and how it should be in cold storage, all these things came easy. So everybody, usually there was someone there had a part that the things came easy to them, and everybody learned something from everyone else. Even the instructors learned a thing or two. They went through the courses at the Marine Institute, but did learn about a lot of stuff until we were in the course. Cod farming needs these skills to make a the whole thing a success. It's useless to have excellent fish in your farm if your processing is inadequate especially if quality is the name of the game. Pool all these skills together, let everyone benefit, and cod farming will be a success (Plant worker, Sweetbay).

These cod aquacultural ventures would entail economic realities that differed from corporate models. This inshore fisher noted:

> My ideal operation would be a family operation. I think that in order for cod aquaculture to work, the family operation is probably the only way that

> it would make economic sense, because it is time consuming, and if you've got to pay somebody for every hour that they are going to spend on that cod cage it is going to be awfully expensive to operate. There are times that you might have somebody there just standing there watching the cage, and even if it was only 5 bucks an hour, you can't afford to pay somebody out there 20 hours a week or 50 hours unless, of course, you're a big company. But if it is family owned and operated then I could send the son out, or my wife--the same as other fishermen--time don't mean that much in this set up. But time means a lot if you are paying them five, six, seven bucks an hour (Inshore fisher, Princeton).

One of the instructors expanded on this theme in the following way:

> If you go with small scale farming and I hope they do because it will employ more people and they can take pride in something that they own independent then there's a fair bit of work involved to get the fish originally to the farm itself, and actually making the cages and the nets. It's time consuming-- it's not hard labour or nothing like that, but if you had a couple of people teamed up, or more, like a trap crew or a fisherman and plant worker buddy up, it wouldn't be no big hassle (Course Instructor, Bonavista Penisula).

Since these aquacultural recruits conceptualised cod farming as an extension of the traditional inshore fishery, they rarely separated the two industries. Rather, they saw them as complimentary and mutually beneficial to those in various fishery sectors. Many fishers noted their desire to remain active in fishing, and therefore preferred to adopt aquaculture methods that would mesh with inshore fishery production. Plant workers saw cod farming as an opportunity to secure meaningful employment by utilising their processing skills in filleting, freezing, and shipping as well as in developing skills for farm operation.

These recruits hoped that cod farming would be a supplement to their income and an effective way to diversify fish production. For many, this would entail fishing and processing a number of local species. Many recruits said that wives, children, and trap crews would probably be involved in the industry in both farming and processing aspects. They also hoped that aquaculture could be used to off-set reliance on Unemployment Insurance (U.I.). In fact, many recruits hoped that employment in aquaculture would keep their children and other young people in the outports, retain knowledge about the inshore fishery, and sustain this way of life.

On a similar note, it was the contention of a number of recruits that income could be generated for others in these communities because aquaculturalists could buy additional starting stock and feed from other inshore fishers. As well, many noted that feed (in the form of offal) could be purchased from small plants in local areas, creating another practical use for undersized and previously dumped fish. It could also be beneficial for plant workers who, unlike fishers who had fishing licenses, would be unable to obtain their starting stock and feed from the inshore fishery. Furthermore, having these aquacultural recruits working within an integrated fishery and aquaculture model would enhance the likelihood of their viable co-existence with traditional inshore fisheries.

Most of these recruits agreed that keeping the industry integrated with the inshore fishery would contribute to equity. Many asserted that because they would remain fishers and plant workers within their locale, they would not place a farm in an area which would disrupt inshore fishing activity. As one inshore fisher attested:

> Hell, I'm living there and fishing and farming there. ... If ownership was kept local, then if I or someone else had fishing grounds that we still fished and depended on, then we would want a say in what kind of stuff that went on there--just like fishers who didn't farm would want to have a say. Monitoring water quality and pollution would be very important to me and other guys in the bay. You wouldn't cut your nose off to spite your face now, would ye? (Inshore fisher, Plate Cove West).

These aquacultural recruits believed that production based on an extension of the inshore fishery could promote self-reliance and could be environmentally safe. They held this view because production would use local bay cod for starting stock and migratory bait species (like caplin, herring, and squid) for feed. This production model would offer cost cutting measures which could insulate cod farmers from debt to and control by fish companies. It could also avoid what these recruits see as the potentially disturbing use of disruptive technology - disruptive to their fishing operations and to marine environments. For many of these fishery workers, disruptive technologies include genetically-altered hatchery fry and the exploitative use of bait species for such uses as commerical feed, which is laced with antibiotics and growth hormones. They felt their continued integration with the inshore fishery could help maintain concern about the effects of production on the stock health of various species upon which their their livelihoods would depend.

Such an extensive alliance between inshore fishing practices and novel cod farming methods holds great possibilities for lessening potential conflict. It also increases the likelihood of sensitive local resource management, because ties between fishery workers would be stronger than with production models which rely on alternative commercial sources for fry and feed. Many recruits felt their preferred production model could be achieved through strong legislation that limited legally the involvement of fish companies and their technology.

Great wariness existed among those interviewed about the development of production systems that might marginalise local control. One fisher expressed his distrust and adamant objection to development that might jeopardise traditional user rights, marginalise local knowledge, and damage the environment:

> Say, if big business got into it (cod farming), and they got a site in Trinity Bay, they'd take one whole section or sections of Trinity Bay, and all

> the people would be concentrated in that one area. You'd have to drive to Trinity Bay if you wanted a job. They'd (big business) take that part of the bay and tie up that part of the bay, and it wouldn't be able to be used for anything else probably - only for cod aquaculture. Everybody would depend on that one big company to make it a success in whatever kind of aquaculture production it was. Their job would depend on their (the company's) methods. But if you had individuals in it ... they're going to see if there is anything going wrong (environmentally or economically) and you're not talking about hundreds of thousand of dollars there, or huge environmental disruptions in the bays. To ensure success they (rural people) can provide their own starting stock, their bait, and they can supply their own cages. They haven't got the overhead that big company farms got. People from these communities can stay in their own areas and farm, and fish. You're not taking people from every part of rural Newfoundland. You are letting people stay where their roots are to - places where they fished all their life - an area where they knows, and they'd make better money by doing it on their own than they would with the big company. Besides, if a big company gets into it and they are employing a thousand people say as full-timers, if the industry goes under, the company's economy is safe, but the big loss is a thousand people out of work. There is a lot of money in circulation in that area that won't be in circulation anymore. But I'm sure a thousand people in the aquaculture business as individuals in family operations with other stuff on the side are not going to go under all in one day. The environment will be the better for it, and it won't cost the taxpayer a fortune in loans and grants or whatever it might be to keep the big companies afloat. I believe in the small operation, the family operation, the strengths found in rural Newfoundlanders (Inshore fisher, Princeton).

This sentiment is grounded in the argument that production which utilizes the knowledge and technology of inshore fishers would be more responsive to the needs of local cultures and environments. These production systems are in stark contrast to those state and corporate models which utilise highly scientific knowledge and prescriptive technology. These trainees felt that production grounded in local knowledge would facilitate greater degrees of autonomy and foster benign production practices. Thus, these production systems would provide greater insulation from pervasive state and corporate control.

An overwhelming number of these recruits felt that aquacultural production based on inshore fishery knowledge and technologies would ensure long term resource use. It would foster better products and a greater concern for water quality, as well as greater monitoring of the effects production has on the environment in inshore areas. This is because production would rely on those with more intimate knowledge of the particularities of the locale. Furthermore, production synchronised with local fishery cycles would entail all fishery workers sharing dependence on the same resources. Thus, stress on the aquatic system would be kept to a minimum because all fishery workers in the area would have a vested interest in extensive fishery and aquaculture management.

Four years into the moratorium, these recruits remained extremely skeptical of production systems favoured by fish companies and government, which they felt did not bode well for the development of cod aquaculture. The track record of government and fish companies raised for them serious concerns about the development of cod farming in this province. Some felt that governments, scientists, and fish companies would legitimise the use of destructive technology, and this must be curtailed if the "small guy and mother nature is to stand a chance." This notion echoes their experience in dealing with government and fish companies that had pursued intensive commercial cod fishing. On a number of fronts, these recruits have learned to link the political motivations of elected officials and fish corporations with the development of intensive aquacultural production. Political economy is not new to these recruits. This is probably best represented by their concerns about the role of fish companies in the development of cod farm technology. From fishers there was a resounding opinion that if they and their families are to make a livelihood then the "processors" and their technology must be kept out. Plant workers who were employed by processing firms were less concerned about the involvement of larger companies in aquaculture. They also expressed more interest in being hired labourers for larger aquaculture companies, but they too had reservations. One plant worker explained that he hopes cod farms will develop independently from the control of fish companies:

> Scattering the farms around .... the best results I would say is to see them spread out... Small, I think that would work better like I said, the family size operation, and looking after their own farm. They would put more into it than the company. The company part of it, if the company had a farm they'd hire employees, and we all know

> they would have a tendency not to do so good a job as if you were looking after your own, and your money dependent on what you do with the environment and such. It would work better, it would work better.
>
> Processors, I know they're involved in it (aquaculture) even now and they're getting involved in other things now. But I see, down the road you know, that they will, they've got the financial means for starting up farms and probably being involved with fishermen. Getting together with fishermen and saying 'we'll supply you with the traps or cages and the fish and you look after them and we'll take them back to our processing plants' - something on that line eh. But they would be there to get people off the ground like they did years ago when fishermen wanted to set up in the spring of the year and he'd go to a company and they gave him the nets and the gear and when they started shipping they'd pay for it that way and go into debt with the company more times than not. Cod farming could probably be the same thing you know, the big companies on top (Plant worker, SweetBay).

One inshore fisher offered this judgment:

> It's a conflict of interest and it screws the little guy. Just use FPI for example, if those fish companies start hatcheries when they get a big enough supply to do their fish plants, fishermen get nothing for their fish. So, I don't think they should have anything to do with it in the first place. They should have a license for processing, like buying fish, and that's enough for them - they should be made to stay out of fishing and farming (Inshore fisher, Plate Cove West).

Another inshore fisher explained Seaforest's adeptness at spear-heading the development cod aquaculture:

> They (Seaforest) knocked on a lot of doors. They had the clout. They knew where to go and what they wanted, because they were pretty high officials to

> start off with. There was money there to start off with. There was Craig Dobbin and Charlie Power (managers at Seaforest), and those boys know how to get around (Inshore fisher, Plate Cove West).

Many saw that affiliation with Seaforest in the future might be necessary for financial and technical reasons. Access to the company's veterinary services and markets was seen as advantageous. One inshore fisher summed up Seaforest's strong position in shaping the industry:

> Many of us may have to go through Seaforest because they have the technology, the expertise, the scientists, all the latest technology. They have access to all that, and without them we may not. They have access to all the world markets, and transportation. If you go into this some day, you may have to go through somebody like this I guess to market your fish and get supplies (Inshore fisher, Princeton).

After I discussed with them the existence of fish companies in other aquaculture industries like salmon farming in N.B., and prawn production in the Pacific Rim, many of the recruits were quick to understand the control companies could have over start up costs and market prices. They were quick to condemn it. Some came to voice concern that if Seaforest developed hatchery technology, the company might be in a position to establish a hatchery reliant industry. Under such a production model, these recruits feared it would be illegal to catch and farm wild cod from the inshore fishery. Many of these recruits objected to such a monopoly. They also resented that such a production model would make them reliant on the company. This reliance would stem from the control integrated fish companies maintain through prescriptive practices like the sale of fish fry, veterinary services, commercial feed provisions, drugs, and market power. As one inshore fisher put it:

> Yes, if big enterprise got into it they'd probably flood the market with cheaper fish than you or I could probably produce. Stick it out for a couple of years until you finally have to give in or give up, or buy you out, or get you in a position where they'd buy you out or you'd start producing for them on their terms. They'd run you out (Inshore fisher, Princeton).

Another inshore fisher remarked, partly in exasperation from his past dealings in the fishery,

> Well, that's their (Seaforest and other large companies) idea, to make money. Well, it will be like it was years ago like the merchants basically. But they'd ... well, like years ago fishermen just didn't know they were being ripped off or there was nothing they could do about it. But now, you're looking at fishermen being a lot more educated than what they were years ago. So they're more educated, and they'll go try to have a better deal out of cod farming. If they're going to rip you off then we're just not going to take it anymore (Inshore fisher, Trinity).

6.6 Conclusion

In this chapter, I illustrated how Seaforest's production model which relied upon the production practices and the natural cycles of the inshore fishery, was negatively affected by the decline in inshore landings and the eventual moratorium on fishing wild cod and other groundfish in the early 1990s. I then discussed how Seaforest preserved its place in cod aquaculture through moratorium related training programs, specifically the training of fishery workers for cod aquacultural production. I illustrated that the training courses organised by Seaforest and MI were based upon Seaforest's early production model. This model, because it drew heavily upon the local knowledge and holistic technology of the inshore fishery, required participants who were versed in the dynamics of the inshore fishery. Thus, the training programs sought fishery workers as participants. The production model jelled well with fishery workers, just as it had with the inshore fishers who helped develop the model for Seaforest. In short, the acceptance of this production model rested on its incorporation of local knowledge and holistic technology. These recruits viewed aquaculture as an extension of the wild inshore fishery. Furthermore, many assert the importance of strengthening fishing and processing components.

This chapter illustrated that fishery workers associated social justice and environmental issues with aquaculture production. They were wary of production models that would require expensive technology (like genetically altered hatchery fish, commercial feed, antibiotics, and growth hormones) and would centralise power within fish corporations, thus placing control outside of the local community. These fishery workers preferred production models that utilised local knowledge and holistic technology, because they contended such production models would not disturb their livelihoods and nature.

Chapter 7

Conclusion

This thesis has analysed how cultural groups, through their knowledge traditions and technologies, shape power dynamics in fish production systems. Through a case-study of cod aquacultural development in Newfoundland, I have attempted to show that placing knowledge traditions and technologies in a cultural context and critically analysing them from the perspective of power reveals social justice and environmental issues associated with fish production.

Knowledge traditions and technologies are associated with particular cultural groups. These cultural groups, through their knowledge traditions and technologies, relate to social and natural entities differently. Some develop knowledge traditions and technologies for dominating social groups and reorganising nature. Other cultural groups use their knowledge traditions to establish symbiotic relations with other cultural groups and to adapt to the particularities of local environments. In some cases, domination by cultural groups forces other cultures to use their knowledge traditions and technologies as a means of resistance.

Two main knowledge traditions associated with fish production were identified, namely the local and scientific.

I argued local and scientific knowledge traditions can be associated with different cultural groups and therefore can be associated with power differently. Scientific knowledge has been associated with cultural groups (like those directing fish companies) who wish to colonise social and natural entities, thus concentrating power. Local knowledge has been associated with cultures (like local fishing communities) that are more egalitarian, have maintained local diversity, and decentralised fishing operations in their locales.

Technologies are practices associated with a cultural group's knowledge tradition, and can also be associated with power in fish production. Here, I distinguished between two kinds of technology, holistic and prescriptive, associated respectively with local and scientific knowledge traditions of cultural groups. I argued that the prescriptive technologies associated with intensive fish production are practices of scientific knowledge that attempt to dominate social and natural entities within production. Prescriptive technologies often supplant local methods for extensive fish production and restructure nature. Holistic technologies are associated with local fishing cultures and are artisanal in many respects. As a result, they provide greater autonomy for those who practice them and allow practioners to adapt more readily to local environments. They are therefore less intrusive on nature than prescriptive methods because production is tailored to mesh with the particularities of the world's diverse local environments. Furthermore, local knowledge and holistic technologies are resilient. Like nature, local fishing cultures have resisted and been transformed by the colonising forces of external cultural groups. In some cases, local fishing cultures have amalgamated local and scientific knowledge traditions incorporating holistic and prescriptive practices. This has resulted in intermediate technologies. I also argued that the knowledge traditions and practices of local cultures contain indications for more symbiotic relations with social and natural environments. This theoretical framework was then applied to analysing global trends in aquacultural development and to Newfoundland's long history of cod production, especially new iniatives in cod farming.

7.1 Global Aquaculture

Through an examination of global trends in aquacultural development, I suggested that intensive models employing scientific knowledge traditions and prescriptive technologies are coming to dominate. I examined how, in some regions of the world, holistic aquacultural practices of local fishing cultures are being supplanted by external cultures employing prescriptive technologies related to intensive aquacultural models. I presented evidence suggesting that intensive aquacultural production models have redirected the practices of local cultures and restructured nature with the consequence of furthering the commercial interests of governments and fish companies, as well as increasing their control. I also described how such models link many local fishing cultures to powerful corporate and scientific structures through an expanding web of market relations. However, nature and local cultures have resisted such colonising forces and continue to provide possible alternatives for more sound aquacultural practices. In some cases, intermediate aquacultural technologies have been developed that connect local and scientific knowledge traditions through amalgamating holistic and prescriptive technologies.

7.2 Newfoundland: From Cod Fishing to Cod Farming

I used a case study analysing the development of cod farming in Newfoundland to illustrate my argument. Newfoundland's post WWII development of an intensive system of frozen fish production eroded some local knowledge about harvesting and processing aspects of salt fish production resident in the area's local fishing cultures since the 19th century. During the 1950s and 1960s, a number of inshore fishing and onshore curing aspects of salt fish production were marginalised and this household based production of salt fish was replaced by corporate controlled frozen fish production. I argued that the scientific management and prescriptive technologies associated with the distant water fleet and offshore fish harvesting separated knowledge from experience. This allowed fish companies to increasingly dominate various harvesting and processing sectors. It also aided in the concentration of fisheries management with governments and scientific organisations. Outside of exacerbating social disparities, this production model proved dangerously inflexible for the particularities of local fisheries and threatened the abundant groundfish resource of the region. A related resource crisis of the 1970s and 1980s renewed interest in the local knowledge and holistic technologies of the inshore fishery. Although undermined in the post WWII period, I argued that inshore fish production in Newfoundland endured because its participants retained vital knowledge for diversified fish production and this insulated them somewhat from the prescriptive technologies of fish companies and the uncertainties of nature.

In Newfoundland during the 1980s, cod farming developed as an extension of the remaining inshore fishery and relied heavily upon the knowledge and skills acquired by inshore fishers. I demonstrated that this production model drew heavily upon the local knowledge and holistic technologies of the inshore fishery. The programs for training cod aquaculturalists that developed in the wake of the cod moratoria in the 1990s also drew upon the knowledge base and practices associated with the inshore fishery. The acceptance of this production model by fishery workers rested on its incorporation of local knowledge and holistic technologies from the inshore fishery. I described how after working in wild fish production, these fishery workers were aware of the power inequities and the drastic decline in cod landings that resulted from intensive (offshore) and semi-intensive (nearshore) fish production in the 1980s. I communicated their wariness of more intensive aquacultural models which imply corporate integration and employ prescriptive technologies like hatchery fry, pharmaceuticals, and commercial feed. In addition, I illustrated that these fishery workers felt that holistic cod farming practices would allow aquaculture to develop as an extension of the inshore fishery, thus restoring their control over fish production and addressing local social and environmental concerns.

7.3 Social and Environmental Assets of Holistic Aquacultural Practices

The inshore cod fishery is seasonal. Fishing activity begins in late spring, usually around the end of April, and continues throughout the summer months until late September and mid-October in some areas, depending on the geographical location. During this time when cod and other species are relatively abundant along the coast, there are ideal conditions for holistic cod farming practices associated with extensive aquacultural production models. Through holistic cod farming methods in Newfoundland, cod aquaculture would develop as an extension of the wild inshore fishery by making use of inshore fishing gear (like cod traps, nets, boats, and seines) to catch influxes of feeding and spawning aggregations of cod (for use as stock). They could also catch spawning and feeding aggragations of bait fishes like caplin, mackerel, squid and herring (for feed).

Production carried out during the natural fishery cycle, when large concentrations of feeding and spawning fish migrate into local bays, would be advantageous. Instead of relying on genetically altered cod (for use as starting stock), it would utilise local bay cod, which already have morphological characteristics suited for the locale. This would eliminate the introduction of foreign genotypes, which are less adapted to local conditions and may threaten native fish stocks. Likewise, modest use of bait fishes (as sources of feed) would avoid the aggressive fishing of pelagics associated with the commercial feed sectors of intensive aquacultural development. It would also eliminate the widespread need for antibiotics and biochemical inputs, thus reducing the enviromental risks characteristic of more intensive models. Production carried out only for six or seven months of the year would recycle waste instead of saturating bays with large amounts of faecal and feed matter, by leaving winter and spring months free for flushing. These practices could limit stress on marine systems when compared to intensive models.

Cod farming, planned and organised as an extension of the inshore fishery, would also fit with (rather than displace) the seasonal production of other commodities and household work patterns. It could utilise a diversity of fish species, and draw upon numerous local skills while adopting new ways of thinking about fish production and conservation. Outside of the environmental assets of holistic aquacultural methods, these practices would also limit costs and, if it is widespread, would place many aspects of aquacultural production from trapping to harvesting (and in some cases even processing) under the artisanal control of cod farmers and processing workers. This would help insulate these fishery workers from the prescriptive technologies which are part and parcel of intensive aquacultural models favoured by government, scientific organisations, and fish companies. An extensive cod farming model of this kind would not require large cognitive leaps, like those associated with more intensive production, because fish farming would be meshed with the knowledge and practices of local capture fisheries and adapted to local management systems. However, the persistence of the cod moratorium and the state of world's wild fisheries has created a political climate that is jeopardising the development of such a model in Newfoundland.

7.4 The Cod Moratorium and Efforts to Develop Prescriptive Cod Farming Technologies in Newfoundland

In the confines of this thesis, it is impossible to convey fully the impact the cod moratorium has had on fishery workers, their families, and their communities (Williams, 1996; Neis and Williams, 1996; Binkley, 1995). However, it is possible to describe the impact of the moratorium (the legacy of intensive fish production in the wild fishery) on cod aquacultural development in Newfoundland.

In addition to divisive government adjustment programs which have taken advantage of this social and environmental crisis to encourage rural Newfoundlanders to leave the fishery (Sinclair, 1996), the moratorium has also provided a climate which has pushed the trajectory of cod aquacultural development towards an intensive model. The collapse of the wild cod fishery and subsequent moratoria have retarded the development of holistic cod farming practices that integrated the wild fishery and fish farming. The moratoria spurred training initiatives and the creation of the province's first cod aquacultural training programs. However, the depletion of the wild groundfish stocks and the sheer length of the moratoria (now 5 years) have also intensified the fascination of many in government, scientific organisations, and fish companies with the prescriptive technologies associated with intensive aquacultural models. In fact, the possibility that prescriptive technologies (like genetically altered hatchery fry, pharmaceuticals, and commercial feed) could eventually control every stage of cod fish production in Newfoundland seems more likely today than at any time in the past.

Ironically, a few weeks before I ended my fieldwork in the summer of 1995, Seaforest announced a plan to construct a new cod hatchery (Cleary, 1995). If successful, this hatchery may make possible an intensive cod aquacultural production model similar to the intensive models used for salmon aquaculture in New Brunswick. The company secured large amounts of public financing for the $1.5 million construction cost of the cod hatchery project in a former groundfish plant in Jerseyside, Placentia Bay. Seaforest was granted a $140,000 dollar loan from Atlantic Canada Opportunities Agency, $100,000 from the Argentia Development Corporation, and considerable funds from the National Research Council (Benson, 1996; Cleary, 1995). If feasible, the company plans to sell hatchery fry to Newfoundland cod farmers for use as starting stock.

The company's private development and promotion of hatchery operations, its role as facilitator of training, integrator of fish feed systems, provider of necessary veterinary services (including pharmaceuticals), and buyer and marketer of farmed cod suggest its long term objective may be vertical integration through an intensive aquacultural model. If so, this is a departure from the holistic production techniques it utilised and promoted in the mid-

1980s and taught in the cod aquacultural training courses during the early 1990s. A shift to commercial inputs would result in higher costs for fish farmers. This would inevitably prevent many fishery workers from practising holistic production, and force them into contractural agreements and debt with fish companies. In addition to disregarding fishery workers' sensitive knowledge for the intricacies and complexities of inshore areas, it would also preclude their equitable participation in fish production.

In all likelihood, a shift to hatchery production would supersede holistic aquaculture practices, and instead employ commercial feed systems, growth hormones, and antibiotics. The intensive production model allows fish companies to extend their control backwards into fish production. It lessens the autonomy of fishery workers within fish production and consolidates power with the corporations who manufacture the inputs and control markets. This consolidation of power could be achieved with government aid.

With Premier Brian Tobin's election in 1996 came an announcement that a new department of Fisheries and Aquaculture would be created (replacing former department of Fisheries and Agriculture) and the initiative to develop and expand aquaculture in Newfoundland would be intensified. The initiative will support aquaculture planning, education in aquaculture technologies, research and development and extension services to aquaculture operators. Total production is expected to increase over the next four years from 1,200 tonnes to more than 9,000 tonnes. This increase will generate an estimated 850 new jobs of which 500 will be in direct production (The Sou'Wester, 1996).

Whether or not government and fish company initiatives will result in intensive aquacultural models utilising scientific knowledge and prescriptive technologies remains to be seen. However, Seaforest's pursuit of a cod hatchery does imply a shift away from local knowledge and holistic technologies of early cod production.

Depleted wild cod stocks and the longevity of the moratorium may have tipped the scale in favour of proponents of intensive cod farming models and prescriptive technologies. Increased fish production and large economic profits associated with intensive production models using hatcheries, like New Brunswick's intensive salmon farm industry, may also play a role in distracting our attention away from the need to allow our depleted wild fish stocks to rebuild. Scientific knowledge and prescriptive technologies have aided the development of intensive production models globally by marginalising local knowledge and holistic practices and masking the negative social and environmental impacts of this model. They may be used to constrain resistance to intensive cod aquaculture in this province as well. The development of intensive aquaculture would place the future of Newfoundland fishing families and their local knowledge in an even more precarious position than they have had in wild fish production.

7.4 Rethinking the Role of Families in Local Fish Production

If alternative fish production models are not developed, then the most serious cost outside of the social injustice levied on displaced and fishery dependent local cultures and degraded marine environments, will be the hardest to measure - abandoning the ideal of local production. Ideally, family-based fish production offers a workplace and home combined, an attractive environment in which to raise a family, to participate in a community of producers who are kin, friends, and neighbours, as well as to develop local skills, knowledge and technologies for co-managing complex systems of people and natural resources. This ideal has been undermined by fish companies which want fishery workers integrated into intensive fish production models where they lack the power to raise prices and mesh production to local conditions. It has also been undermined by governments which favour intensive development instead of providing significant amounts of financial support to local producers and alternative fish production from the public purse.

The traditional Newfoundland outport family lives on in the phrases of development agencies, the public relation campaigns of fish companies, and in the speeches of politicians who have done so much to make it a relic of the past. However, it is ailing in many respects, and, in a way, pledging allegiance to it fosters the illusion that family fish production is wholeheartedly equitable and under the control of fishery workers. The family enterprise alone cannot make any bold attempt to challenge the long term dominance of the intensive production models favoured by governments and fish companies. Although the outport fishing family has been the backbone of Newfoundland society for centuries, there were a number of disturbing aspects to traditional outport life.

Since, the 19th century the stewardship of inshore areas through sensitive ecological practices has taken second place to the survival of the family in a market dominated first by merchants and more recently by fish companies. The welfare of individual members of fishing families has also been sacrificed as male heads of households have attempted to ensure the survival of the family enterprise by exploiting themselves, their wives, and their families. In addition, the power differentials in fishing communities between men and women, as well as between fishers and plant workers are important issues (Williams, 1996, Neis and Williams, 1996). Likewise, the central role women have played in fish production has gone unrecognised for far too long (Nadel-Klein and Davis, 1988).

Maintaining family cod fishing enterprises would not be a panacea for all power inequities and ecological management problems. This is not to argue that household based production and local knowledge should no longer be vital for fish production. But in giving up the ideal of family fish operations we can begin to construct new ways of preserving the strengths while quelling the weaknesses of family based fish production. Collective-fish production arrangements, in which many families pool their resources and labour in order to form strong cultural units, may bring fishery workers some of the benefits of our modern world without exposing them to control of fish companies, or to the isolation and inequalities that often come with rural life and household production. In addition, co-management regimes which re-integrate fishery workers directly into the formal management of marine resources would delegate decision making back to local communities. This would maximise the quality and range of local knowledge traditions through dialogue with scientific understandings of social and environmental aspects of production can strengthen local production (Felt et al., forthcoming).

These issues surrounding local fish production (both fisheries and aquaculture) highlight a number of research topics requiring further study. Future exploratory research into viable fish production must continue to assess the strengths and weaknesses inherent in various production systems, including those of local fishing cultures. Likewise, monitoring the social and environmental impacts of future cod aquacultural development in Newfoundland with the aid of fishery workers and their local knowledge traditions is crucial. Research that pushes for the integration of fishery workers' local knowledge should be a prerequisite for both fisheries management and aquacultural development. Furthermore, other case-studies examining how the local knowledge traditions and holistic technologies associated with inshore fisheries can aid the production of other native marine species through extensive aquacultural models should also be undertaken.

7.6 Lending Strength to Fishery Workers and Local Knowledge

Autonomy over work, a defining quality of human life, was very important to the fishery workers/aquaculture recruits I interviewed. Certainly their visions of aquaculture do not embrace production models that further marginalise their place in fisheries management, deny them the satisfaction of having discretion over production, and exploit themselves and their families in order to sustain themselves in the industry. The presence of such concerns in the minds of these fishery workers should be clear acknowledgement that the prescriptive technologies associated with intensive fish production models are destructive to outport fishing families and nature.

The sweep of intensive fish production models in both the wild fisheries and aquaculture globally is overwhelming. At the centre of intensive development are the interests of cultural groups within governments, scientific organisations, and fish companies who wish to expand their control over social and natural entities. Intensive aquacultural development has often gone unquestioned on the whole in Canada. Any challenge to this kind of development must not overlook the power of those who develop it. In all likelihood, no alternative framework could long co-exist with intensive models. If fishery workers are able to organise in co-operative units and thus stabilise the family in fish production, the skills, knowledge, and enthusiasm, as well as a stronger drive to resist those cultural groups favouring intensive production models might be generated. The time to take account of the aspirations of fishery workers for aquaculture is now. The state of the wild fishery and the fact that aquaculture in Newfoundland will take place in bays where only limited understanding about inshore ecosystems exists strengthens arguments by fishery workers and activists for more holistic production practices. However, more public debate over aquacultural development must be undertaken now.

The pursuit of intensive production by personnel in governments, scientific organisations, and fish companies is offensive to Newfoundland fishery workers. In general, their opposition is rooted in the fear that intensive production models will inevitably prevent many of them from equitable participation in cod farming, decrease their autonomy within production, jeopardise traditional user rights, and degrade the marine environments from which they make their livings. They have good reason for concern. Studying aquaculture globally including prawn production in the South Pacific and salmon farming in New Brunswick, gives credence to the concerns of these rural Newfoundlanders. It is important to understand that the consequences of developing intensive aquacultural production in Newfoundland include increased integration of and domination by fish companies. This would further disenfranchise fishery workers in outport communities. The development of this production model could also unleash untold environmental havoc due to the use of genetically altered hatchery fish, huge amounts of fish meal, pharmaceuticals, and bio-chemicals.

However, this need not be the charter course. Regional economic development can be structured to benefit the local requirements of fishery workers and coastal environments first and foremost. Legislation can be used to ensure maximum employment and strengthen the position of family enterprises and co-operative organisations through the support of holistic aquacultural technologies. This will entail statutory limitations on corporate integration and intensive development. Government initiatives organised towards financing alternative production that is holistic, utilises fishery workers' local knowledge, and meshes with diversified fishing practices must be undertaken. However, all of the above implies a necessary shift in power and a reorganisation of fish production to accommodate local fishery workers and nature.

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Appendix I

Original Interview Schedule for Fishers/Aquacultural Recruits

Introduction: This study is part of a much larger project that is collecting the local knowledge of fishery workers and studying the impact of the fishery crisis on well-being of coastal communities. My particular part of the project is looking at the relationship between the knowledge fishery workers possess about the traditional wild fishery and the development of aquaculture in this province.

Demographic Information

When were you born? Where?
Where are you currently living
What is your current occupation?
What is your religious denomination?
What was your father's occupation? What was your mother's occupation?
What is your marital status? Spouse's occupation?
Do you have children? Number of children? Age of children? Children's occupation?
Formal education level?

Aquaculture Experience

Discuss the process that got you involved in aquaculture.

Prompt: explore context of the cod moratorium

Prompt: ask respondent to describe their experience with the aquaculture course: year of course, enrolment process, location of courses, instructor's name, content and organisation of the course: classroom/practical - cage construction, processing, marketing, feeding, fish physiology, disease etc., satisfaction with the course.

Did your training group experience any any glitches/problems during classroom studies or in the operation your farm ie. poor scheduling around your fishing activity, mortality rates, ice, weather, gear design? If so, how were they solved? **Prompt: innovations, observations about fish physiology and behaviour, and consultation with Seaforest, scientists, MI.**

Wild Fishery Experience

I would now like to ask you a series of questions about your experience with the traditional fishing industry. I am also interested in your general views and concerns about the fishery.

How long has family been in fishery?
Always in this community/region?
Age when started fishing
Location, where did you first fish?
Sectors where fished? inshore/long liner/offshore
When fished in each sector?
Last season fished?
Who did you fish with when you started? Crew size for each species/season?
Who were you fishing with when you last fished?
Who taught you to fish?
Formal training in fishing? if yes, what?
Crew member? Any years as skipper? If yes, how many years?

Cod Fishery

I would now like to ask you a series of questions that compare your experience in the traditional cod fishery during an average/ relatively good fishing season with a relatively bad year just before the moratorium. I am especially interested knowing the dynamics you associated with the cod fishery, and the other fisheries your participated in during your fishing career.

I would like to know what time of year you fished, the gear you used, your landings (if you know this) a description of the fish--, behaviour, size, colour, etc. direction of migration, timing of migration/spawning, and relationship to other species (bait fisheries and by-catch).

Describe a relatively good fishing season before the moratorium:

prompt: use chart to capture movement

Month/season generally started: latest? earliest? generally ended?
Species fished during these months (herring, cod, lobster, caplin, crab, squid)?
Gear used-type, design, number, mesh size?
Locations fished?
Description of cod landed-size, colour, sex, condition?
Direction of migration?
Abundance--typical catch at this time of year?
Feeding on?
By catch--which species? amount?
Change in gear/location/effort?

Repeat above questions for the remainder of the season to when season ended.

In general what were good fishing seasons (landings) when you first began fishing? What were bad fishing seasons?

prompt: for things that would influence the fishing season

Where was catch sold? When started? In what form? How much were you paid?

Compare this relatively good fishing year to a relatively bad year fishing year just before the moratorium?

<u>**Knowledge of Cod Behaviour**</u>

Were there places around where you tended to see baby cod? Were they numerous? What about tomcod?

What did the cod's diet consist of? bake apple, blackberry, caplin, squid, herring.

Explore relation between cod and other species' migration, spawning (caplin, mackerel, herring)

Where did you find the cod? On what grounds.

Describe the changes in cod size, abundance, behaviour, changes, in fishing conditions

prompt for information on: the cod fisheries relation to herring run, caplin run, lump run, squid run, wind, tides, bait supplies

Discuss changes other changes which affected like crowding grounds, results in trap berth draw, fishing out of grounds, water temperature, markets, unemployment insurance, licensing.

How would you explain the decline in the cod? Describe process of decline.

Can you tell a female cod from a male cod? Does the amount of each sex change between grounds? over the season? has it changed over the years?

Have you ever harvested spawning cod? (ie. running eggs/milk) If so, where? when? and last time you saw this?

Note: concentrate of where spawning occurred/gear used/size of spawning cod/ colour

Describe a good trap berth, and a bad trap berth. Describe good handline ground and bad handline ground. Describe good trawl ground and bad trawl ground. Describe good gill net ground and bad gill net ground. Describe good and bad grounds for lobster pots and squid traps.

Prompt for substrate, wind, tide, water temperature, and any other possibly relevant factors.

Are there places where you used to catch cod where you no longer catch them? Are there places where you didn't catch them before but where you now catch them?

Do the cod leave your fishing grounds? If so, where do they go? For how long?

Are there cod which stay around the local bays for most or all of the year? How do you know this? Are there any differences in these fish i.e. length, shape, colouration, or flesh colour? If they don't go very far away, why do you think this is so? What is their seasonal movement around the local bays(s)? Prompt: perhaps use chart to capture movement.

Describe a good site location for cod cages, and a bad site location. Number and size of cages, depth, tide, bottom type, temperature, wind, ice, shelter, proximity to cod traps and other fishing grounds. Use chart to highlight good areas.

prompt: ask respondent to explain issues involving ice and over-wintering of fish, use chart.

Compare good cod trap berth and good cage site.

What differences exist between wild fall cod and fall farmed cod?

prompt: size, colour, flesh quality, taste.

Compare: cod behaviour when in cod trap to cod behaviour in farm cages.

Do cod spawn in cages?

To your knowledge do larger cod eat smaller cod (wild/farmed)

What relation does cod farming have with other species you fish? prompt: sources of feed

Do other marine life feed off the food and faecal waste which drops to the bottom of the cage?

What natural predators are a threat to wild and farmed cod? seals, sea birds.

What parasites are associated with cod (wild and farmed)?

Knowledge and Skills

What knowledge and skills do you think are required for aquaculture?

Did the knowledge you gained from the wild fishery benefit you in your formal aquacultural training? If so, in what ways?

How did the instructors view the experience and skill you acquired from the traditional fishery? Was it deemed relevant?

In your opinion, how does the knowledge gained from the traditional fishery benefit the working of an aquaculture operation? Explain.

Farm Operation

What are your long term goals as an aquaculturalist: diversify, expand, experiment with new species etc.?

In general, how do you feel about aquaculture and its potential in this region?

What types of aquaculture do you think would work here and why?

Describe what a cod farm operation in this area would look like. How would this mesh with your fishing operation:

size of operation (number of cages, and type/plastic or wooden)?
species (number)?
location (geographical, proximity to fishing/spawning grounds, depth, distance from shore, currents, water temp., salinity)?
gear (construct yourself/previously owned/brand new)?
methods of operation/site maintenance?
marketing (who buys/who processes/ and why)?

Is security an important factor when setting up a cod farm operation? prompt: fear of theft, vandalism (cutting lines) etc.

Prompt: ask respondent to outline the steps for license allocation. Inquire whether a requirement to hold community/public meetings is a good measure.

What would be the source of your starting stock and feed? If source is wild fishery explain

How do you feel about proposals to catch cod (& other species) for starting stock and feed?

What tasks are required for site operation ie. feeders, divers, book-keepers?

Who would be involved with your operation/proposed operation? former crew members, family, etc.

What do you think of aquacultural food products especially quality of products?

Are you familiar with processing methods for aquaculture products and for the different species farmed (cod, lumpfish, wolfish, winter flounder, sea urchins, mussels, scallops)

General Issues

How has government initiatives in the promotion of aquaculture affected your participation in the industry - licensing process and other government regulations for aquaculture?

What, in your opinion, are the major hurdles (if any) to the development of successful aquaculture?

Do you feel government is doing an adequate job at managing aquaculture?

Do you think adequate financing (government/private) is available for setting up an aquaculture operation?

Who do you think should participate in aquaculture?
Do you think big business should be involved? If so, on what level?

Should aquaculture be an industry to supplement the income of many coastal residents, or a profit driven industry for a core few full-time aquaculturalists?

Should government restrict participation in the industry? If so, in what ways, and for whom?

How do you think stocking stock and feed should be obtained? commercial hatcheries and feed operators or caught from the wild? How should licensing of fisheries for aquacutlure uses be managed?

prompt: combination of licenses held by current fishermen or permit anyone with an aquaculture operation to harvest.

prompt: how should these other fisheries be managed

What kind of job do you think fish scientists are doing in advancing the industry? Have they been interested in talking with you about the observations you have made while taking the aquaculture course?

Do you feel that aquaculture is a highly politicised industry? Explain.

Who is benefiting most from aquaculture development?

prompt: aquaculturalists, coastal residents in general, government bureaucrats (fishery officers), politicians, fishery science personnel, gear manufactures, and fish companies.

Have you considered processing your own food products for market?

Are you concerned about health and environmental risks arising from some aquaculture methods? **prompt: disease, waste, disruption of spawning areas and other effects on wild fishery**

Are you concerned that pollution such as waste from sewers and offal dumping will threaten your operation?

What are your views on using aquaculture methods (like hatcheries, antibiotics, and growth hormones)? What about using hatchery fish for stock enhancement?

How do you think access to cod farming sites should be determined?

prompt: membership in local community or a local lottery draw like for cod berths

Who should be given decision-making power in managing the aquaculture development?

Have you been a member fishery organisation/union in the past? Are you currently a member? What about aquaculture associations and committees?

Are you in contact with other aquaculturalists? Do you exchange ideas and observations about the industry?

In your opinion, how is aquaculture viewed in your community?

Do you see potential conflict between aquaculturalists and traditional fishermen?

Prompt: describe relation between wild fishery and aquaculture. Could it be a complimentary, if so how? Could it be competitive with the wild fishery? Explain.

How would you describe the "politics" which exist within the fish production? prompt: government, fisheries science, fishers, processors, plant workers, unions, health inspectors, markets, especially from your own experience as a fish.

Appendix II

Original Interview Schedule for Fish Plant Workers/Aquacultural Recruits

Introduction: This study is part of a much larger project that is collecting the local knowledge of fishery workers and studying the impact of the fishery crisis on well-being of coastal communities. My particular part of the project is looking at the relationship between the knowledge fishery workers possess about the traditional wild fishery and the development of aquaculture in this province.

Demographic Information

When were you born? Where?
Where are you currently living
What is your current occupation?
What is your religious denomination?
What was your father's occupation? What was your mother's occupation?
What is your marital status? Spouse's occupation?
Do you have children? Number of children? Age of children? Children's occupation?
Formal education level?

Aquaculture Experience

Discuss the process that got you involved in aquaculture.

Prompt: explore context of the cod moratorium

Prompt: ask respondent to describe their experience with the aquaculture course: year of course, enrolment process, location of courses, instructor's name, content and organisation of the course: classroom/practical - cage construction, processing, marketing, feeding, fish physiology, disease etc., satisfaction with the course.

Did your training group experience any any glitches/problems during classroom studies or in the operation your farm ie. poor scheduling around your plant work, mortality rates, ice, weather, gear design? If so, how were they solved? **Prompt: innovations, observations about fish physiology and behaviour, and consultation with Seaforest, scientists, and MI.**

<u>Note:</u> if respondent has fishery experience refer to cod dynamic section of fishermen questionnaire.

Fish plant experience

I would now like to ask you a series of questions about your plant work. I am also interested in your general views and concerns about the fishery.

When did you get involved in plant work?
Why?
How?
What plant?
Who owned the plant?

History of Tasks Performed during Career in Plant

What tasks did you do in the plant?

prompt: length of hours, number of days a week, number of shifts, and length of season

Did you tend to do the same job all the time or did you move around?

Did you feel you had time to pay close attention to the work process and particularities of fish?

How much control did you have over your work?

Was there much interaction/communication between workers and owners/managers? What about other fishers?

Were there times when you became aware of changes in the plant?

prompt: effects of incentive, mechanisation, on how tired you felt, hours worked, equipment used worked, changes in tasks performed, difficulties to make poundage due to smaller fish/crab.

Changes in Raw Material

I would like to ask you to describe changes in raw material during your career in the plant from when you started in the plant to moratorium. I am also interested in exploring how this affected your work in the plant, especially indicators of change.

What was the fish like when you first started at the plant?

prompt: health of stocks (size and amount of fish processed), gear, location of fish caught, processing technology, types of products, trucking, icing, packaging.

Where did the fish come from when you first started working there?
How was it processed?

Where was it caught? How was it caught? (locally, trucked in from)
Who brought it in?

Did the origin of the fish/crab change during the years you were at the plant?

If yes, explain. **prompt for vessel type, location caught, location landed, other.**

Did the introduction of longliners affect work at the plant? affect your job? (larger fish, different species, gluts)
Did this affect jobs (types/numbers)
Did this make it difficult to detect if there were changes in the stocks?

Did you process gill net fish? If yes, when did this start? What was the fish like/compared to other fish. what impact did gill nets have on work at the plant.

Did you process dragger fish? If yes, when did this start? What was this fish like/compared to other fish? what impact did draggers have on work at the plant.

When did you observe the most noticeable changes in raw material-quantity, type, quality, and impact on work?

Did they start processing other species at some point? If so, when and why?

Did you notice changes in the quantity, size, quality of cod around the time when started doing other species?

Did you stop processing some species/products? If so, why? Did the market disappear. species decline? Did they get too small for certain packs?

Were large fished processed into particular products?

Did the decline of large fish contribute to the elimination of specific products?

Was there more competition for fish?
Did companies start trucking fish away? Did fishermen start selling to other companies?

Did they start processing fish they used to refuse (ie. small)?
What used to happen to the fish they refused?
Did they bring new machines to process small fish when they realised that the large fish were decreasing in number?

Did you notice a reduction in calls to work and in length of the plant's operating season? When?

Were there fewer night shifts?

Were shifts cancelled abruptly, later starting time scheduled, shorter notices given?

Did it become difficult to qualify for UI?
Did the plant close earlier?
When did you notice these changes?

Control over plant work and quality of fish

Were there times when you felt you were too busy to be concerned about the particularities (the details of the appearance and characteristics) of the fish you were working with?

What do you think affects the quality of fish produced?

Could you influence the quality of fish at your work place?

Could you notice differences between fish caught inshore, with trawls, with handlines, with mid-shore fishing with long lines, gill nets?

Can you think of some ways the plant could have improved the quality of fish produced?

*During your employment at the plant, did you process fish which are now being farmed in aquaculture? Cod, lumpfish, wolfish, winter flounder, mussels, scallops, sea urchins.

If no, were these species by-catches which came to the plant but were not processed:

Describe characteristics: quantity, colour, size, texture, quality
Overall, how did the gradual decline and ultimately the moratorium affect you?

Did this contribute to your decision to pursue aquaculture?
What do you think affects the quality of fish produced?

What do you think of aquacultural food products? prompt: quality of product.

Are you familiar with processing methods for aquaculture products and for the different species farmed (cod, lumpfish, wolfish, winter flounder, sea urchins, mussels, scallops)?

Processing and Waste

Note for truckers/dispatchers only: Truckers/those who worked on the wharf, receiving, unloading, gutting, filleting fish on wharf, did you see or hear of the practice of discarding fish?)

When you first started at the plant was there much waste? if so, how much? What was wasted?

Did the wastage change over-time? If so, why did these changes occur in your opinion. prompt: increase, decrease. type of wastage.

Did a shift to multiple-species based processing involve more waste?

Was there more emphasis on quality in those later years just before the moratorium?

Can you think of some ways to reduce the waste in fish processing?

Knowledge and Skills

How does cod farming compare to processing work? prompt: for comparison of skills and knowledge

What knowledge and skills do you think are required for aquaculture?

Do you feel that the knowledge/skill you gained from your processing work in the plant was of benefit to you in the formal training? If so, in what ways?

How did the instructors view the knowledge and skill you acquired from your processing experience? Was it deemed relevant?

How is the knowledge you have from your time as a processor of benefit in the working of an aquaculture operation?

Do you think the knowledge and skills you have from your time as a plant worker are more applicable to processing aquacultural products than farming?

Farm Operation

What are your long term goals as an aquaculturalist: diversify, expand, experiment with new species etc.?

In general, how do you feel about aquaculture and its potential in this region?

What types of aquaculture do you think would work here and why?

Describe what a cod farm operation in this area would look like. How would this mesh with your fishing operation:

size of operation (number of cages, and type/plastic or wooden)?
species (number)?
location (geographical, proximity to fishing/spawning grounds, depth, distance from shore, currents, water temp., salinity)?

gear (construct yourself/previously owned/brand new)?
methods of operation/site maintenance?
marketing (who buys/who processes/ and why)?

Is security an important factor when setting up a cod farm operation? prompt: fear of theft, vandalism (cutting lines) etc.

Prompt: ask respondent to outline the steps for license allocation. Inquire whether a requirement to hold community/public meetings is a good measure.

What would be the source of your starting stock and feed? If source is wild fishery explain

How do you feel about proposals to catch cod (& other species) for starting stock and feed?

What tasks are required for site operation ie. feeders, divers, book-keepers?

Who would be involved with your operation/proposed operation? former crew members, family, etc.

What do you think of aquacultural food products especially quality of products?

Who would be involved with your operation/proposed operation? former crew members, former plant workers, family, etc.

If given the opportunity (financial loans, training) do you think you would prefer to operate a small processing plant? If so, what production process would you employ and why? Types of products you might prepare for market?

General Issues

How has government initiatives in the promotion of aquaculture affected your participation in the industry - licensing process and other government regulations for aquaculture?

What, in your opinion, are the major hurdles (if any) to the development of successful aquaculture?

Do you feel government is doing an adequate job at managing aquaculture?

Do you think adequate financing (government/private) is available for setting up an aquaculture operation?

Should government restrict participation in the industry? If so, in what ways, and for whom?

Who do you think should participate in aquaculture?

Do you think big business should be involved? If so, on what level?

Should aquaculture be an industry to supplement the income of many coastal residents, or a profit driven industry for a core few full-time aquaculturalists?

How do you think stocking stock and feed should be obtained? commercial hatcheries and feed operators or caught from the wild? How should licensing of fisheries for aquacutlure uses be managed?

prompt: combination of licenses held by current fishermen or permit anyone with an aquaculture operation to harvest.

prompt: how should these other fisheries be managed

What kind of job do you think fish scientists are doing in advancing the industry? Have they been interested in talking with you about the observations you have made while taking the aquaculture course?

Do you feel that aquaculture is a highly politicised industry? Explain.

Who is benefiting most from aquaculture development?

prompt: aquaculturalists, fishery workers, government fishery bureaucrats, politicians, fishery science personnel, gear manufactures, fish companies.

Have you considered processing your own food products for market?

Are you concerned about health and environmental risks arising from current aquaculture methods? **prompt: disease, waste, disruption of spawning areas and other effects on the wild fishery**

Are you concerned that pollution such as waste from sewers and offal dumping will threaten your operation?

What are your views on using aquaculture methods (like hatcheries, antibiotics, and growth hormones)? What about using hatchery fish for stock enhancement?

How do you think access to cod farming sites should be determined?

prompt: membership in local community or a local lottery draw like for cod berths

Who should be given decision-making power in managing the aquaculture development?

Have you been a member fishery organisation/union in the past? Are you currently a member? What about aquaculture associations and committees?

If your plant reopened, would you return to that type of work? Have you looked for work in other plants?

Are you in contact with other aquacultural recruits? Do you exchange ideas and observations about the industry?

In your opinion, how is aquaculture viewed in your community?

Do you see potential conflict between aquaculturalists and traditional fishermen?

Prompt: describe relation between wild fishery and aquaculture. Could it be a complimentary, if so how. Could it be competition with the wild fishery? Explain.

How would you describe the "politics" which exist within the fish production? prompt: government, fisheries science, fishers, processors, plant workers, unions, health inspectors, markets, especially from your own experience as a plant worker.

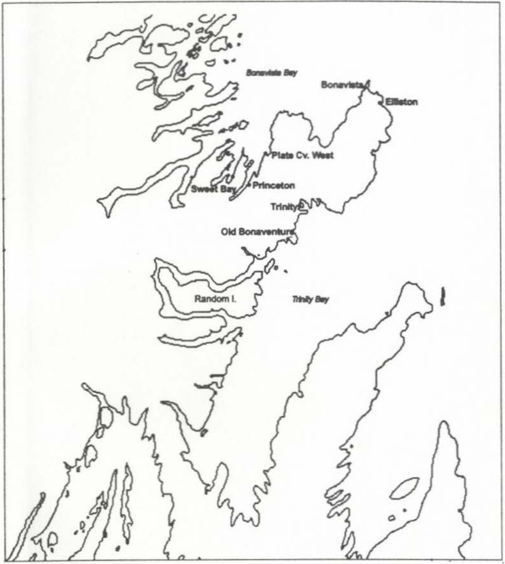

Figure 1: Locations of 19 Fishery Worker/Aquacultural Recruit Interviews