# INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

**The quality of this reproduction is dependent upon the quality of the copy submitted.** Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI®

Bell & Howell Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

# Managing Nature: A Look Inside the Salmon Arena

Tanya Alexandra Pergola

A dissertation submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

University of Washington

1999

Program Authorized to Offer Degree: Sociology

In presenting this dissertation in partial fulfillment of the requirements for the Doctoral degree at the University of Washington, I agree that the Library shall make its copies freely available for inspection. I further agree that extensive copying of this dissertation is allowable only for scholarly purposes, consistent with "fair use" as prescribed in the U.S. Copyright Law. Requests for copying or reproduction of this dissertation may be referred to University Microfilms, 300 North Zeeb Road, Ann Arbor, MI 48106-1346, to whom the author has granted "the right to reproduce and sell (a) copies of the manuscript in microform and/or (b) printed copies of the manuscript made from microform."

Signature Tanya Peyrla

Date 6/2/99

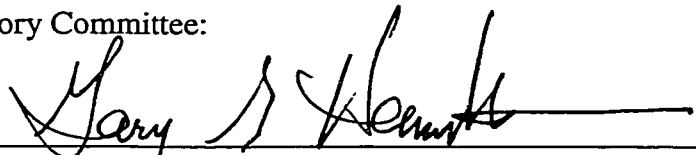
University of Washington
Graduate School

This is to certify that I have examined this copy of a doctoral dissertation by

Tanya Alexandra Pergola

and have found it is complete and satisfactory in all respects,
and that any and all revisions required by the final
examining committee have been made.

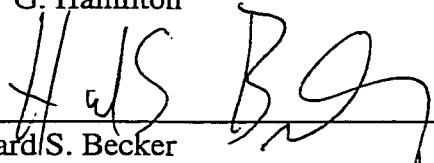
Chair of Supervisory Committee:



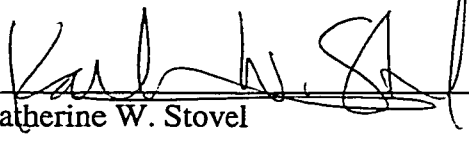
Gary G. Hamilton

Reading Committee:

Gary G. Hamilton



Howard S. Becker



Katherine W. Stovel

Date: 6/2/99

University of Washington

Abstract

MANAGING NATURE: A LOOK INSIDE THE SALMON ARENA

by Tanya Alexandra Pergola

Chairperson of the Supervisory Committee: Professor Gary G. Hamilton
Department of Sociology

The declining runs of wild salmon in the Pacific Northwest region of the United States are an ideal case of an environmental problem. Like global climate change, declining water quality, and population density, the decline in salmon runs are both caused by and cause change in diverse sectors in human societies – including economic, political, technological, and cultural systems. Despite salmon's ability to mobilize allies in support of their continued existence, their numbers continue to decline. I employ the concept of "non-human actors" to explain how the natural world and social world interact, conflict, and shape each other. Both non-human and human actors have a limited repertoire of behaviors that define what they do. Ecological actors, such as salmon, are constrained by biologically programmed "rules," while human actors are constrained by the rules of what they are used to doing within the organizations where they work. I argue that when new information becomes available that suggests a new interpretation of the rules – in this case, new scientific knowledge about what salmon's needs are – many of the rules familiar to actors within the social worlds that deal with salmon do not seem to make

sense anymore. These types of changes result in conflicts, negotiations, and compromises between actors within an institutionalized field of activity. The methodology employed in this study can be used as a template for the study of other environmental problems. I use an arenas perspective as a heuristic tool that allows the researcher to "see" how organizational structures create repertoires of behavior that dictate the rules of action for actors involved both directly and indirectly with a particular environmental issue. By exploring the salmon arena as it changes over time, I am able to 1) mark significant events (e.g. rise of ecosystem management) that cause changes in the field of action; and 2) locate places of inertia within the arena. Identifying the patterns of human behavior in such a manner gives one a deeper understanding of the nature of environmental problems.

TABLE OF CONTENTS

Page

# LIST OF FIGURES

# LIST OF TABLES

# PREFACE

Efforts to confront what have come to be defined as "environmental problems" have been increasing significantly since the mid-1960's. People working within international, national and regional agencies, educational institutions, scientific research organizations, and citizen advocacy groups have been actively engaged in attempts to address ecological issues such as loss of biodiversity, air and water pollution, depletion of natural resources, population growth, and global climate change. Yet, the vast quantity of time, money, and effort that has been expended has led to few real successes.

Environmental problems are major policy issues: How do we gain a better understanding of the complex nature of environmental problems and the possibilities for solving them? In *Managing Nature: A Look Inside the Salmon Arena,* I argue that we need to take a broader look at how environmental problems have been organized. I do not claim that this perspective will help us solve our ecological problems, but this study should add to the growing public and professional awareness that the increase in environmental problems will force us to make profound changes in both our institutions and our daily lives.

I use the case of the decline in the wild salmon runs of the Pacific Northwest to illustrate how environmental problems have been organized in American society. Because salmon have great cultural, economic, recreational, and symbolic importance in the Pacific

Northwest, their declines – largely a result of human impacts on the environment – have resulted in much concern. As wild salmon runs have declined over the century, the number of social actors involved in "the salmon problem" has increased exponentially. However, the majority of the efforts to reverse the declines have been controversial and unsuccessful in many cases. Despite salmon's ability to mobilize allies in support of their continued existence, their numbers continue to decline.

The main theoretical contribution of this study is to a sociology of the environment. Recently, many natural scientists have become aware that environmental problems and change cannot be understood, much less dealt with, in the absence of substantial contributions from the social sciences (Stern et al., 1992). Yet, as social scientists, we have not been very successful in articulating exactly what our contribution is and how it can be useful toward solving environmental problems (Harper, 1996). This study aids in the effort of defining the role of social science in environmental problem solving by providing a framework for an articulate and practical sociology of the environment. A useful sociology of the environment is one that takes science and the physical world seriously. My narrative weaves biology, hydrology, and ecology together with social science perspectives in order to explain what has happened, and is happening, to salmon.

I use the concept of "non-human actors" to explain that the salmon problem is an illustration of how the natural world and social world interact, conflict, and shape each other. I explain how both non-human and human actors have a limited repertoire of behaviors that define what they do. Ecological actors, such as salmon, are constrained by

biologically programmed "rules," while human actors are constrained by the rules of what they are used to doing within the organizations where they work. I argue that when new information becomes available that suggests a new interpretation of the rules – in this case, new ideas about what salmon's needs are – many of the rules familiar to actors within the social worlds that deal with salmon do not seem to make sense anymore. These types of changes result in conflicts, negotiations, and compromises between actors within an institutionalized field of activity.

The ultimate message is that despite our best scientific efforts to manage this natural "resource," many stocks of salmon are still at great risk. How can this be? There are more people engaged in the activity of trying to protect wild salmon than ever before. In the Columbia River Basin alone, $3 billion has been spent since 1981 to research the problem and implement remedies[1]; yet on March 16, 1999, the National Marine Fisheries Service listed nine subspecies of salmon and steelhead in Washington and Oregon as threatened or endangered under the Endangered Species Act (ESA). Maybe we still have not gotten the science right. Maybe we need more research. Maybe we need more people working on solving the problem. Keep these questions in mind as the story unfolds for I return to the issue of humans' problematic efforts to manage nature at the end.

[1] Oregonian, July 27, 1997, p. A1.

ACKNOWLEDGMENTS

So many people have helped guide me along this journey that it is hard to know where to begin to thank everyone. I will start by saying that financial support for this research has been provided by the U.S. Environmental Protection Agency. Special thanks go to my committee: Gary Hamilton, Howie Becker, Kate Stovel, Julie Brines, and Eric Smith. I am most appreciative to Bill Freudenburg, Allen Schnaiberg, Ric Scarce, Riley Dunlap, and Ray Murphy who helped me "carry the flag" of environmental sociology in my department. I will never forget Darryll Johnson and Mark Van de Kamp who talked environmental issues with me for years and helped draw me to the magical salmon. Heartfelt thanks go to Eric Doyle, who introduced me to the wild and complicated world of salmon and encouraged me to keep learning about these fish. A big hug goes to my dear friend April Eaton, who was always there to listen to my wild insights about everything from environmental sociology to how to grill the perfect salmon. Many thanks go to Ann Vogel and Jarrett Paschel who helped me hammer out what it was that I was trying to say. Another hug goes out to Charlie Eaton, who helped open my eyes to the mysteries and similarities between the natural and social sciences. And to Pat Linton, who unearthed a wellspring of creative energy that helped me break through the writers block dam. During the final stages of the battle upstream, I owe a big "thank you" to the following people, cats, and places: my wonderfully supportive co-workers at The Hartman Group, my soulfriend Stephanie Gailing, Deb Carnegie and Alesha Durfee, my mom and sister, my incredible friends, Shaka, Mishka, Café Ladro, Tully's in Ballard and Mercer Island, and Torrefazione in Fremont. Lastly, and most importantly, thank you to the salmon of the Pacific Northwest, who provided the inspiration to make this project as beautiful as it could be.

DEDICATION

The author wishes to dedicate this dissertation to her father Charles Anthony Pergola who inspired her to continue upstream despite all the challenges in her path, including his own passing into the next life.

# INTRODUCTION

## IF SALMON ONLY KNEW HOW MUCH WE CARED

In April of 1996, I sat in a large conference room to listen to parting remarks of a conference entitled "Towards Sustainable Fisheries: Balancing Conservation and Use of Salmon and Steelhead in the Pacific Northwest." Close to five hundred people had convened in Victoria, British Columbia, to discuss the "salmon problem." Policy makers, scientists, resource users, tribal organizations, and interested citizens all came to voice their own perspectives on the decline of wild salmon runs in the Pacific Northwest. Over the course of the five days, I participated in many debates, heard countless suggestions for new policies, and listened to many pleas for consensus as to what to do. As I sat there during the parting remarks, I kept thinking to myself "if the salmon only knew how much we care about them."

People have cared about salmon for a long time in the Pacific Northwest. The native peoples of the region viewed salmon as a symbol of the soul's capacity for divine questing and transformation: animate representations of great powers, fellow beings in the universe (Fobes et al. 1994, p. 25), and a source of food that their culture subsisted on. With the introduction of trading and then commercial fishing, people cared about salmon for their economic value, in addition to their cultural heritage. Elaborate techniques were developed to assure high levels of harvest of the resource including artificial propagation of fish. As the environmental movement gained momentum, some

people began to care about salmon for what they signified – a healthy ecosystem. Always a cultural icon for the people of the region, their meaning evolved in complexity throughout the decades, as different groups of people constructed new ways to view the salmon.

This is a story about the evolution of meanings about salmon, the people who have voiced these meanings, and the conflicts that arise over contested viewpoints. I argue that the salmon problem, as it is defined today, can be better understood when we examine how the change in viewing salmon as an economic resource capable of being manipulated, to an indicator of a healthy environment that should be given its freedom, results in a redefinition of the institutionalized field of activity surrounding salmon. Most of the rules of how to interact with salmon during the former time period are called into question during the later time period. Many of the reasons as to why it is difficult to move forward towards bringing back healthy stocks of salmon can be traced to the struggles resulting from changing the rules.

## HUMANS AND THE ENVIRONMENT

The attempt to reverse the declining salmon runs of the Pacific Northwest is an exemplary case of how environmental issues evolve into large and complicated arenas of activity. The salmon arena has come to include not only the obvious players, such as fishers, hatcheries, and conservation groups, but also a large network of governmental agencies on the local, state, federal, and international level, scientists, developers,

farmers, ranchers, loggers, and the hydropower and aluminum industry. Because each of these groups brings its own beliefs and "way of doing things" into the arena, understanding what it means for each actor to be participating in this issue helps to define the structure of the arena and, consequently, provides a framework for understanding the problem. It is only when we understand the history and structure of this arena of activity that we gain better insight into the current struggles occurring within the salmon world and perhaps obtain better ideas of how to solve the problem.

Environmental sociologists have been engaged in a long-standing debate about the relationship between environment and society. Some argue (Hannigan, 1995) that all environmental problems are primarily the result of the process of social construction and focus on the ideological origins of environmental problems. Others argue that environmental problems cannot be understood apart from the biophysical and ecological material truths of these problems (Bell, 1998). Scholars like Bell (1998) and Murphy (1998) argue that we should focus on the interplay of the material and ideal factors. There is strong consensus by scholars in the broader field of environmental studies that we need to move beyond the natural science/social world dichotomy and to take seriously the material/objective and ideological/subjective dimensions of environmental problems in our work. However, talking about the need to do this is one thing, operationalizing it is another. This study is an attempt to bridge the gap by providing a theoretical and methodological framework for understanding environmental problems. The perspective I take here is in line with that of Murphy (1998, p. 26), that "social constructions have to

be seen within the context of nature's constructions, with the interaction of the two being critical for both."

I use an organizational perspective as an analytic tool to structure the findings of my research. I describe how the organization of activity surrounding salmon has changed over the decades and can be characterized by two distinct time periods. At time one, the "resource" was managed very mechanically and salmon were controlled in order to satisfy the needs of a human economy. At time two, we see some organizational actors arguing for releasing control of the resource and giving salmon back their freedom in nature. Over the past several years, there has been a movement within certain segments of the salmon arena towards a more "natural" style of management of the salmon resource, called "ecosystem management." Those actors who are trying to employ the ecosystem perspective to help solve the salmon problem are recognizing that there are constraints and conflicts involved when interacting with institutions of natural resource management that developed decades ago. These "old world"[2] institutions provided the original foundation for how to manage the salmon resource and therefore maintain a strong hold on the way action is structured within the arena. I explain the conditions that gave rise to this new ecosystem perspective and describe the difficulties involved in "doing things differently."

---

[2] This is how people interested in sustainable fishery policy talk about this. I first heard this term used by Iona Campagnolo, chair, Fraser Basin Council and former member of Canadian Parliament at a Salmon Homecoming Forum in Seattle on September 13, 1997.

In the last chapter, I explain the utility of this perspective for studying other environmental problems and how this perspective helps us understand why it is so difficult to change the course of action when attempting to improve environmental degradation. Before I describe the two main elements of my analytic toolkit – non-human actors and the arenas perspective – I briefly explain how other sociological approaches typically used for the study of environmental problems do not provide a broad enough understanding of specific cases.

## SOCIAL MOVEMENT THEORY

Much of the research on environmental problems began within the subdiscipline of social movements. Many of the studies focused on the environmental movement in general Melucci (1989), Eyerman and Jamison (1991). These researchers were primarily interested in how activist organizations formed in support of environmental issues and how participation in environmental movement activity often ended up impacting an individual's identity (Lichterman 1992).

I began my research by working within the social movement tradition but found that focusing only on the activist organizations dealing with salmon would have structured my research around the social construction of the salmon "crisis." My study would have been about the resources mobilized by organizations in order to create a "salmon problem" and how participation in such activity would have changed the collective identities of those involved in saving the salmon. While such a study would be useful in

its own right, I found that this approach reveals only a small part of the salmon story and provides very little information about the broader science and policy context. In addition, the social movement approach does not encourage the researcher to separate out the natural science aspects of a case and observe their dynamics apart from the way in which movement participants construct them. I believed that in order to truly understand what is happening with salmon, and environmental problems more generally, one had to take a broader view – to look beyond social movement organizations and include the scientific community, well-established government agencies, and even other seemingly unrelated social worlds that all play roles in the evolution of environmental issues.

## SOCIAL CONSTRUCTION OF SOCIAL PROBLEMS

The other obvious path I could have taken to describe the case of salmon would have been to use the "constructing social problems" approach. The constructionist approach to environmental problems is rooted in the work that Spector and Kitsuse did in the early 1970's (Hannigan, 1995). Spector and Kitsuse defined social problems as "the activities of groups making assertions of grievances and claims to organizations, agencies and institutions about some putative conditions" (1973, p. 146). Using this perspective, the researcher focuses on the activity of those making the claims about a problem and pays little attention, if any, to the origin and nature of the claims themselves. For example, rather than document global climate change, the social problems analyst is encouraged to focus on how this problem is "generated and sustained by the activities of complaining groups and institutional responses to them" (1973, p. 158).

In many ways, part of my analysis does focus on the social construction of the salmon problem, but again, I have tried to take an even broader perspective. If I had approached my case from a constructing social problems point of view, I would have used the emergence of a "salmon crisis" as the focal point of the analysis. While this approach would have encouraged me to move beyond the activities of social movement organizations and include aspects of the scientific and policy communities, the addition of these worlds would have been to add in how their activities help shape the claims-making process. In order to gain a better understanding of environmental problems, one needs to move beyond analyzing the claims-making process and to take seriously the potential validity of the claims themselves. The nature of the claims plays a big role in the organization of social activity and cannot be ignored. As I described above, this study is an attempt at illustrating the interaction between social constructions and nature's constructions, and I found the constructing social problems approach too heavily weighted toward the social construction of the salmon "problem."

## ORGANIZATIONAL SOCIOLOGY

For the most part, environmental sociologists who have worked more closely within the boundaries of traditional sociology have utilized the concepts from social movement theory and social constructionism. There are others who have attempted a complete reorientation of sociology, working outside the traditional disciplinary boundaries, so as to take a "more holistic perspective that would conceptualize social processes within the context of the biosphere" (Buttel, 1987, p. 466). While I view this study as a contribution

to this latter attempt of developing a unique theory of environmental sociology, I came to this point only after exploring the limits of traditional sociological perspectives.

As I was researching the case of salmon, I realized that I had to look beyond the activist organizations that were talking about the salmon crisis, and to analyze the activity of governmental agencies, the scientific community, and other industries that play a role in the salmon issue. I looked to the subdiscipline of organizational sociology as an obvious place to find theories about organizational dynamics. The perspectives of organizational fields within organizational sociology would allow me to broaden my analysis to include actors that were left out of a traditional social movement or social constructionist analysis.

Organizational fields research emphasizes relations among similar and dissimilar organizations in a given field that is either geographically bounded (e.g. areal fields research on communities) or is a specialized organizational domain (e.g. functional field models of mental health sector) (Clarke, 1991). While the approach used by functional field researchers closely paralleled the framework I was developing for my case, it could not account for the needed inclusion of other elements in my models. Clarke explains the reason for this exclusion to be "the units of analysis are usually organizations of some sort and the structure, direction, and consequences of formal hierarchical relations among them are often taken for granted rather than rendered as problematic and to be determined empirically" (1991:126).

Clarke points out that "DiMaggio and Powell's work within the organizational field approach does take the structure of the field to be empirically defined, and makes their perspective quite close to the social worlds/arena analysis approach" (p. 126) I describe in the next section. She argues that the distinctiveness between the perspectives ultimately lies in their epistemological differences. In any case, I found the concepts of organizational sociology to be the most useful of the sociological approaches I explored when framing my analysis, and I view the theoretical approach I am developing here as a combination of environmental sociology and organizational sociology. The two main analytical tools that I employ are the concept of non-human actors and the arenas perspective.

## NON-HUMAN ACTORS

Sociologists of science have used the concept of "non-human actors" in their research on the interaction between specific technologies and societal relationships (Latour, 1987; Southerton & Shove, 1998; David, 1985). These scholars have examined the way in which such seemingly mechanical and sturdy items such as trains, refrigerators, typewriters, and computers are actually not only the result of many intertwined processes of human interactions, but also can be viewed as evolving and dynamic non-human actors that structure human relations. For example, Southerton & Shove (1998) explains how the freezer evolves from a rare technology found in only a minority of British households in 1970 to a crucial element in the fabric of modern kitchens and the ordering of everyday

lives by 1995. They argue that this technology has the dual role of creating new possibilities for time management, while also constraining its users in certain ways.

In any study of environmental issues, non-human actors have to be taken seriously. Some scholars who have examined the interaction between environment and society talk about aspects of the natural world as if they were "actors" playing crucial roles in the organization of social life (McEvoy 1986; Callon 1986; Freudenburg 1995). However, they do not specifically focus on how the behavior of phenomena such as sardines, scallops, and mountains as "natural" non-human actors, differ from the behavior of technological non-human actors. This study attempts to delineate how the behavior of ecological non-human actors shapes and constrains the institutionalized fields of human activity.

While Clarke (1991, p. 140) believes that the agency of non-human actors "may well be conditional upon its being constructed or granted (at least initially) by some human actors," I am not interested here in any attempt to determine which comes first. The interesting story lies within the articulation of how human and non-human actors shape each other's activities that in turn give rise to certain organizational forms. While salmon are the most central non-human actors that weave my narrative together, technologies such as hydropower dams also play important roles in the organization of the salmon problem.

Callon (1986) argues that all actors – whether they be human beings, institutions or natural entities – have the capacity to influence other actors because society and nature are intertwined in a complex web of interrelations. Non-human actors structurally condition the interactions within the situation through their specific properties and requirements—the demands they place on humans who want to, or are forced to, deal with them. Other actors must routinely take their obduracies into account (Clarke, p. 140). Freudenburg et al. (1995, p. 367) explain that they "do not impute any volition or will to the biophysical environment," but rather suggest that the common expectation in environmental sociology is that environmental resources can both "resist" and "encourage" human action.

In this study, I examine how the biologically programmed behavior of salmon structures the human arena of activity. I argue that as humans learned more about the needs and behavior of salmon, the institutionalized field of activity surrounding salmon changes in the attempt to adapt to this new knowledge.

## ARENAS AS FIELDS OF INSTITUTIONALIZED ACTIVITY

The other analytical tool I use to provide the framework in which to talk about the salmon issue is the concept of "arenas." This concept is a part of an analytic method developed by Anselm Strauss that can be used to understand human social organization (Clarke 1991). In her 1991 article, Adele Clarke defines an arena in the following manner:

> An arena is a field of action and interaction among a potentially wide variety of collective entities. Conceptually, an arena includes all collective actors (be they organizations, social worlds, fledgling social movements, ideologies or technologies) committed to acting within it. The analytic focus is on action while the units of action are the collective entities present in the situation. The kinds of action – the nature of the basic social processes – are empirical questions. Possibilities include conflict, competition, cooperation, exchange, and negotiation. The actions are to be understood by developing a dense understanding of the perspectives taken by all the collective actors (p. 128).

The primary components of an arena are distinct social worlds. Strauss and colleagues (Strauss, 1978) and Becker (1974, 1986) define social worlds as "groups with shared commitments to certain activities, sharing resources of many kinds to achieve their goals, and building shared ideologies about how to go about their business" (Clarke 1991, p. 131). These social worlds are both internally and externally dynamic. Participants within a social world are continuously negotiating how they should be thinking about and doing their work. It is common for subdivisions to form within social worlds where participants realign themselves around emerging ideologies and activities. Social worlds may also intersect with each other. Conflict, competition, negotiation, and/or exchange, depending on the situation may characterize these meetings.

An important component of the social worlds/arenas perspective is the focus on how the previous actions of social groups structurally situate subsequent action. An example of this phenomenon is Strauss's work on the health care arena that argues that "it is likely that physicians will remain at the top of the hierarchical heap in the operating room if not the hospital well into the twenty-first century" (Clarke, 1991, p. 129). Indeed, structural

elements are not unchanging, but are slower to change than other aspects of situations (p. 129). This approach to understanding the social world encourages the researcher to observe human activity as it becomes structured, or institutionalized, in order to understand consequences of subsequent action that may look at once confusing from another perspective.

Because arenas are formed around issues [e.g. health care (Strauss), Endocrine Disruptors (Casper & Christensen, 1998)], all individuals and groups who are even remotely connected to the issue may be brought into the playing field. In many cases, these participants may be working in organizations that originally have no knowledge or overlap with the core organizations within the arena, but then something changes so as to pull them in. It is common for these new participants to be reluctant members of the arena with their activities being characterized more by conflict than by peaceful negotiations. The addition of these reluctant participants often contributes to a reconstructing of the arena. For example, for many years pharmaceutical companies in the United States have been reluctant to participate in natural/alternative healing. They viewed any acceptance of these practices, often motivated by prevention versus curative, as a threat to their stake in synthetic, manufactured drugs that are used to cure illnesses. As people have become more interested in prevention and are seeking to take control over their health care instead of relying on costly, impersonal health care organizations, the demand for vitamins, minerals, and herbal supplements has increased dramatically. Pharmaceutical companies' very existence in the economy as providers of health care

products depends upon their widening and redefining what might be seen as an "integrated health care" arena. As more and more pharmaceutical companies have been introducing dietary supplement products into the market, they argue that the former providers of alternative health care should be brought under the regulative umbrella of the Food and Drug Administration, which is a well-institutionalized field of activity in which the pharmaceutical companies know the rules of the game. Much of the conflicts and debates within the integrated health care arena are concerned with regulation and the scientific "facts" regarding the efficacy of dietary supplements and other "alternative" health care practices.

As this example shows, analyzing an institutionalized field of activity during a time of radical change can help one gain a deeper understanding of the sources of power, conflict, and resistance to change that exists within organizations. Those who work within this "arenas" tradition typically proceed in their research by asking the following types of questions: What factors contribute to structural change within and between social worlds? How would you characterize the type of relationships that contribute to that change? How do reluctant participants get pulled into an institutionalized field of activity – the arena – and how does their participation contribute to reshaping the arena?

Clarke's articulation of social worlds/arenas perspective reads more like a handbook of how to go about studying a particular issue as opposed to a predictive theory. This is because the perspective provides a flexible tool that can be used by the researcher as an analytical framework, and allows one to ask more specific questions that further the

understanding of the case. The perspective helps to define theoretical questions as it is applied to a specific research problem. This study is an attempt to expand and refine the perspective's explanatory potential. I do this by highlighting how arenas can change, using a "Time 1" and "Time 2" scenario, and by using the focal concept of "non-human actors" and deconstructing the term "management" to help define the organizational and institutionalized boundaries of the arenas. In essence, employing an arenas perspective allowed me to see how changes in the science of salmon translated into changes within the institutionalized field of activity encompassing the salmon issue.

Arenas perspective allows the researcher to include aspects of both the biophysical and social worlds, and both human and non-human actors, to provide insights regarding the interaction between these elements in an organized manner. This approach to social research encourages the researcher to take a very broad, inclusive look at a phenomenon. Yet, the perspective also helps the researcher to draw boundaries around a social problem and "reign in" the critical components of a specific issue. This is especially useful in the study of environmental problems, which often quickly devolve into a discussion about how everything is related to everything else. Environmental issues are based on dynamically evolving natural systems. Any human activity that attempts to make sense of the changes in the natural world is also going to take on a dynamically evolving character. A fluid, yet structured, approach is the most useful way to analyze these types of problems.

## ORGANIZATION OF THE STUDY

This dissertation is really a story about management – management of an animal that exists in the natural world. In human society, management involves a person, or people having control over others and organizing them in some way, with some mission in mind. In the story that follows, I take a broad view of management, deconstructing it in a way to describe how the management of salmon has been constructed and how it has evolved over time.

In the process of describing the people involved in the salmon world, the activities they engage in, and the conflicts and power struggles arising out of their different perspectives, we get a picture of how the salmon problem has been created and what the future of it looks like. The questions I seek to answer in this study are the following: What does it mean to "manage" a natural resource? How do humans come to think that we can manage this natural "resource"? How does the behavior of salmon, as non-human actors, shape and constrain the behavior of human actors? What actors, organizations, and institutions are involved in the collective activity of managing salmon? What are the problems that are encountered and need to be worked out in the process of managing salmon? And, why hasn't the management worked so far and what can we do differently?

During the course of my research, it became clear that while the salmon arena is constantly evolving, a significant change occurred that resulted in a dramatic re-shaping of the arena. Therefore, I structure the following narrative into a "Time One" and "Time

Two" scenario. I label the first arena "Humans Managing Salmon" and the second arena "Salmon 'Managing' Humans."

Before I explain how humans managed salmon during Time One, I describe the basics of the biological and ecological aspects of the salmon problem in Chapter One. Chapter Two then describes the shape and texture of arena one. I then explain the causes of change in the salmon arena in Chapter Three. Chapter Four describes the arena at time two. After having laid out this story, I explain in Chapter Five how the legacies left to arena two from arena one are constraining the efforts of conservationists. Finally, Chapter Six concludes with some insights into the generalizability of this case to other environmental problems and leaves us to ponder what we can do, or want to do, with our own individual lives with respect to environmental issues.

## THE DATA

My data comes from a variety of sources. A substantial amount of literature on the history of salmon, salmon biology, and salmon policy is available in books written for both academic and popular audiences. I used these materials to understand the ecological aspects of the salmon problem and how salmon policy has evolved throughout history. It became clear to me early on in the project that I needed to gain a fairly high-level of knowledge of salmon biology in order to understand the parameters of the salmon problem and therefore spent a substantial amount of time reading biology and ecology materials and interviewing experts about salmon fishery science.

Much of the material for this study comes from fieldwork conducted between February 1996 and October 1998 and an analysis of over fifty formal and informal interviews with hatchery workers, commercial fishers, sports fishers, fish biologists, managers, and other actors involved in the salmon arena. I began my research by driving along the Columbia and Snake Rivers and visiting towns, dams, and hatcheries along the way. I attended many conferences and seminars where salmon policy was being debated and constructed. As a participant observer, I entered into work group sessions that discussed subjects such as the possibilities of changing institutional structures to better serve the needs of salmon and strategies for integrating communities into sustainable fisheries management.

I collected all the primary sources on salmon I could obtain that were written by government agencies, nongovernmental organizations (NGOs), and salmon activist groups. Most of these materials were calls for how "to do things differently/better" in terms of saving the wild salmon. I used these to observe where much of the cutting-edge activity within the arena was occurring and then looked back in time to see how we got to this point.

Lastly, being a resident of the Pacific Northwest enabled me to continually monitor the activities and reactions of the community here with respect to salmon and the environment in general. I collected and read all the media coverage on the salmon issue, watched news reports, and taped documentaries of the salmon problem. I went to galleries and museums that had exhibits on the salmon story, and traveled to the places where one observes salmon on their returning journeys to their homes and watched them

spawn and die. In essence, I did what I had to do to become an expert on the topic. I became known as "salmon woman" in my department and even went so far as to dress as a spawning sockeye salmon with a friend for Halloween one year. That was the closest I could get to taking the perspective of the salmon.

# CHAPTER 1: THE SALMON PROBLEM

In *Upstream: Salmon and Society in the Pacific Northwest*, the authors admit that "the 'salmon problem' is easy to state, hard to analyze, and even more difficult to solve" (NRC, p. 18). Of course, this statement depends on what we mean by the word "problem." The authors, a team of scientists appointed by the National Research Council, state that:

> Although we refer to the decline in the numbers of salmon as "the salmon problem," it is a problem for people – those who make their living from the fish, such as Indians in subsistence lifestyles and trollers who catch fish commercially; those charged with regulating fisheries in the public interest; and the nine million human inhabitants of the Pacific Northwest, for whom salmon are a symbol of their geography, a way of life, a delicacy, and an indicator of ecosystem condition. (p. 18)

People have observed the decline in salmon numbers for at least one hundred and fifty years. The nature of the responses to the declines have evolved over time and it is the consequences and reactions to these responses that have made the "problem" hard to analyze from many disciplinary perspectives. The intent of this chapter is to provide the necessary biological and ecological data that define some of the dimensions of the "salmon problem." In the following pages I explain some of the basics of salmon biology and about the places salmon go during their life history. This information provides the foundational knowledge for understanding how the limited repertoire of behaviors associated with salmon biology shapes human activity.

## THE BIOLOGICALLY PROGRAMMED LIVES OF SALMON

Salmon were living in the Pacific Northwest long before humans. Scientists have hypothesized that Pacific salmon (*Oncorhynchus*) evolved anywhere from 500,000 to 1,000,000 years ago (Groot and Margolis, 1991). Salmon have lived together with people in the region for at least 10,000 years and have always had great cultural, economic, recreational, and symbolic importance. The life cycle of salmon, with their seemingly magical ability to find their way back to their native streams, had initially intrigued the native peoples and still remains partly a mystery to scientists today.

Wild salmon have always been amazingly capable of adapting to changes in the natural landscape. While the Pacific Northwest region went through turbulent geographic disturbances, salmon continued to inhabit the rivers, streams, and oceans, reproducing and continuing to evolve in the face of many environmental hardships. Some scientists now argue that because salmon have been around so long and have adapted to so many changing environments, they have created a diversity within their populations that we must maintain if we are going to continue to have salmon around for another 10,000 years. They argue that our current reconfiguration of the landscape, after building power dams, cities, farms, and other industries in the path of the salmon, may now be too much for the creatures to successfully adapt. The signs are not looking good, for many of the stocks are way down in numbers. But, of course, only time will tell.

In the Pacific Northwest, scientists have recognized seven species of Pacific salmon (see Table 1.1), all members of the genus *Oncorhynchus* (Latin, meaning "hooked nose,"

referring to the crooked shape of the jaws that many males develop at spawning time). Two fish commonly known as trout, steelhead, and sea-run cutthroat, have recently been reclassified as Pacific salmon.

TABLE 1.1 Seven Native Species of Anadromous Salmon in Pacific Northwest (source *Upstream*, p.22)

| Common Name(s) | Scientific Name |
|---|---|
| Pink (humpy) salmon | *Oncorhynchus gorbuscha* |
| Chum (dog) salmon | *O. keta* |
| Sockeye (red, blueback) salmon | *O. nerka* |
| Coho (silver) salmon | *O. kisutch* |
| Chinook (king, spring) salmon | *O. tshawytscha* |
| Steelhead (anadromous rainbow) | *O. mykiss* (formerly *Salmo gairdneri*) |
| Sea-run cutthroat trout | *O. clarki* (formerly *Salmo clarki* ) |

Each of the species vary in the specific details of their life histories, for example the length of time that juveniles spend in freshwater varies as well as the length of time adults spend in the ocean maturing. However, all share three common characteristics – anadromy, homing, and semelparity. These characteristics become important to the scientific community when considering the issue of biodiversity, a concept I will explain in more detail below.

Salmon are *anadromous* fish, meaning that they are born in freshwater, migrate to sea to grow and mature, and then return to the same freshwater streams and rivers where they were born to reproduce and die. While some runs of salmon travel only a few miles to

the ocean and back, others travel hundreds of miles back and forth. Because salmon move such long distances through the landscape, they are dependent on a large complex of freshwater and marine environments (NRC, 1996). This helps explain the extensive geographic scope of the salmon problem.

We still do not know exactly how salmon find their way back to the exact places in which they were born after travelling such long distances during their lifetime. In their definitive volume on Pacific salmon life histories, biologists Groot and Margolis explain that "the methods used by salmon to navigate on the high seas and return to their home streams in an orderly schedule remain one of the most intriguing mysteries of animal migration" (p. 82). At this time, biologists' best guess is that the fish use some combination of the external magnetic pulls of the earth and their own internal sense of smell:

> It thus becomes necessary to postulate that salmon have a bi-coordinate system of navigation that enables them to know where they are and where they are to go (and when to leave in order to get there on time).
>
> Salmon navigate using a map, based on the inclination and declination of the earth's magnetic field, a celestial compass with a backup magnetic compass, and an endogenous circannual rhythm adjusted to day length.
>
> It appears that homing has learned components, because juveniles imprint on the odours of their home stream and are able to recognize these odours as they near their streams on their homeward journey as adults (Groot & Margolis, 1991, p. 82).

Because of this *homing* ability, salmon end up reproducing in relatively isolated groups. Combined with the natural selection that occurs within a diverse set of habitats, this homing characteristic ends up creating very distinct populations spread across a large geographic space (NRC, p.29). These biological "rules" provide the bases for the concept of biodiversity that I introduce below, and eventually structure policies regarding the preservation of salmon habitat.

The behavior of spawning only once in a lifetime and then dying is called *semelparity*. Fish biologists argue that *semelparity* evolves in species that reach a large body size by the time of first spawning and do not have much of a chance of surviving another migration given the treacherous journey. After emerging from their "nests," juvenile salmon may spend virtually no time at all in their natal waters, or they may remain there for up to two years. When it is time to head to the ocean, their organs and body chemistry undergo physical transformations so that they can survive in salt water. After one to five years in the ocean, their morphology and body chemistry changes again – this time reversing itself so that the salmon adapt to living in fresh water. They reverse their course and swim to the same stream where they were born. There, they spawn, producing the next generation and, with the exception of some steelhead, the parents die. An important consequence of this behavior of growing at sea and dying in freshwater is that the carcasses end up transporting nutrients into freshwater environments where they don't normally exist. These nutrients become an integral part of the ecosystems and are used by other animals on both land and in the water (NRC, p. 30). When this scientific

finding – connecting salmon to the broader landscape – was made known to actors involved with managing the resource, the scope of the salmon problem expanded. That is, with the decline of numbers of fish passing through waterways in the region, the associated nutrient loss drew in actors who rely on healthy watersheds to advocate for salmon recovery.

The general life cycle of salmon is illustrated in Figure 1.1. This depiction of the life cycle is for both salmon that spawn naturally and those that are propagated in hatcheries. The image also includes some examples of the obstacles salmon face during the course of their journeys to the ocean and back. Thus, this "general life cycle" is not an illustration of the basic biological life cycle untouched by humans' interaction with the landscape, but rather a concise depiction of the elements that help contribute to the salmon problem.

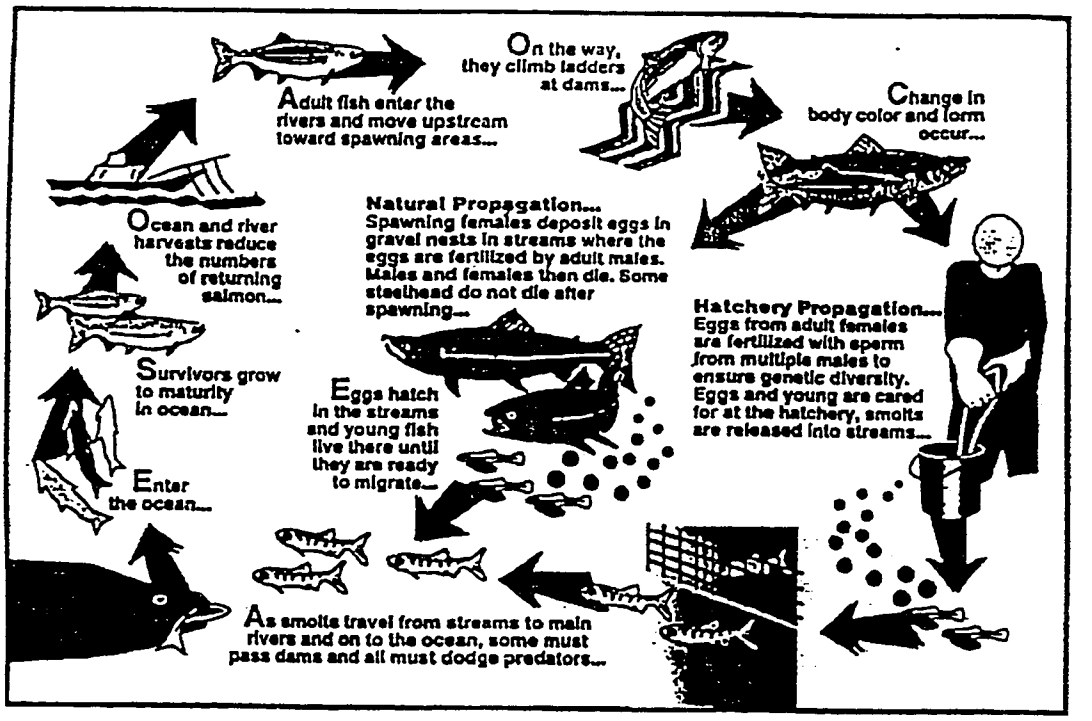



Figure 1.1 General Life Cycle of Salmon.

## HOW THE PLACES SALMON INHABIT STRUCTURE THEIR REPERTOIRE OF BEHAVIOR

Given the life cycle described above, salmon rely on two major types of geographic units for their existence: river basins and the ocean. River basins are the fundamental freshwater geographic unit and the North Pacific Ocean is the second major geographic unit for salmon in the Pacific Northwest (NRC, p. 34).[3] Since salmon inhabit, or at least at one point did, almost every river basin in the region, and combined with their residence in the ocean, the biological and ecological boundaries of the salmon arena are huge. This makes the case of the declining stocks of salmon a particularly complicated environmental problem. Yet other cases of threatened or endangered species share many commonalties with the salmon problem – in terms of the complex web of both social and ecological factors that contribute to the decline in their numbers – a topic I will expand upon in Chapter Six.

The definition of a river basin is the river itself (e.g. the Columbia, or Snake River) and the entire network of tributaries that drain into that river. The size of a river basin varies significantly:

> A river basin ranges in size from small, unnamed coastal streams that drain less than a few square kilometers to large rivers, such as the Columbia and Sacramento, with drainage areas of thousands of square kilometers. (NRC, p.34)

---

[3] The volume *Pacific Salmon Life Histories*, edited by C. Groot and L. Margolis, brings together and summarizes much of the available biological information on the life histories of the seven Pacific salmon species.

Salmon need cool flowing waters with gravelly bottoms to spawn. In preparation for spawning, females swim vigorously back and forth on their sides to dig out a shallow depression in the gravel of the stream bottoms. During the act of spawning, she deposits a "pocket" of eggs in the depression that are simultaneously fertilized by an accompanying male or males. She then covers them with gravel.

In order for spawning, incubation, and survival of fertilized eggs to occur, scientists have found that certain stream conditions are more favorable than others. Groot and Margolis explain that floods, siltation, freezing, desiccation, and disease can all take a toll on salmon at this stage of their life cycle. For example, poor gravel percolation or poor water quality can cause mortality of eggs. As the landscape of the region has been increasingly altered by human activity, the impact on salmon spawning, incubation, and survival of fertilized eggs has been significant. For example, run-off from agricultural areas into streams inhabited by salmon can increase siltation and cover gravel needed for the females to make their nests, called "redds."

Trees in the riparian zones along rivers help provide shade to keep the water in the river at the proper temperature for fish and eggs to survive. The woody debris that falls from trees along the riparian zone into the streams have also been found to help provide shade and protected areas for salmon to spawn, and for their eggs to develop. These scientific findings – connecting salmon to the broader landscape – end up drawing in more human actors into the arena in response to this awareness about salmon's expanded repertoire of

behavior. For example, the social worlds of the logging industry and agricultural industry are drawn into the scene when the agricultural industry's use of pesticides and the forestry industry's practice of cutting down trees needed to shade and protect salmon are recognized as being harmful to the fish.

Once juvenile salmon are ready to head to sea, their journey is best accomplished when they have a fairly clear passage to the ocean. Salmon have always had an amazing ability to adapt to the natural obstacles in their path, such as large rapids, waterfalls, and other predators. However, scientists point out that placing a large cement dam in a river where salmon migrate makes the process of adaptation very difficult. Some dams have fish passage systems in place, which I describe in more detail in the next chapter. Yet, in some of the river basins in the region, particularly the Columbia, scientific experts suggest that the path that salmon have adapted to has been so significantly altered by human activity, that the river is no longer a river but a series of reservoirs. When asked what salmon now need in order to survive another generation, I heard many conservation biologists say, "well, salmon need a river."

The element of the salmon life cycle that holds the greatest uncertainty for scientists is the ocean. Characteristics of the ocean, such as temperature variations, are logistically difficult to measure because "they occur over such large spatial and temporal scales that are not easy to observe directly, in contrast with the more local effects of land use and fishing" (NRC, p. 39). Scientists have found that there is a phenomenon known as "interdecadal variation" that creates a situation where sea surface temperatures change in

fairly predictable patterns. For example, from 1977-1986, sea surface temperatures were more than .5 degrees Celsius below average. These patterns impact salmon migration and survival at sea. For the most part, salmon prefer cooler waters. It is not known how much variation in the overall population of salmon is explained by the impact on ocean conditions, but it is the element that is least able to be manipulated by human management techniques. Some scientists have pointed out that we spend so much time and effort on managing human activity related to salmon as they travel through the rivers on land, while the key to the numbers of salmon may really be what happens in the ocean.[4]

The prospect that the status of salmon populations may be significantly low now, because of ocean conditions that are poor for salmon, and their numbers may rebound when the ocean temperatures change, makes many conservationists unnerved. All their efforts in attempting to change management practices on land may ultimately be the least important factor for improving salmon runs. In any case, they argue it might not hurt to help protect the part of salmon's habitat that we do have some control over as humans. Because, for the most part, humans do not have influence on ocean conditions, the human activity that becomes part of the salmon arena is influenced more by the boundaries of river basins and the associated activity that occurs along the banks.

---

[4] Interview with Bob Francis, Professor, School of Fisheries, Adjunct in Oceanography, Marine Studies, Quantitative Sciences, March 6, 1997.

## CONFLICTS APPEAR WHEN SALMON DO NOT RECOGNIZE POLITICAL BOUNDARIES

It is important to point out here that because salmon travel through such an extensive range during their lives, they end up crossing many human imposed boundaries like political jurisdictions. Some stocks of salmon cross the international border between the United States and Canada and many cross-state and county lines. This fact makes management of salmon quite complicated in the sense of creating many instances of conflicts and negotiations between human actors. For example, some salmon that are born in Canadian streams end up being caught by Americans off the coast of the United States, and vice versa. This biological programming of these ecological non-human actors shapes the geographical scope of the institutionalized field of activity surrounding salmon.

The migratory pattern of salmon has created a long-standing conflict between the United States and Canada. The conflict is essentially over the distribution of annual harvests – the "allocation problem." Salmon allocation is a particularly contentious issue, in part because salmon are a valuable resource for many different social groups: commercial fishing industry, recreational economy, and the native tribes. All these groups compete for a share of the harvest, and as the numbers dwindle, the fight over allocation becomes more heated. An example of the complexity of the allocation and interception issue is as follows:

> In Washington and Oregon, treaty tribes of Native Americans exercise harvest rights for ceremonial purposes as well as

> commercial sale. Native tribes in British Columbia (called First Nations) are negotiating similar harvest rights. The important recreational catch accounts for a higher percentage of the salmon caught in Washington and Oregon that it does in British Columbia and Alaska. The big recreational fishery off Vancouver Island, in the Puget Sound region, and off the Washington and Oregon coasts competes for harvest shares with the commercial fishery. In all areas, the social and political significance of salmon fishing outweighs its contribution to the local economy. (Huppert, 1996, p.1)

The complex life cycles of salmon help define these conflicts over allocation and interception. Because salmon migrate far into the sea during their ocean-feeding years and return to coastal waters only during spawning migrations, pink, sockeye, and chum salmon are caught largely as mature adults in coastal fisheries (Huppert, 1995). They are harvested at this time in their life cycle because this is when they are most economically valuable. Sockeye and pink salmon from British Columbia's Fraser River migrate into the Gulf of Alaska, but on returning the stocks split, some migrating to the east and some to the west of Vancouver Island. Those sockeye migrating through the Strait of Juan de Fuca are caught in large numbers by U.S. commercial fishers in the San Juan Islands area. Because salmon intermingle across political jurisdictions during their migrations, it is impossible for fishers to separate them by nation of origin. Hence, it is inevitable that fish originating from Canadian streams will be caught in U.S. fisheries, and that U.S. fish will be caught by Canadians (Huppert, 1996, p. 2).

The Pacific Salmon Treaty between the U.S. and Canada was supposed to help manage the disputes over allocation of harvest. It succeeded in some ways but failed in others. For example, it did establish agreed harvest allocations in the transboundary rivers, yet it

failed to set up a means of equitably balancing salmon interceptions between the two countries (Huppert, p. 2). This failure led to what has been called "the salmon war" between the two countries. One of the most notorious events of this "war" occurred on July 19, 1997, when a flotilla of Canadian gill net fishers surrounded an Alaskan-bound American ferry at its berth in Prince Rupert, B.C. to prevent its departure. The Canadians said they were angry over failed U.S.-Canadian talks that should have set salmon quotas for both countries.[5] A Canadian court order freed the state ferry for passage to Alaska within forty-eight hours, but the conflict over allocation remains. The treaty has yet to be renewed. In this case, the rules that dictate how salmon behave create conflicts when they clash with the rules laid out by human society.

## THE BIODIVERSITY ARGUMENT CHANGES THE RULES OF THE GAME

The large geographic range and the ecological complexity of salmon and their habitat contribute to a large and complicated sphere of human activity. Before I explain how salmon have been managed by humans, I need to briefly explain the concept of biodiversity as it is understood by conservation biologists. This concept plays a significant role in organizing contemporary activity around the salmon issue.

Those who are working towards the goal of reversing the declining salmon runs, view their mission as "developing management strategies for maintaining the biodiversity of

---

[5] Seattle Post-Intelligencer, July 21, 1997.

salmon for future generations."[6] Some scientific experts explain that maintaining biologically diverse populations of salmon is important because if a disease were to appear, it could threaten all salmon populations. At first this may seem like a strange motivation. All this effort is being expended to save wild salmon just in case some disease were to hit the region? This answer makes more sense once one learns about the science of conservation biology.

The loss of biodiversity on earth is one of the key areas that those who work to protect the environment spend resources on. The U.S. Environmental Protection Agency Science Advisory Board for the Western Region has identified the loss of biodiversity as one of the most important environmental issues of the day, particularly in the Pacific Northwest.

> Biodiversity is the total diversity and variability of living things and of the systems of which they are a part. This covers the total range of variation in and variability among systems and organisms. At the bioregional, landscape, ecosystem and habitat levels, at the various organismal levels down to species, populations and individuals, and at the level of the population and genes. Biodiversity is the resource upon which all human generations past, present and future, are dependent. This dependency includes our stocks of current and future food and fiber, medicines, spiritual enrichment, and an array of ecological services.[7]

While landscapes have changed over time, and species have always come and gone, the current "crisis" is said to be rooted in the rate, scale, and cause of the current loss of

---

[6] Draft of "Towards Sustainable Fisheries: Building a Cooperative Strategy for Balancing the Conservation and Use of Westcoast Salmon and Steelhead Populations", The Sustainable Fisheries Foundation (1996).

[7] United Nations Environment Programme (1995); Ecological Society of America (1998).

species. Conservation biologists note that millions of years ago, the rate of extinction was roughly one species per year, while today the rate is hundreds, possibly, thousands times higher. Some scientists estimate that 15 percent of all the world's species could be gone in ten years. And, while climate change is identified as the most likely cause of past extinctions, it is human activity that seems to account for most extinctions today (Grumbine, 1992, p. 18).

According to conservation biologists, the evolution and continued existence of a species is dependent on both genetic differences between individuals within a population *and* genetic difference between populations. If there are no differences between local populations, meaning that a species consists of many copies of the same genetic population, then a new disease might be introduced to which most individuals are genetically susceptible; the disease would threaten all populations, and therefore the entire species (NRC, p. 148).

The spread of the importance of the biodiversity perspective throughout the scientific community dealing with conservation issues ends up changing the rules of the game in terms of managing salmon. Since salmon had once inhabited the majority of the rivers and streams in the region, and since it is important to maintain the diversity of these populations, then efforts to sustain the resource have to take into account the human impacts on the land over a very large portion of the Pacific Northwest. Thus, dealing with the salmon problem has become part of the activities of agencies, industries, and other organizations throughout a significant portion of the region.

## ARGUMENT FOR SALMON AS AN INDICATOR SPECIES CREATES CHANGES IN ARENA

Another reason given for maintaining diverse salmon populations is that healthy salmon runs are an indication of healthy ecosystems.[8] Because ecosystems are complex, continuously evolving systems, it is difficult to separate out the combination of factors that change ecosystem functioning:

> No single disease process has led to the current environmental predicament. Rather there are a multitude of stressors, many of them interactive, that have caused ecosystems to degenerate... Taking nature's pulse has proved to be largely illusory. For the vast majority of natural systems, there is scant likelihood of discovering any function remotely equivalent to the pulse in human medicine. Far from exhibiting regularity, most ecosystems might be characterized by arrhythmia—that is, by a dynamics that is highly irregular and punctuated by surprise... The indicator species approach has been the mainstay in assessing the health of many ecosystems. Here "type 1" species (species that have a rather narrow tolerance for conditions deviating from the somewhat austere conditions originally found in naturally occurring systems) are used as a surrogate for ecosystem integrity. (Rapport, 1992, pp. 146-148)

These "type 1" species, or indicator species, have become the mainstays for many in the environmental community as well. The whooping crane, the spotted owl, the marbled murrlet, and the salmon are all threatened or endangered species that are viewed as

---

[8] The term "ecosystem," a shortened version of "ecological system," was coined by British ecologist Arthur Tansley (1935), who defined it as: "the whole system... including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment." In other words, an ecosystem is an organizational unit consisting of both living and nonliving things that occur in a particular place. (Kormondy and Brown, 1998, p. 30)

indicators of the degradation of the habitats, the ecosystems, in which they live. While in most cases, there are many other species of both plants and animals that are declining in numbers within specific ecosystems, the ones that get most of the attention as environmental "problems" of loss of biodiversity, are the species that are labeled as "indicators." When scientists observe an increase in the numbers of any of these indicator species populations, then, in turn, conservation efforts to restore habitat are seen as being successful.

Since salmon seem to do best in cool, clean, fast moving water, it makes sense that the places where wild salmon still survive are typically the places where their habitat has been maintained in this fashion, either by not being altered by humans or by being consciously managed to be this way. When communities in the region want to boast about how healthy their particular watershed is, they use the presence of returning salmon runs as a measure. When species are chosen by the scientific community to be indicators of the health of an ecosystem, human activity becomes focused around the habitat needs of that creature. This helps explain, for example, why we saw so many rules and policies develop around the maintenance of the forested ecosystem for the spotted owl, while the banana slug has not managed to mobilize many allies in support of its existence and its associated habitat.

## HOW FINDINGS ABOUT THE STATUS OF PACIFIC SALMONIDS RESTRUCTURES THE SALMON ARENA

The most comprehensive account of the status of Pacific salmon was published in 1991 by Nehlsen et al. The authors reviewed an extensive assortment of available data in which to reach their conclusions. They analyzed information collected by scientists on the number of salmon that returned to spawn, the number of redds found in the rivers, the number of adults caught in both the commercial and recreational fisheries, the number of salmon observed to be passing through the fish ladders at the dams, and anecdotal observations.

Based on these data, they identified native (non-hatchery raised) stocks[9] that fell into three categories: 1) at high risk of extinction, 2) at moderate risk of extinction, and 3) of special concern (p. 7). Figure 1.2 displays their findings on a map of the region. The main generalization made from this study is as follows:

> Pacific salmon have disappeared from about 40% of their historical breeding ranges in Washington, Oregon, Idaho, and California over the last century; and many remaining populations are severely depressed in areas where they were formerly abundant. If the areas in which salmon are threatened or endangered are added to the areas where they are now extinct, the total area with losses is two-thirds of their previous range in the four states. Although the overall situation is not as serious in southwestern British Columbia, some populations there also are in a state of decline,

[9] The word "stock" is used to describe the fish that spawn in a particular river system (or portion of it) at a particular season, and that do not interbreed to any substantial degree with any group spawning in a different place, or in the same place at a different season (Nehlsen et al. 1991, p. 7)

> and all populations have been completely cut off from access to the upper Columbia River in eastern British Columbia. Even if the estimate of population losses of about 40% is only a rough approximation, the status of naturally spawning salmon populations gives cause for pessimism (NRC, pp. 75-76).

Some other generalizations were that coastal populations tended to be somewhat better off than populations inhabiting interior drainages, and that populations near the southern boundary of species' ranges tend to be at greater risk than northern populations (NRC, p. 76). Lastly, the scientists pointed out that in many cases, populations that have not declined are composed largely or entirely of hatchery fish (p. 77). I explain in Chapter Three how these findings trigger a major transformation in the salmon arena from a time when salmon were viewed as creatures that could be controlled and manipulated as a resource, to ones that are perceived to be indicators of a healthy ecosystem.

In sum, when people talk about "the salmon problem," they begin by talking about these facts regarding the declines in numbers. Obviously, it is the *reasons* behind the declining numbers that are most interesting to scientists, concerned citizens, and those actors who are labeled as direct contributors to the declines.

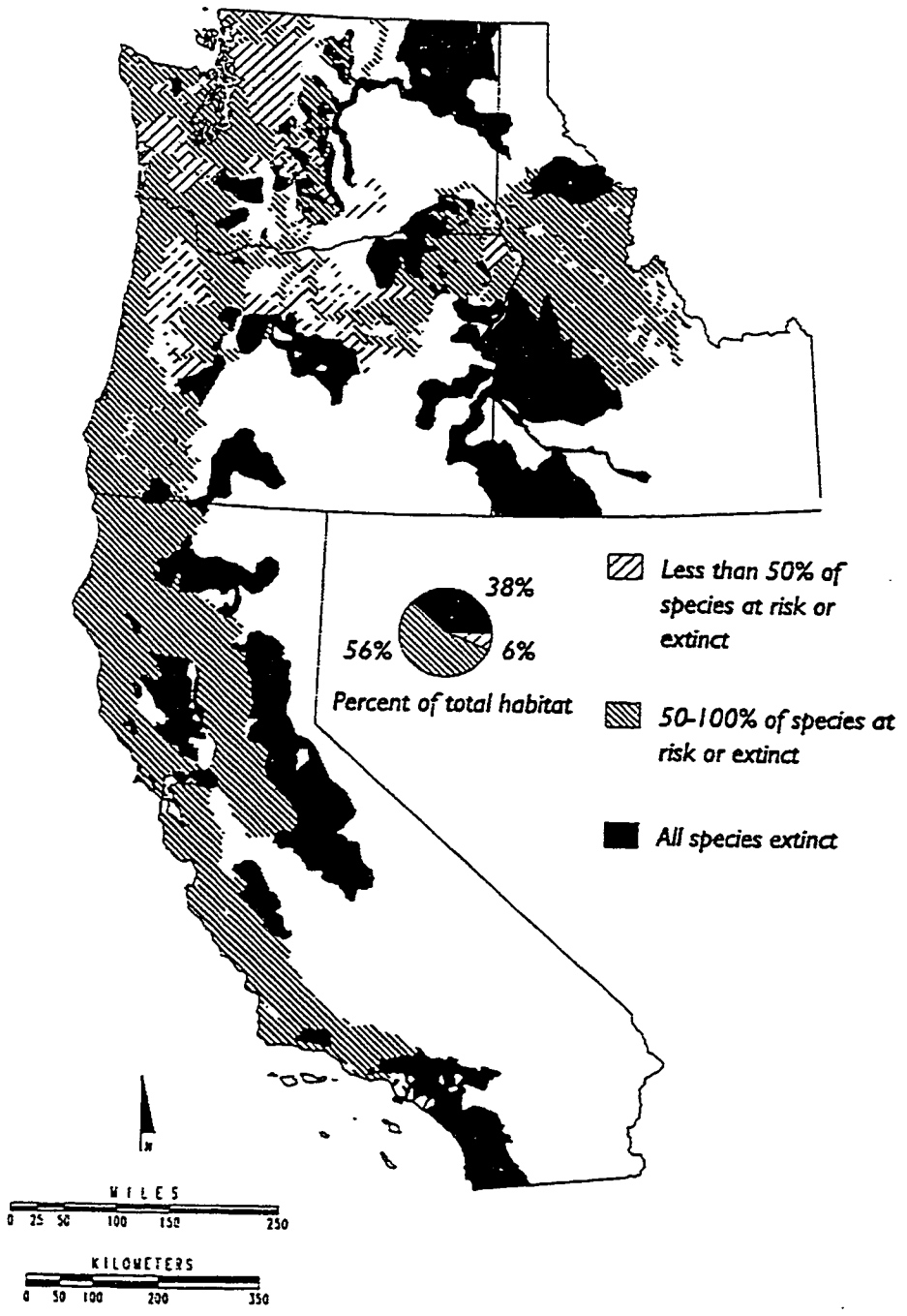



Figure 1.2 Status of Native and Hatchery-Based Salmon Stocks.

## CONCLUSION

Salmon are probably the most studied fish. Scientists know a lot about their life cycle, genetic structure, and the type of habitat they prefer. In the pages that follow, I explain how this evolving scientific knowledge has informed management practices over time and how this knowledge about the biophysical/material world has interacted with the social activity surrounding salmon. Figure 1.3 illustrates this social-biophysical interaction. This chapter was intended to provide an introduction to the aspects of the natural ecosystem in which salmon are a part that provide the foundations for negotiations between the social worlds that make up the salmon arena. Likewise, there are aspects of human culture that help define the shape and texture of the salmon arena.

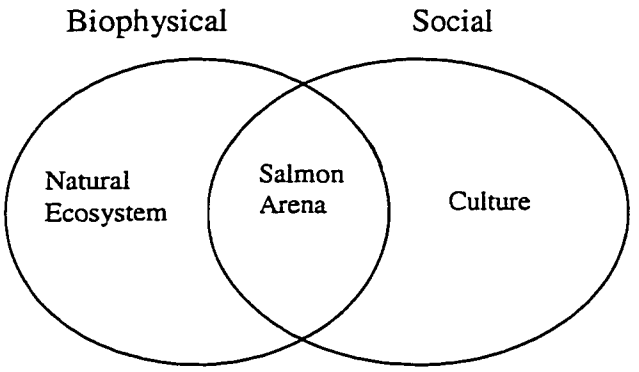



Figure 1.3. Biophysical-Social Interaction.

This interplay of the social and the biophysical will be a continuing theme in the chapters that follow as I explain how salmon have been managed by humans and how salmon are now "managing" humans. In many ways, scientists are continuing to make progress in their understanding of the lives of salmon and to share their knowledge with those who are responsible for managing the resource. As I will attempt to argue in the next chapters, the social activity that was built around initial scientific knowledge creates a field of action that becomes institutionalized and therefore difficult to alter when faced with new and different scientific "facts" about salmon and their needs.

# CHAPTER 2: HOW HUMANS MANAGE SALMON

Lower Granite Dam is located on the Snake River in eastern Washington, about twenty miles from the Idaho border. Lower Granite is one of twenty-seven large dams built on the mainstems of the Columbia and Snake Rivers between the late 1930's and the late 1970's for the purposes of hydropower, irrigation, and flood control. Placing dams in rivers impedes the passage of salmon migrating from their natal streams to the ocean. In the case of the Lower Granite, the operators, the U.S. Army Corps of Engineers, have taken some measures to rectify the blocked fish passage situation. Initially called "Operation Fish Run," and has become known as the "Juvenile Fish Transportation Program" in the 1980's (Mighetto et al. 1994), the Corps constructed a system whereby juvenile salmon are funneled onto barges or what look like oil tanker trucks at Lower Granite dam. These barges and tanker trailers are equipped with a recirculating water and aeration system. The juvenile fish, called smolts at this stage of their life-cycle, are then either barged down the Snake and Columbia or driven close to 300 miles down the highway and released on the other side of the Bonneville Dam where they then have unencumbered passage to the ocean, 146 miles away. One can be amazed at how ingenious humans have become in their efforts to manage natural resources.

This type of management of the salmon fishery[10] is an example of the technology humans developed and implemented in order to maintain the resource during the early 1970's. It

---

[10] The concept of a "fishery" is made up of several dimensions: 1) it is the act, process, occupation, or season of taking fish or other sea animals, 2) a place for catching fish or

is an illustration of how those in charge of managing the salmon viewed the resource for most of this century: as a fish that could be manipulated, or "tooled" (Scarce 1995). In this chapter, I explain how this view of salmon as an economic resource creates fish that are, in many ways, technological non-human actors. The institutionalized field of activity that gets constructed around salmon during this time is a reflection of this perspective.

The history of the activity surrounding resource management during this era is rich and long.[11] The historical account I provide in this chapter is focused on the specific ways in which actors involved in the salmon arena used science, technology, and cultural appeals as the basis for managing salmon during this time. Salmon, as mechanical non-human actors, can be considered to be, in large part, powerless during this era. While the biophysical environment did play a role in organizing the activity within the salmon arena at this time, both salmon and their habitat were viewed by most of the human actors as elements of nature that could be controlled and "conquered."

---

taking other sea animals, 3) a fishing establishment, 4) the legal right to take fish at a particular place or in particular waters, and 5) the technology of fishery.

[11] There are many good books that provide this history in detail. See *The Northwest Salmon Crisis: A Documentary History* (1996), edited by Joseph Cone and Sandy Ridlington, and Chapter Four in *The Organic Machine: The Remaking of the Columbia River* (1995) by Richard White.

## SCIENCE PROVIDES FORMULA FOR RULES OF THE HARVEST

The dominant motivation at this time was to manage the salmon resource for commercial interests. Therefore, the field of action during this era focused around catching salmon and how to continue to catch salmon. Elaborate mathematical models were developed by fish biologists working within the academy that informed management decisions made by state and federal agencies.

Commercial salmon fishing by non-Indians began on the Columbia River in the 1830's. Since at that time there was not a good method for storing the fish, only small numbers of fish were taken. It wasn't until the technology for canning was brought to the region in the mid-1860's that the fishery really expanded. Improvements were made to fishing gear as well, and by the early 1880's, a gill-net fleet equipped with nets that could scoop up large numbers of fish in the rivers had increased from two (in 1866) to 1,500 (NRC, p.255). Market demand for canned salmon was high and by the end of World War I, several runs were overfished, meaning that not enough fish were allowed to return to their spawning beds to reproduce the next generation.

Between the World Wars, a surplus of Alaska-caught salmon and the Depression decreased the demand for salmon from the Pacific Northwest. However, after World War II, the fishery expanded into the ocean and commercial fishing along the coast became popular. According to National Research Council scientists:

> While Pacific salmon fisheries developed rapidly during their early history, our ability to manage them did not. Much of the basic

> biological understanding of Pacific salmon and information that could be used to manage salmon fisheries were being developed as the fisheries developed, but their application to management developed much more slowly (NRC, p 275).

The tool that was developed to provide the rules for the harvest was called "maximum sustained yield" (MSY). Briefly, salmon-fishery management assumes that there is a surplus of salmon where a given number of spawning adults produces, on average, more progeny than are needed to replace the parents and overcome all the obstacles that contribute to natural mortality. Fishery managers have attempted to calculate the maximum number of salmon that are available for catching, while having enough left over to reproduce the next generation:

> Managing fish (and forests) through the concepts of maximum sustainable yield has for half a century raised hopes for maintaining environmental quality while producing sustained growth. In the 1930's E.S. Russell introduced into fisheries concepts about maximizing agricultural production. W.E. Ricker defines maximum sustainable yield as, "the largest average catch or yield that can continuously be taken from a stock under existing environmental conditions." (Courtland Smith in Cone & Ridlington, p. 57)

These MSY models have been the dominant tool used to manage the commercial harvest for most of this century. Smith (p. 57) explains that "maximum sustainable yield management is institutionalized in legislation establishing fishery management practices. The Magnuson Fishery Conservation and Management Act of 1976[12] requires that fishery

---

[12] Congress passed the Magnuson Act in 1976 for the following reasons: 1) to assert jurisdiction over fisheries within the exclusive economic zone of the US, 2) to control foreign fishing in the zone, 3) to establish conservation-based management of these resources, and 4) to promote development of the US fishing industry. Among other

management plans both assess and specify the present and probable future condition of, and maximum sustainable yield and optimum yield from, the fishery.

Although this type of methodology was viewed as the best model for managing the fishery at the time, it is now well known that sustainable yield management has been successful in few fisheries (NRC, 1996). After over 50 years of sustainable yield management many fish stocks are in very poor condition, hardly sustainable at all. How can this be? The answer lies in the fact that during this time, scientists believed that they could develop the knowledge to control nature and that salmon were essentially machine-like creatures that had stable, predictable patterns of behavior. They developed MSY models without taking into account the following issues:

> The estimation of the biological production function in a highly variable natural environment.
>
> Differences between populations and change over time within populations.
>
> The necessity for accurate data on total fishing mortality by age and population over all fisheries, on number of spawners by age, and on future production. (NRC, p. 277)

In essence, the biophysical environment was assumed to be more static than it is. MSY models have been relied on by agencies for decades, and were the default management

---

things, the plans developed by the regional councils (in which the Pacific Fishery Management Council is one) must prevent overfishing and achieve optimum yield, utilize the best scientific information available, provide for management throughout the range of the stocks, and promote efficient utilization of fishery resources. [Rutter, Larry

tool. As I describe in Chapter Four, attempting to get agencies to change their reliance on this tool – when introduced to new scientific findings about salmon – is very difficult, given the initial dependence of fishers on this policy for their economic livelihoods.

## CULTURAL INPUTS STRUCTURE RULES OF THE HARVEST

As the numbers of salmon declined, the native peoples of the region began to voice their concern about the decline of their own fishery. Not only did they subsist on the salmon harvest, but many made a living on the commercial catch. By 1970, the tribes were harvesting only about two-percent of the salmon runs because non-Indian fisheries in the ocean and Puget Sound left little salmon for the tribes. The tribal fishery was primarily in the rivers as opposed to off the coast or at the mouth of the river. Non-Indians harvested the fish in the beginning of their migration back to their natal streams. Salmon stop eating when they enter the mouth of river to head back to their "homes". Most of their body fat reserve is used in the upriver migration-- at death, females have utilized well over 90% of their reserves (Groot and Margolis, 1991). By the time they are ready to spawn, they have lost weight and are ragged from negotiating rapids and the perils of the river on their journey home. While Indians used to eat salmon that had traveled upstream, the salmon fishery created by white settlers during the first half of the century was built around the "more desirable" fatty, healthier looking salmon. Therefore, commercial fishers caught fish either at sea or at the mouth of the river, when they are at

---

G. (1997). "Salmon Fisheries in the Pacific Northwest: How Are Harvest Management Decisions Made?". *Pacific Salmon & Their Ecosystems*, p.365.]

their peak weight, and thus most commercially desirable. Fishery management was done by agencies utilizing models that would maximize the number of fish that could be caught at the most commercially desirable locations, yet allow enough fish to return in order to reproduce for future harvests.

As a result of these practices, conservation efforts to increase salmon stocks fell primarily on the tribes. The state of Washington, after allowing heavy non-Indian harvests, ended up imposing the entire conservation burden on tribal fishers to ensure a sufficient number of spawners (males and females that were allowed to make it all the way back to their natal stream sites to reproduce) (Cone, 1996). Most of the fish that did make it back into the rivers at the end of their journey were not allowed to be caught.

By the 1970's, this situation created such intense conflicts between native and non-native fishers that the government was called in to help resolve the problem. Because of the inequities in the harvest, the federal government (as trustee for the tribes) filed suit, claiming that the state's discriminatory regulation violated the promises of the Stevens treaties[13], and that those treaties entitled the tribes to a "fair share" of the harvests (Cone, 1996). In 1974, in one of the most famous rulings in the salmon world (most people now refer to it simply as "the Boldt decision"),

> Judge George Boldt, in looking at the treaty negotiations and historic tribal fishing practices, concluded that the government

[13] The treaties reserve to the tribes a sufficient quantity of fish to satisfy their moderate living needs, subject to a ceiling of 50 percent of the harvestable run. [United States v. Washington, 506 F. Supp. 187, 203, 208 (W.D. Wash. 1980)].

> treaties reserved to the tribes the right to harvest up to 50 percent of the salmon runs. The Boldt decision result was of course a considerable redistribution of harvests toward the Indian fishery (Cone, 1996).

This significant ruling was based on an appeal to the cultural rights of the native peoples of the region. In their reflections on this historic decision, Michael Blumm and Lorraine Bodi of American Rivers note that:

> This "retribalization" encouraged the tribes to develop expertise in harvest management and salmon biology. This expertise allowed the tribes to begin to interact with the states and federal government on a government-to-government basis. Tribal biologists added important new perspectives to the science of salmon management, helping to advance the state of the art, especially focusing on the entire salmon life cycle instead of concentrating on hatcheries, which had been the center of attention of most state biologists. Within a few years of the Boldt decision, the tribes and state fish and wildlife agencies forged an alliance to demand better habitat protection and improved hydroelectric operations. This alliance would eventually help produce the fish and wildlife provisions of the Northwest Power Act. Thus, the ramifications of Judge Boldt's decision were far reaching; it is no exaggeration to suggest that the era of modern salmon management began with his historic decree in 1974 (Cone & Ridlington, 1996, p. 193).

The Boldt decision has been institutionalized into fishery management to this day. This re-distribution of the harvest to different social groups played a significant role in the re-distribution of commercial fishing dollars within the regional economy. Although, since the numbers of salmon available for harvest has dwindled, many of the Indians I spoke

with argue that "50% of zero is nothing" [14] and blame non-Indians for degrading habitat so much as to reduce the stocks for all peoples of the region. Some tribal members have been joining in the effort with non-Native fishery managers to help rebuild the stocks. In any case, this resolution of the conflict over harvest at the time was a significant event in structuring the rules of action within the salmon arena and continues to play a role in current management practices.

## CREATING FISH

When the dams were constructed along the mainstems of the Columbia and Snake Rivers, economic growth was the dominant motivation by the government at the time. The large hydroelectric dams were built not only to supply the region with cheap electricity, but also to help develop a large agricultural growing region in an area characterized by a semi-desert-like landscape. Little concern was paid to the salmon fishery at this time. As I described in Chapter One, the construction of the dams created impediments for fish passage. Some of the dams were constructed with fish ladders – cement structures that allowed salmon to negotiate through the dams – but some were not. It turned out that many of the juvenile salmon did not make it past the dams during their downstream migration.

One way the numbers of fish could be augmented was to build hatcheries to artificially propagate baby salmon. Motivated by the alteration of salmon habitat by dams, and

---

[14] Billy Frank Jr., Chairman, Northwest Indian Fisheries Commission, personal interview.

increases in harvesting, fish biologists working within academic institutions developed techniques to artificially propagate baby salmon. State and federal agencies funded their research. On the Columbia River, large-scale hatchery production in the lower Columbia River, below the dams, became the dominant method to substitute for upriver losses caused by dam construction. Hatchery workers intercept the first fish back in the rivers, slice open the stomachs of the female and male fish, and mix the eggs and the milt together in large buckets. By taking the reproductive material out of the male and female salmon and combining it in containers, scientists are able to produce a much larger number of larvae (called alevins) than what occurs through natural spawning. The alevins are then tended to by humans in a managed environment until they grow into smolts and are ready to head down the river toward the salt water to live the rest of their lives out in a similar fashion to wild salmon (naturally spawning).

Hatcheries are able to propagate large numbers of salmon each season. For example, in the Snake River basin alone, 14.9 million chinook juveniles were released in 1989 (NRC, p. 303). Both the commercial fishing industry and recreational fishery came to rely on hatchery-raised salmon. The amount of salmon produced by hatcheries had an overall impact on the salmon population by greatly increasing the number of available fish. Hatcheries became a widely accepted technological fix for dealing with a decreasing wild salmon population. However, there were problems:

> Hatchery production has shifted both species composition and geographic origin. Wild salmon return to their natal streams to reproduce and die. As a result of the shift of production to the

> lower river basin, far fewer fish now run to the upper river, beyond the Cascade Mountains (Lee, p. 26).

In order to sustain commercial fisheries, governments and other entities have built and operated salmon hatcheries along the West Coast of North America, including more than 80 in the Columbia basin. In *Compass and Gyroscope* (1993), Kai Lee explains how these hatcheries were originally located:

> Although hatchery construction was originally authorized to mitigate damage resulting from the construction of dams, an agreement (which did not include Indian tribes) put most of the salmon production west of the Cascades, downstream from all or most of the dams. This choice avoided losses from the dams and reservoirs and allocated the bulk of the fish to non-Indian harvesters (Lee, p.27).

As economic interests dictated the need for increased numbers of salmon, funding for research and implementation of hatcheries led to an expansion in scientific knowledge about the artificial propagation of salmon. This new knowledge about how to create fish helped establish one of the main rules that structured action within the salmon arena at this time. That is, when fishers or scientists noticed dwindling stocks of salmon in a specific area, then hatcheries were built to augment the numbers of fish. Throughout the region, the salmon fishery became dominated by hatchery-raised stocks.

The way in which hatchery production was done, however, ended up creating stocks of salmon that had less genetic diversity than would have occurred in the wild. In the process of constructing mechanized non-human actors, fish biologists had helped structure a repertoire of behavior that would prove to conflict with the biologically

programmed rules of wild salmon. Yet creating fish in hatcheries has been an integral part of fishery management for decades. Without hatchery-raised salmon, the commercial and recreational fishery would have collapsed a long time ago. The issue of hatchery-raised salmon is a central part of the "salmon problem," and I discuss the continuing conflicts it raises in Chapter Four.

## CONTROLLING THEIR JOURNEYS

Hatchery-raised fish not only allowed scientists to increase numbers of fish, but they also allowed them to direct their journeys. Another example of how salmon were manipulated for the benefit of human needs illustrates how the fish, as mechanized non-human actors, even had their repertoire of movement controlled:

> There is a hatchery on the Columbia River that had been constructed largely with funds from the state of Oregon but had originally been producing fish from a broodstock of salmon that naturally turned right after entering the Pacific Ocean from the mouth of the Columbia. The Oregonians got upset that Washingtonians were catching the fish off of their coast when they had funded the hatchery. So, hatchery workers were told to change the type of broodstock they were using to Rogue River salmon, which naturally turn left after leaving the mouth of the river. A similar thing happened in a river in Washington where the British Columbians got upset that hatchery fish meant for their harvest were turning left after entering the Pacific. Fish that naturally turned right were substituted for these fish. (Steve Phelps, Washington State Department of Fish and Wildlife, personal interview.)

Through the use of scientific knowledge and practices, humans have been able to direct the movement of salmon through their habitat in order to meet the needs of certain social groups [see figure 2.1]. Many fisheries biologists view this practice as the ultimate achievement in understanding their subjects. While others, particularly conservation biologists, view this as the ultimate example of human's desire to control nature without taking into account the needs of the fish.

In addition to using hatchery science to help control the movement of salmon throughout their geographic range, scientists also implemented bypass systems, and trucking and barging systems, to help salmon negotiate the dams. Bypass systems divert fish from entering turbine intakes of the dams (Mighetto et al., 1994, p. 93). Earlier bypass facilities were not as sophisticated as contemporary ones, which now include elaborate fish ladders attempting to mimic the rapid-like conditions that had once been present in the river before construction of the dams. These ladders are now an integral part of many dams. Many tourists go to these areas to view salmon as they move through the ladders. Although conservation biologists view the ladders and other bypass systems as an artificial means to managing the salmon resource, in some ways, their very existence has contributed to educating the public about the power and cultural importance of the fish as they view these strong creatures negotiating their way up fish ladders.

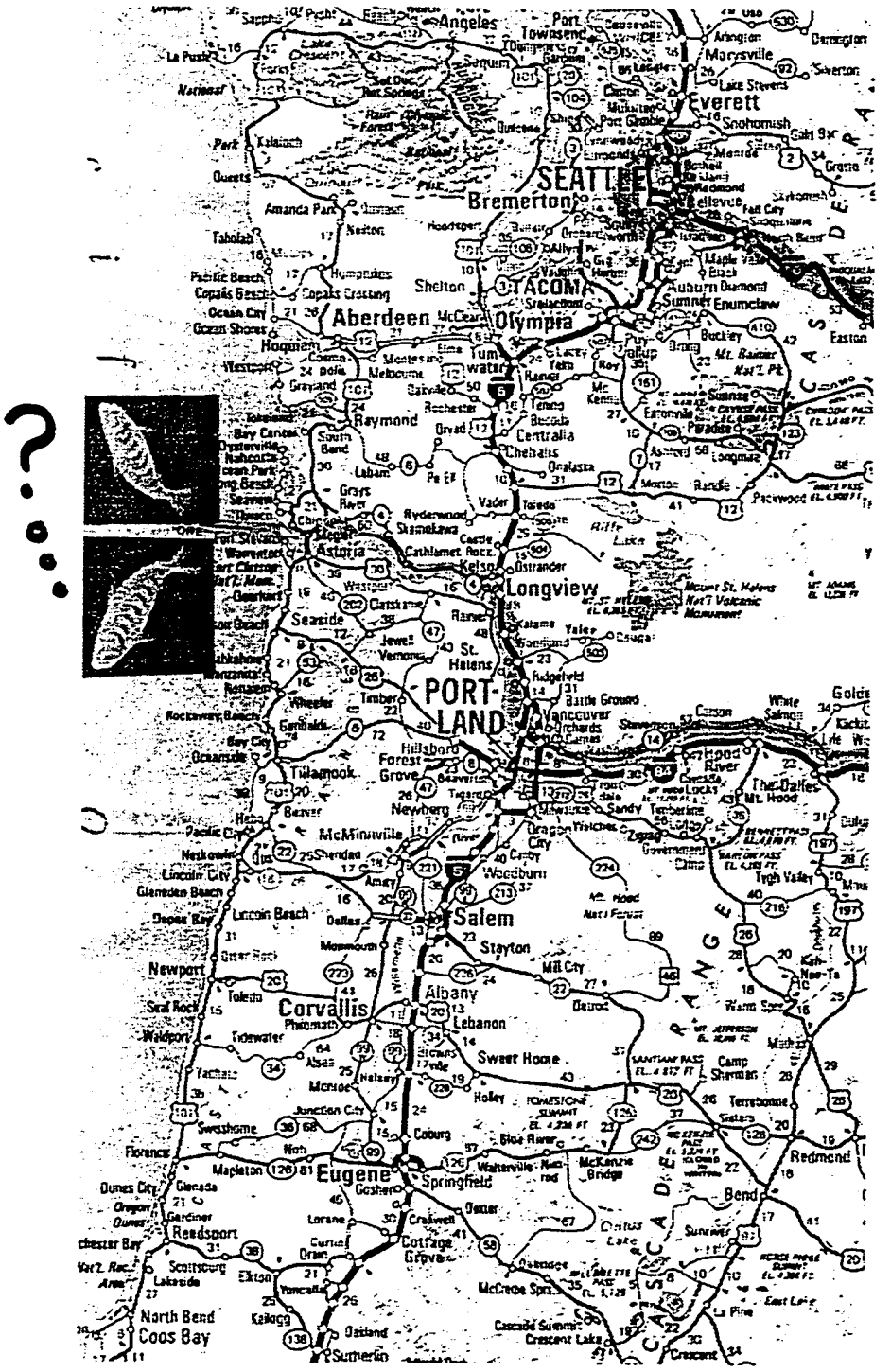



Figure 2.1 Movement of Salmon Through the Pacific Northwest.

As I described in the beginning of this chapter, barges and trucks are also used to move salmon down the rivers in an effort to bypass the dams. Each barge has the capacity to haul 50,000 pounds of smolts, and the five fish tankers the Army Corps of Engineers uses can haul 1,750 pounds of smolts (Mighetto et al., 1994, p. 122). The use of these barges and trucks has become an important part of salmon management over the decades. In fact, the whole infrastructure that has been developed along the Columbia River-- the hatcheries, the fish ladders, the barging and trucking system-- is an elaborate system of technology that has structured the institutionalized field of action around salmon since the middle part of this century.

I should point out that the meaning of salmon as a cultural icon of the people of the region was not completely lost during this time; it was just overshadowed by other interests. Historian Richard White explains:

> Responsibility for Columbia salmon in the immediate postwar years fell largely to the Washington Department of Fisheries, the Oregon Fish Commission, the U.S. Fish and Wildlife Service, and the Bureau of Indian Affairs. They were no match for the Army Corps of Engineers, the Bureau of Reclamation, and the BPA. And as if all these difficulties were not enough, the mystique of salmon, its noneconomic value, was initially diluted by its very abundance. Salmon had declined in the 30's and 40's, but they had, ironically not declined enough to excite widespread *public* alarm. In the 1930's, W.H. Rich, Director of Research for the Oregon Fish Commissioner, argued that the salmon were worthy of "consideration far beyond their immediate economic value", but his pleas largely went unheeded. The meaning of the salmon remained opaque, scattered among many scaly bodies; it became clear only as it became concentrated in the fewer and fewer salmon who remained. This would take years. And in the meantime, fishery interests took another stance. They made the fishery seem

> a purely technical problem in a largely economic enterprise. Managers, canners, and commercial fishermen defined salmon as "capital" (White, 1995, p. 93).

It was not until the ideologies espoused by the wider environmental movement and conservation biologists specifically, that the traditional cultural meanings of salmon as well as the newer ecological meanings gained more prominence in the wider public and ended up transforming the salmon arena.

## DAMS AS NON-HUMAN ACTORS

In many ways, the dams and the operators of the dams were "reluctant participants" in the salmon arena because, if left to their own desires, they would not have chosen to expend energy in dealing with issues related to salmon. There were other interests that were operating in the arena at the time, such as the commercial fishing industry, that held enough power to draw in these participants and influence their actions. In turn, the inclusion of these participants ended up influencing the shape and texture of the arena. As I will discuss in Chapter Five, the actions taken by these actors created important legacies and sources of inertia in the arena that would influence future action. It is important to highlight the world of the dams as a "going concern" that shapes action within the salmon arena. At time one, dams were involved in the salmon arena only tangentially, as dam operators responded to scientific requests for building hatcheries, fish ladders, and barging systems to help mitigate the losses of salmon traveling through

their path. However, because dams are large, expensive structures to build, they became institutionalized as part of the salmon problem.

The dams were built by the U.S. government at a time when labor was cheap and inexpensive electricity helped foster economic growth in the Pacific Northwest. The Columbia River Basin now has 19 major dams. Combined with the more than five dozen smaller dams, this constitutes the world's largest hydroelectric power system (Lee, 1993). Because the dams ended up blocking fish passage along the rivers, by the late 1970's, the salmon runs of 10 to 16 million in the pre-industrial era had dwindled to 2.5 million (Lee, 1993). The hydropower industry was reluctantly brought into the salmon arena at this time with the objective to make up for the losses of fish for the harvest. Scientists, at this time fish biologists working within academic institutions, believed that they had the answer to the dam problem by researching the construction of hatcheries. Government agencies were created to help manage the mitigation attempts (hatcheries, barging, trucking, fish ladders) to correct for losses of fish.

While there were several smaller attempts to manage the conflicts between the hydropower industry and the commercial fishing industry over the declines in fish populations, the most significant negotiation that occurred during the time of arena one was the passage by Congress of the Northwest Power Act (NPA) at the end of 1980. The centerpiece of the new process was the Northwest Power Planning Council (NPPC).

The stated goal of the NPA was "to provide effective procedures and authorities whereby fish and wildlife of the Columbia River Basin will be treated *on a par with power needs and the other purposes* for which the hydroelectric dams of the region were built and are operated and maintained" [Section 4(h) (H.R. Rep. No. 976, 96th Cong., 2d Sess. 49,50,56-57 (1980). Cone & Ridlington, p. 256]. The Bonneville Power Administration (BPA) and other Federal agencies responsible for managing or operating the hydro facilities on the Columbia and its tributaries were expected to protect fish and wildlife that were impacted by the dams.

The NPPC was created to study and implement this directive. Their job was to negotiate with the fish and wildlife agency, tribal organizations, and the public to construct a program that would protect fish and wildlife by providing plans for mitigation techniques and fish and wildlife enhancement projects (Cone & Ridlington, p. 256). These programs were to be implemented in such a way as "to assure that the Pacific Northwest region would continue to have an adequate, efficient, economical, and reliable power supply" (Pacific Northwest Electric Power Planning and Conservation Act, Pub. L. 96-501. Cone & Ridlington, p. 258).

> Congress also established a number of criteria the program was to satisfy, including (1) complementing existing and future activities of regional fish and wildlife agencies and tribes, (2) demanding the best available scientific knowledge, (3) treaty rights, and (5) providing improved salmon survival at dams and salmon flows of sufficient quantity and quality to meet sound biological objectives. Some five months after the NPA was signed into law, a coalition of the region's fish and wildlife agencies and tribes submitted over seven hundred pages of recommendations to the council, including

> increased river flows, improvements in fish bypass at dams, habitat protection and respiration measures, and hatchery facilities. In November 1982, the council used those recommendations as the basis of its Columbia Basin Fish and Wildlife Program (Cone & Ridlington, p. 263).

The NPA and its fish and wildlife program dramatically changed salmon law and policy. There were now to be continuing interaction and negotiations between those who were trying to maintain salmon runs and those held responsible for contributing to their decline.

> Formation of the NPPC created an open regional forum where trade-offs between hydropower and salmon, as well as other restoration issues, such as the feasibility of relying on hatcheries to supplement wild stock runs, were discussed...
>
> Its' systemwide focus created a new institutional framework in which federal and state agencies with varying missions were encouraged to act cooperatively to help the program achieve its goals, which included a doubling of the Columbia's salmon (Cone & Ridlington, p. 263).

The hydropower industry, the associated hatchery organizations, and other organizations that were in charge of mitigating losses of salmon through technological fixes were now firmly embedded in the salmon arena. However, despite this effort to remedy what were seen as problems with salmon at the time, several scholars have noted that the NPA and the NPPC program "promised more than they delivered" (Cone & Ridlington, p. 264).

> For one thing, the act's limited scope – it focused on the hydroelectric system while overlooking harvest regulation, federal

> land management, and state water law – made a comprehensive approach to salmon restoration impossible...
>
> The real Achilles heel of the fish and wildlife program lay in "the water budget." The council had rejected the fixed flows suggested by the agencies and tribes and instead adopted a water budget that dedicated a volume of water to help facilitate downstream salmon migration during spring. However, the amount of water dedicated to salmon on the Snake River was not as large as the agencies and tribes recommended because the council wanted to ensure reservoir refill. The council also rejected establishing a budget on the lower Columbia, limiting the budget to the upper Columbia and the Snake. The water budget was regularly unmet (p. 264).

Many believed that salmon were far from being treated "on a par" with other purposes such as electricity generation and irrigation. The conflicts with other industries such as agriculture, logging, and real estate development had not even begun. The voices on the side of salmon had not gained enough power to mobilize allies into the arena. As scientific knowledge about the needs of salmon increased, these industries would be drawn into the arena of activity and cause the repertoires of behavior of actors within the field to significantly change.

## LANDSCAPE OF ACTIVITY DURING TIME ONE

Figure 2.2 is an illustration of the actors and interactions that characterized the salmon problem as I described it here during this era. The circles indicate the social worlds I have described as actors within the arena at this time. The lines represent the interactions between the social worlds. The straight lines are intended to indicate direct influence of one organization over another, while the curvy lines indicate that conflict and

negotiations characterized these interactions. I have labeled the figure "Humans Managing Salmon" because of the focus on managing salmon for the benefit of humans. Salmon were powerless in many ways at this time – technological non-human actors – being manipulated for the needs of the human economy.

However, although the intent at this time was to maintain the stocks so that the fishing industry could continue, the numbers of fish continued to plummet despite all of these mitigation efforts. On February 2, 1998, the Seattle Times reported:

> More than $3 billion has been spent to revive dwindling Columbia Basin salmon. Yet fish runs continue to plummet.
>
> Fish are tracked with sonar, radio tags, microchips, and even balloons embedded in their fins. They are drugged and sorted counted and studied, managed, propagated and shipped in barges, pickups, and tanker trucks.
>
> Gun-toting fish cops with heatseeking radar have patrolled the Columbia from the air and on the ground for poachers and habitat vandals. Hundreds of millions of dollars are being added as afterthoughts to dams.
>
> Yet, so far the only thing thriving are scores of consultants, fish managers and policy-makers who have made careers of saving the fish.

We thought we knew what we were doing during this time period. Science was telling us "the best" information to maintain the stocks. Unfortunately, the salmon were not doing what we expected them to do. It can be said that this is because salmon were powerless themselves during this time and were unable to mobilize allies in support of their needs for continued existence. Callon (1985) talks about researchers and professional delegates

"speaking" for scallops in his study about the scallop fishery in St Brieuc Bay. He mentions, of course, that the scallop larvae express nothing themselves, but they end up having authentic spokespeople. There are negotiations between scallops and the researchers revolving around such questions as how many larvae can be trapped (p. 215). In this same way, we can view salmon in the Pacific Northwest as having spokespeople--commercial fishers, the tribes, and biologists, all were given a voice to the salmon, using their own perspective, to get what they want. However, at this time, these human actors were giving a voice to salmon based on what humans desire from the fish. As new types of scientific knowledge begin to develop, a new "voice" is heard. The voice of the salmon itself, viewed through the lens of conservationist biologists, but believed to be a closer reflection of the true voice.

While there were some voices who complained about the impacts of the dams, the hatcheries, and the over-harvesting of the resource throughout this era, they did not seem to have enough power to influence the type of activity that was occurring in the arena. However, as 1) the environmental movement gained influence, 2) the conservation biology profession became more prevalent, and 3) the belief system of ecosystem management became more widespread, the voices for salmon started to use new language and gain more of an audience as they mobilized allies. The next chapter explains these societal trends and how they created a major paradigm shift that called into question the entire institutionalized field of action within the salmon arena.

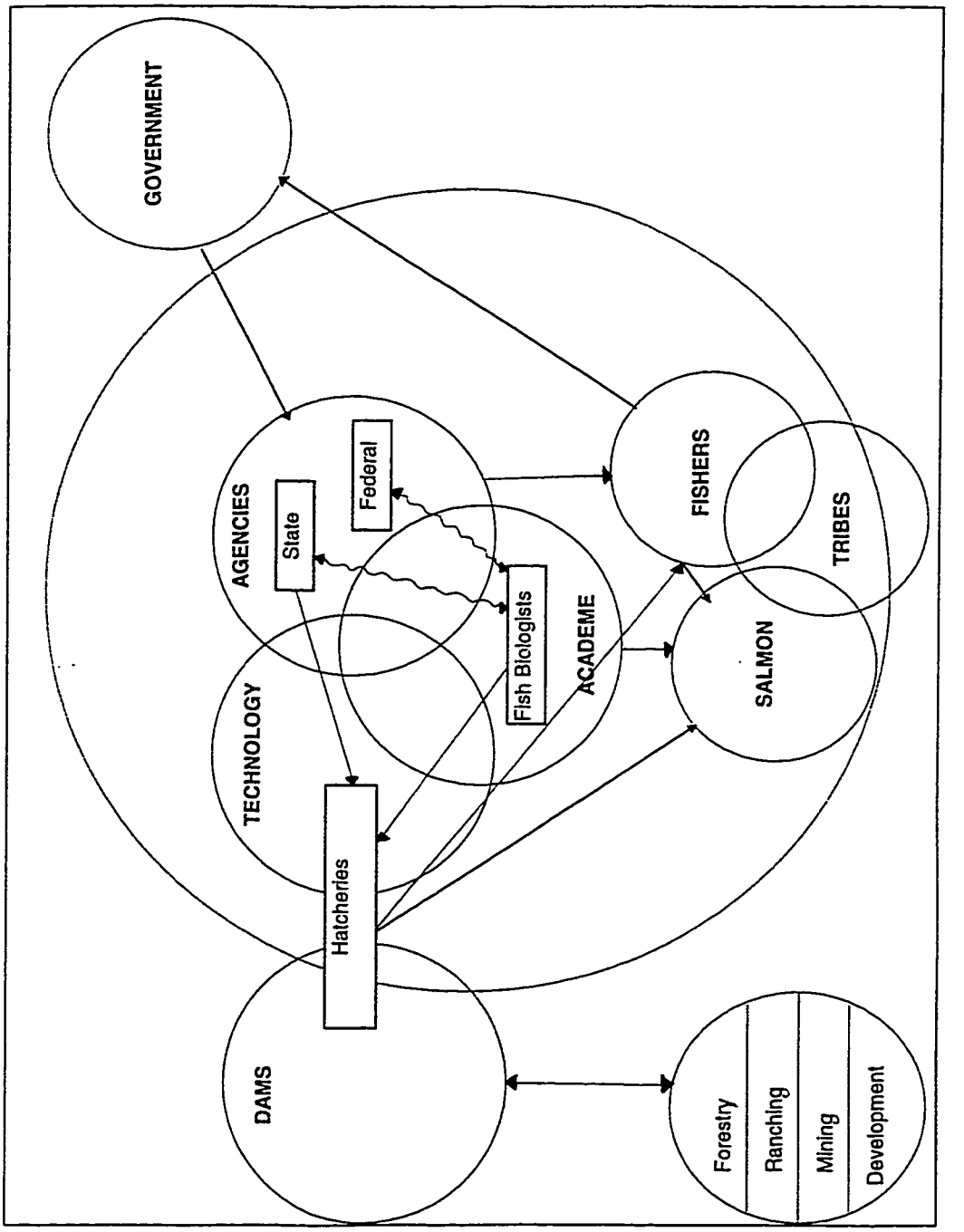



Figure 2.2 Humans Managing Salmon.

# CHAPTER 3: THE PARADIGM SHIFT

In February of 1997, the State of Oregon drafted a "Salmon Conservation Plan" in an effort to thwart a federal listing of several types of salmon under the Endangered Species Act[15]. The plan included many elements and used language similar to other plans being developed by conservation groups throughout the region:

> Effective salmon restoration programs have a fundamental requirement: They must work in concert with the salmon's strengths.
>
> The failure of half a century of restoration programs, especially those that emphasized artificial propagation, can be traced to practices that worked against the salmon's biological strengths...Forests, rangeland, rivers and salmon have the internal capacity to recover from major disturbances. They have been doing so for thousands if not millions of years. The principal role for humans in the recovery of Pacific salmon is to not interfere in the natural recovery process, but to control their own behavior in a way that lets natural recovery take place. In other words, there is a strong need for the practice of stewardship which encourages the natural healing process. There are specific things we can do to assist salmon in their recovery, but what we do must work with the strengths of the salmon (OCSRI).

The use of the words "the strengths of salmon" are indicative of a new view of salmon. A new paradigm of salmon management has been prevailing throughout the region, one

---

[15] The OCSRI was initially developed with an emphasis on coho salmon in coastal river basins since those species were under proposed listing at that time. The introduction of the plan states: The plan will expand to include all anadromous salmonids throughout the state. While the plan is focused on salmon, it also will help to conserve and restore functional elements of ecosystems that support fish, wildlife, and people. No state has ever attempted such a comprehensive program.

that attempts to take more seriously the needs of the fish. It is common to hear conservation biologists say, "we need to take the perspective of the salmon." In many cases, this style of management is still in its conceptual phase and, as I will describe in Chapter Five, organizations that are attempting to take action under these new concepts are struggling against old institutional barriers.

The other concept that is crucial to this new paradigm is "letting natural recovery take place." Proponents of this new style of management argue that the role of humans should be to give freedom back to salmon (Scarce, 1995). However, this does not mean relinquishing all control over the management of the resource. As the excerpt from the Oregon plan describes, humans should control their own behavior in order to let the natural healing of salmon stocks proceed. This "controlled freedom" suggests the irony of "natural management," where we now have more people than ever before attempting to manage salmon's freedom.

In the next chapter, I explain how this new perspective has altered the field of action surrounding salmon. Salmon have mobilized allies so as to give them the power to demand that changes be made to many of the activities of industries and citizens in the region. In effect, salmon can be perceived as "managing" humans. They are now ecological non-human actors whose repertoire of behavior, and the rules they follow to sustain themselves, have become clearer to scientists. These new rules suggest a different repertoire of behavior for human activity to follow in relationship to salmon. How did this change come about? How did groups who claim to take the perspective of

the salmon gain enough power to begin to influence human activity on a broad scale? In this chapter I discuss two overlapping trends that developed in the broader intellectual and cultural arenas, which helped to contribute to a new climate of opinion surrounding natural resource issues. First, I analyze how the beliefs espoused by the larger environmental movement get reflected in the salmon world. Secondly, I examine the rise of conservation biology and the development of a concept known as "ecosystem management." I argue that the ideas, strategies, and techniques fostered by these belief systems[16] provide a very different context for managing salmon. As we will see in the next chapter, this paradigm shift acts as the stimulus for significant changes in the salmon arena.

## ROOTS OF CHANGE: THE ENVIRONMENTAL MOVEMENT AND THE ENDANGERED SPECIES ACT

The roots of what is now commonly referred to as "the environmental movement" can be traced back to the early 1800's in the United States. Although some scholars argue that environmental concern can be found as far back as in ancient Roman, Greek, and Chinese cultures (Bell, 1998, Oelschlaeger, 1991), most use Henry David Thoreau's writings in the mid-1880's and Aldo Leopold's conservation work in the early 1900's, as the main legacies to contemporary environmental concern in the United States. Most people

---

[16] I hesitate to call these "social movements" because they encompass more than what is typically considered to be a social movement. For example, ecosystem management techniques are taught in university courses, and researched and implemented by governmental agencies.

recognize Rachel Carson's publication of *Silent Spring* in 1962 as the spark that ignited the modern environmental movement (Kline, 1997). There is much to say about the beliefs, strategies, and tactics of environmentalism and its associated organizations. I will discuss only those that are crucial to understanding the story of salmon: the legal strategy of the Endangered Species Act (ESA), and the beliefs of deep ecology and protecting the earth for future generations.

Most of the early activity of the contemporary environmental movement centered on the issues of air and water pollution. The Clean Air Act was passed in 1970, followed by the Clean Water Act in 1972. The piece of legislation that is crucial to the salmon story is the Endangered Species Act (ESA) passed by Congress in 1973. The ESA mandated that federal agencies use the most current scientific evidence to list all species in danger of extinction as either "threatened" or "endangered", and to develop and carry out plans for their recovery (Kline, 1997). While preservationists had talked about the decline of species, including salmon, for decades, their voices were not heard outside of their own community. In 1973, non-human species were finally given a "voice" by the government.

According to the ESA: "The law prohibits any action, administrative or real, that results in a 'taking' of a listed species, or adversely affects habitat". The issue of protecting habitat in order to protect the species has been at the foundation of many conflicts surrounding listed species. Protecting individual animals is one thing, but protecting large land masses in which the species live expands the scope of the problems. The

example of the spotted owl in the logging regions of the Pacific Northwest provides an illustration of how the focus automatically expands from saving a specific creature to protecting a wider habitat. That is, in order to protect the spotted owl, we need to protect the places they live, which scientists found were primarily old growth forests. Scientists found that the spotted owl needs an extensive territory of old growth forest to survive successfully. Once listed as an endangered species, their habitat needed to be protected and, thus, severe regulations on the region's logging industry were put into place. The federal government restricted logging in a 2,000-acre radius around known spotted owl nests, required that at least 500 acres of the largest trees in that zone be left uncut, and prohibited logging within 70 acres of a nest. The spotted owl controversy, characterized by intense conflicts between environmentalists and loggers, provides another example of how new scientific knowledge of biology and ecology translated into a transformation in an institutionalized field of action.

"Deep Ecology" is the name of the worldview held by the more radical side of the environmental movement. Many of those who fought for the ESA and many activists within environmental organizations today continue to espouse the beliefs of deep ecology. The term "deep ecology" was coined by Arne Naess in an "attempt to describe the deeper, more spiritual approach to Nature exemplified in the writings of Aldo Leopold and Rachel Carson" (Devall & Sessions, 1985). According to Devall and Sessions:

> Ecological consciousness and deep ecology are in sharp contrast with the dominant worldview of technocratic-industrial societies which regard humans as isolated and fundamentally separate from the rest of Nature, as superior to, and in charge of, the rest of creation. But the view of humans as separate and superior to the rest of Nature is only part of larger cultural patterns. For thousands of years, Western culture has become increasingly obsessed with the idea of *dominance:* with dominance of humans over non-human Nature (1985, p. 66).

Deep ecologists believe this view of humans as dominant over nature (anthropocentrism) has been the cause of much of our degraded environment, and therefore at the root of many of our environmental problems. If we are to ever make progress in solving the environmental mess we have created, we need to view ourselves, as humans, as just one element in the complex web of life on this planet (non-anthropocentrism). If we take seriously the needs of other animals and the ecosystems on this planet, then we will know how to alter our behaviors to be less selfish to our own needs and protect the larger, natural world.

Another important belief that emerged from the environmental movement that plays a large role in the salmon arena is the notion of "protecting the earth for future generations." There is general agreement among the environmentally concerned that the clean air, water, and many of the plant and animal species that inhabit the earth today should be around for our children and for our children's children. Social historian Richard White, describes an experience he had while visiting Ice Harbor Dam on the Snake River. He saw fish everywhere, but they were carp and shad, not salmon. The

river had been altered too much to sustain salmon runs. Electricity, lumber, cattle, and fruit have taken precedence over salmon (1995, p. 90). He goes on to say that:

> Paradoxically, even in their decline, salmon remain culturally as powerful as when they passed upriver in a flood of abundant life. They are repositories of meaning. People still desire salmon. Salmon symbolize nature in the Pacific Northwest; the experience of taking them has become a quintessential Northwest experience. Salmon are not just fish on the Columbia; they are tokens of a way of life.

In a documentary[17] filmed about the Columbia River, Richard Steele, a nuclear engineer, talks about the value of the Hanford Reach area along the river. This stretch of river is public land owned by the federal government and has been protected for decades. It is some of the most important spawning grounds left for fall Chinook salmon. Steele argues:

> You know, this is public land, we're not taking this land away from anybody cause we already own it. It's the people's over in Seattle, the people in Oregon, we all own this land and we need to protect it for the future generations.

These beliefs about non-anthropocentrism and protecting the earth for future generations (an anthropocentric value) began as central tenants of environmental movement activists and now have found their way into other segments of society: mainstream values of citizens and the policy world. In their book *Environmental Values in American Culture*, Kempton et al. (1995) found that concern for the future of children and descendents (intergenerational equity) emerged as one of the strongest values in the interviews they

---

[17] *The River: its people, history, and beauty.* KCTS, 1996.

conducted with American citizens, even for those without children of their own. The discipline of conservation biology and the concept of ecosystem management are two examples of how these environmental values have been translated into the academic and policy worlds.

## CONSERVATION BIOLOGISTS CHANGE THE RULES

The field of conservation biology is over a decade old. There are a growing number of universities that are developing tracks of study in the discipline, typically as joint programs with biology, zoology, and environmental studies. The mission statements of the programs are adapted from that of the umbrella organization "The Society of Conservation Biology" (SCB):

> SCB is an international professional organization dedicated to promoting the scientific study of the phenomena that affect the maintenance, loss, and restoration of biological diversity. The Society's membership comprises a wide range of people interested in the conservation and study of biological diversity: resource managers, educators, government and private conservation workers, and students. The Society was formed to help develop the scientific and technical means for the protection, maintenance, and restoration of life on this planet -- its species, its ecological and evolutionary processes, and its particular and total environment.

Conservation biologists argue for the intrinsic worth of all species. Natural creatures should be allowed to move through the environment according to their own biologically programmed rules and should not be controlled and manipulated by humans.

Interestingly, this perspective gives them an ethical motivation for their work, one that most conservation biologists are proud to admit. This is somewhat unusual for an academic department. They claim that they have a responsibility to the resource and *must* be advocates for their species of interest. This perspective encourages some of them to assume the role of advocate and even activist; conservation biologists have filed Endangered Species Act (ESA) petitions requesting protection of butterflies and salmon, they have given testimony at numerous public meetings, and they have published articles in environmentalist magazines and newspapers (Scarce, 1995). This advocacy is sometimes criticized by other members of the university community and by biologists working in agencies who view the role of scientist to be objective providers of "the facts."

Conservation biologists have been successful in getting their voices heard. The SCB publishes a journal, *Conservation Biology*, which is read widely by resource managers. The perspective that they share has been very influential in the environmental community and their education efforts have spread throughout the wider society. With regard to salmon, the teachings of conservation biology have influenced groups like American Rivers and The Pacific Rivers Council (PRC). American Rivers is North America's leading national river-conservation organization with the mission of protecting and restoring America's river systems. American Rivers activists have been very active in salmon restoration efforts. The PRC recently has distributing brochures in Washington grocery stores that describe a new "Salmon-Safe" logo. This logo is placed on food and

beverages produced by growers who use conservation practices in order to maintain a healthy ecosystem.

## ECOSYSTEM MANAGEMENT PROVIDES GUIDANCE FOR NEW HUMAN REPERTOIRES OF BEHAVIOR

Conservation biologists support the use of an "ecosystem management" approach when it comes to natural resource policies. Ecosystem management is a difficult term to define and has been used to identify everything from scientifically derived beliefs held by scholars within the academic community to a "paradigm shift" that has occurred within natural resource policy circles.

Edward Grumbine has written a number of books and articles on the concept, including a brief history of the term. He explains: "Ecosystem management is a response to today's deepening biodiversity crisis" (1994, p. 28). In 1970, policy analyst Lynton Caldwell published an article advocating the use of ecosystems as the basis for public land policy. In this article he understood that to do so "would require that the conventional political matrix be unraveled and rewoven in a new pattern" (1994, p. 28). By the late 1980's, an ecosystem approach to land management was supported by many scientists and natural resource managers. Grumbine lists the following main goals of the ecosystem management perspective:

1. Maintain viable populations of all native species in situ.
2. Represent, within protected areas, all native ecosystem types across their natural range of variation.

3. Maintain evolutionary and ecological processes (i.e., disturbance regimes, hydrological processes, nutrient cycles, etc.)

4. Manage over periods of time long enough to maintain the evolutionary potential of species and ecosystems.

5. Accommodate human use and occupancy within these constraints (1994, p. 31).

Grumbine claims the first four of these goals are value statements derived from current scientific knowledge that aim to reduce, and eventually eliminate, the biodiversity crisis. The fifth goal acknowledges the vital (if problematic) role that people have to play in all aspects of the ecosystem management debate (p. 31). It is not uncommon for some of the more radical advocates of this approach to reveal deep frustration regarding the role of humans in natural ecosystems, as if humans were somehow "unnatural." Most practitioners, particularly in federal and state agencies, are not as extreme and claim that there is a way to have both sustainable natural systems and social systems.

In their report, "Ecosystem Management: Federal Agency Activities," Morrissey et al. (1994) give examples of how several federal agencies have adopted the concept of ecosystem management within their mission statements. The United States Forest Service has adapted the perspective in terms of managing a whole forest ecosystem instead of subsections within the forest:

> The Forest Service understands ecosystem management to mean using an ecological approach to achieve the management of

> national forests and grasslands by blending the needs of people and environmental values in such a way that national forests and grasslands represent diverse, healthy, productive, and sustainable ecosystems. . . the Forest Service envisions ecosystem management as a holistic approach to natural resource management, moving beyond a compartmentalized approach that focuses on the individual parts of the forest (p. 13).

The US Fish and Wildlife Service has attempted to adapt their practices to move beyond the management of individual species towards a larger web of life:

> Ecosystem management is defined in the US Fish and Wildlife Service's concept document as protecting or restoring the function, structure, and species composition of an ecosystem, recognizing that all components are interrelated (p. 73).

The National Park Service (NPS) was one of the first agencies to adopt this new perspective:

> In the broad policy arena, NPS views ecosystem management to be a philosophical approach that respects all living things and seeks to sustain natural processes and the dignity of all species and to ensure that common interests flourishes (p. 91).

And, the US Geological Survey (USGS) also advocates this perspective:

> Effective ecosystem management recognizes the importance of understanding how each of the living and nonliving parts of an ecosystem contributes to, and is affected by, the health of the whole system. The scale of a managed ecosystem depends on the resources at issue, their role in the whole system, and the variety of natural and human influences affecting the system (p. 99).

The environmental movement succeeded in spreading the values of non-anthropocentrism, intergenerational equity, and the importance of biodiversity into the scientific, academic, and policy worlds. These ideas were also starting to find their way

into the language of mainstream citizens as well. Strong, credible scientific evidence of an "environmental crisis", as evidenced both in this country and in other developed nations around the world[18], is the spark needed to set in motion a field of activity.

## THE LIGHTNING ROD

Although some segments within the salmon arena had worried about declines in runs for several decades, there was little attention paid to the issue by the wider public until the 1980's. By this time, the environmental movement had made people aware of degrading ecosystems and values such as "protecting the earth for future generations." The academic subdiscipline of conservation biology was gaining popularity within universities, and computer technology had improved in such a way as to allow for more comprehensive scientific studies of the natural world over larger spaces and covering longer periods of time. The stage was set for the work of three biologists to initiate a movement that would radically alter the salmon arena.

---

[18] (From the documentary *Green Plans)* "As is always the case elsewhere, it took an environmental disaster to stir environmental awareness in average Dutch citizens. In the mid-1980's, seals began mysteriously dying off the North Sea coast. Some believed that environmental disaster was finally hitting Holland. What Dutch citizens could only sense, Dutch scientists were able to document. Scientists at the National Institute for Health and the Environment, an independent agency that monitors Northern Europe's air, water, and soil released a landmark report in 1988. 'Concern for Tomorrow' stated that Holland would have to reduce pollution by 80% and dramatically cut back on use of resources or the Dutch environment would deteriorate dramatically. In 1989, some of Holland's best thinkers drafted a document 'National Environmental Plan,' commonly referred to as the 'Green Plan,' which set in motion great changes in the way industries and citizens in Holland went about their business."

Three biologists, Willa Nehlsen, Jack E. Williams, and James A. Lichatowich, published an article in the journal of *Fisheries.* In a book that documents the Northwest salmon crisis, editor Joseph Cone writes:

> Publication of an article in a professional journal rarely creates much stir outside the circle of professionals whose own work it touches. Sometimes there is little even to stir that group. Such was not the case with the March 1991 publication of 'Pacific Salmon at the Crossroads' in *Fisheries,* the journal of the American Fisheries Society (AFS). The article created an immediate sensation, not only within the fisheries profession but in the wider public and political realms (Cone, 1996, pp. 295-296).

When asked when the wild salmon "crisis" began, most of the people I interviewed answered "when the 'Crossroads' article was published." The article provides a list of depleted salmon, steelhead, and sea-run cutthroat naturally-spawning (wild) stocks from California, Oregon, Idaho, and Washington. The news was not good. There were many species at risk. The authors explain:

> The declines have resulted from habitat loss and damage, and inadequate passage and flows caused by hydropower, agriculture, logging, and other developments; overfishing, primarily of weaker stocks in mixed-stock fisheries; and negative interactions with other fishes, including nonnative hatchery salmon and steelhead. While some attempts at remedying these threats have been made, they have not been enough to prevent the broad decline of stocks along the West Coast (Nehlsen et al., 1991, p. 4).

Wild salmon, which once numbered more than 8-10 million returning adults in the Columbia River basin alone, have declined to less than one-tenth that number up and down the coast of the Pacific Northwest. They have disappeared from about 40% of their

historical breeding ranges in Washington, Oregon, Idaho, and California over the last century, and many remaining populations are severely reduced. Most runs that appear plentiful are largely composed of fish produced in hatcheries (NRC, 1996). The NRC publication *Upstream* describes the "Crossroads" article as follows:

> Nehlsen et al. (1991) identified 214 salmon stocks as being at risk of extinction and over 100 populations as being recently extinct in Washington, Oregon, Idaho, and California. The report was based on admittedly incomplete data, but it pointed out the widespread nature of salmon declines and the seriousness of the current problem. Although several populations already have been petitioned for protection under the Endangered Species Act when the report was published, public interest in the "salmon problem" was heightened greatly by its appearance, and various state and federal agencies rapidly began to develop management plans to address the conservation needs of potentially listed populations. Nehlsen et al. (1991) also catalyzed efforts to assess further the current condition and causes of declines of salmon (p. 77).

While rumblings had been going on for years, the publication of this article was the lightening rod that provided the scientific evidence to allow salmon, now perceived as ecological non-human actors and indicators of healthy ecosystems, to mobilize allies in support of their continued existence. The field of action surrounding salmon began to expand rapidly. The "salmon problem," which for many decades had been defined as the difficulty in maintaining and creating enough fish for the commercial, recreational, and tribal fishery was now re-defined.

The "salmon problem" is defined by conservation biologists as the decline of wild salmon runs and the reductions in abundance of salmon even after massive investments in

hatcheries and other mitigation techniques have been in place for decades. Scientists claim the declines are largely a result of human impacts on the environment caused by activities such as forestry, agriculture, grazing, industrial activities, urbanization, dams, hatcheries, and fishing. Because salmon travel through the same regions people live, rapid economic development and population growth in the region have been found to contribute to widespread declines in their abundance. The decline of any specific run has its own combination of causes, and they are exacerbated by the unusual, anadromous life cycle of Pacific salmon. Ecologists now know that salmon require high-quality environments that run from mountain streams through major rivers to the ocean. These biophysical characteristics of salmon are now commonly seen as crucial to the sustainability of wild salmon runs. Management of the salmon resource is no longer focused solely on the fish, but now includes its broader ecosystem. As the geographic scope of the problem expanded to coincide with this new knowledge, the salmon arena expanded to include a diverse array of actors who were to follow new rules of behavior when it came to managing the resource.

In the next chapter, I explain how this re-definition of the salmon problem becomes institutionalized into a field of activity that looks very different in many ways from the one I described in Chapter Two. Since many of the rules have changed in terms of interacting with salmon, many of the old repertoires of actor behavior within the organizations in the arena are called into question. In Chapter Five, I explain how the legacies, or patterns of behavior, that carry over from arena one make it difficult for real

progress to be made in recovery of the stocks as prescribed by the new scientific knowledge.

# CHAPTER 4: HOW SALMON MANAGE HUMANS

At the conference "Towards Sustainable Fisheries: Balancing Conservation and Use of Salmon and Steelhead in the Pacific Northwest," held in April, 1996, in Victoria, British Columbia, Jack Donaldson, a retired member of Oregon Department of Fish and Wildlife told the following story:

> When I graduated from college way back in the late 40's, I remember being employed by Fish and Game, going out to the streams and pulling the woody debris out. At that time we thought that what the salmon needed was a clear passage to the ocean. Now, fifty years later, we have people going out and putting the woody debris back into the streams.

He went on to explain that now scientists claim to "really know" what the salmon need. It is a river that approximates what might be its "natural" state. At the time when Donaldson was first employed by the Department of Fish and Game, rivers had been considered to be "littered" with stray logs and pieces of wood that entered into the waterways either from logging operations along the banks, or by natural erosion that caused trees and branches to fall into the streams. Young resource managers were employed to go out into the rivers and streams and clear out this debris so that salmon would not be impeded in their journeys to the ocean and back to their spawning grounds.

Now, decades later, new scientific knowledge "discovered" by conservation biologists reveals that woody debris in rivers actually provides nutrients to the water as it biodegrades. Woody debris also helps provide shaded areas within the rivers, creating

cooler water places that salmon like to go to rest, hide from predators, and to spawn. Because this type of habitat is believed to be the natural habitat that salmon were always used to, resource managers are taking steps to recreate this scenario for the fish as best as they can. Thus, people are employed to put the debris back into the rivers. In addition, there are manufacturers reproducing simulated woody debris for watershed areas that have had forested areas along the river banks clearcut. In these cases, watershed restoration groups are purchasing woody debris to put into the streams in an effort to rebuild the "natural" state of the waterway. In an interview with a policy expert, I was told that there is a handbook on "Boutique Stream Design" that provides details on how to "reconstruct nature" in a watershed area.

This story is an illustration of how the rules of management of the salmon resource have changed. Those in charge of creating and implementing strategies for managing salmon are now operating under the premise that salmon need their "freedom": freedom to move through their life-cycles in what scientists argue is their "natural" environment. The concepts and policies of ecosystem management have created many new rules of action within the salmon arena that center around what scientists perceive to be the needs of salmon. For those who work within organizations that in some way intersect with the salmon world, these new rules do not make a lot of sense to them in relation to their standard repertoire of behavior.

In this chapter, I explain how the activities of the principal actors involved in managing salmon during the contemporary era are expected to follow new rules than they did

during the time period I described in Chapter Two. In many ways, salmon have gained power, or at least those who claim to speak for salmon have gained power, and much of the institutionalized field of action is proceeding as if the salmon are beginning to "manage" humans. As part of this process, the biophysical environment has been redefined from something that can be "conquered" to something that should be managed with respect. Many proponents of the ecosystem management perspective argue that we should be striving towards letting nature "do its thing" as best we can, while monitoring her activities – controlling the chaos so to speak. The sections that follow parallel those in Chapter Two and describe how harvest policies, technology, and cultural practices are struggling to change in order to reflect the new understanding of salmon after the paradigm shift.

## SCIENCE SUGGESTS NEW FORMULA FOR MANAGING THE HARVEST

In his chapter on harvest management in the book *Pacific Salmon & Their Ecosystems* (Stouder et al. 1997), Philip R. Mundy explains how the current perspective on managing the harvest of salmon is more about shaping human behavior than controlling salmon:

> Natural resource management is an often humbling exercise in shaping human behavior to enable the persistence of those parts of our ecosystem that we all exploit. In salmon fisheries management, I am constantly reminded that we do not manage fish, we manage people (p. 315).

Salmon and their habitat provide the rationale for managing human activities. This is a very different motivation than in the previous era when the dominant motivation was to

manage salmon for the interests of humans. One aspect of managing humans in this current scenario means changing the rules that govern the repertoire of behavior of fishers in the commercial and recreational fishery. The policy technique that has been relied upon for decades, maximum sustained yield (MSY) has been called into question as new scientific knowledge has emanated from those who study biodiversity issues using an ecosystems perspective.

The authors of *Upstream* (1996) point out several limitations of the MSY model to management of the salmon harvest that have contributed to the inability of resource managers to actually maintain a sustainable level of salmon:

> • The estimation of the biological production function in a highly variable natural environment.
>
> • Differences between populations and change within populations over time.
>
> • The necessity for accurate data on total fishing mortality by age and population over all fisheries, on number of spawners by age, and on future production (p. 277).

There is an extensive literature on the mathematical details of why the MSY model does not work well. For the purposes of this chapter, it is necessary only to understand the theoretical reasons. As stated above, the MSY model was originally constructed without taking into account the variation in the natural environment. Once the quota for the number of salmon that could be caught in the fisheries was set, it did not change much from year to year, and certainly not within the year. This practice did not take into

account events like floods or fluctuations in ocean temperatures that vary from year to year, or throughout the year, that can have an impact on the number of salmon that return to, or are needed to return, to their spawning beds. In essence, salmon were viewed as a commodity that could be managed to provide the maximum benefit for human economies without much regard for their interconnectivity to the rest of the ecosystem.

In terms of differences between and within populations, harvest management policies assumed that runs of salmon were all fairly similar in their level of productivity. Scientists then discovered that there was actually a large variation in how many salmon survive throughout their cycle depending on the conditions of the rivers, types of predators, and biological differences in reproductive behavior. With the infusion of ideas about the importance of maintaining biodiversity within the salmon fishery, managing the number of salmon as a whole has become less important than managing the individual subspecies of salmon.

Obviously, it is difficult to put into place a specific numerical figure as to the number of salmon overall, and the number of subspecies that can be caught during a season in order to maintain a sustainable number of fish. This is particularly true in "mixed stock" fisheries, where more than one species of salmon are swimming together in the same place at the same time. For example, commercial fishers may harvest a net full of salmon, some of which were raised in hatcheries, while others were born in the wild. Hatchery-raised salmon have a much higher productivity level since humans can control the number of salmon that are reproduced. As stated in *Upstream* (1996), "if fishing

responds to apparent abundance without consideration of the stock composition (proportions from hatcheries vs. from the wild) or if fishing levels are based on hatchery production, the natural population will be overfished and its production will, on the average, decline" (pp. 281-282). On the other hand, if the harvest level was set to sustain natural/wild populations, then there would be a surplus returning to the hatchery. Those fishers who depend on this hatchery harvest for their livelihoods have argued that this technique would be a poor option.

The third limitation revolves around the issue of data collection. If managers are to abide by the beliefs of conservation biologists who argue that we need to maintain a diverse population of salmon in order to sustain the species, then harvest levels have to include the estimated number of fish in as many runs as possible. Obviously, this makes setting harvest levels very complex and time consuming. A large number of people and resources have to be involved in counting fish and estimating run sizes. How ironic that this new style of management of giving salmon back their freedom has more people than ever before involved in managing them.

Proponents of the ecosystem perspective have made it clear that management of the salmon harvest needs to take into account several new assumptions, including 1) salmon are a component of ecosystems and they exist in a dynamic evolutionary process; 2) productivity varies among populations and over time; and 3) the sustainable harvest rate is a function of a population's productivity determined over all life phases of the salmon (NRC, 1996, p. 293). Those experts who are working on plans for management of the

harvest under this "new paradigm" are recommending that MSY models be replaced with what they are calling MSE (minimum sustainable escapement). These models are more conservative than MSY models and take into account more variables:

> Estimates of MSE should ideally include information about the composition of spawning populations, the maintenance of connections between salmon demes (local subspecies), the role of carcasses as nutrient sources for freshwater ecosystems, intraspecific competition in reproduction, mate selection, and gene flow (NRC, 1996, p. 295).

In other words, the goal of setting harvest levels should be to find an optimum number of salmon that can be caught while maintaining an environment that seems to meet the needs of the fish. This strategy requires more sophisticated data collection and modeling techniques than those that have been used to set harvest levels in the past. The implementation of this model would involve changing the rules of behavior of those who work within the agencies that set harvest levels. As I explain in Chapter Five, it is difficult to make these changes in policy tools when MSY models have been the norm for decades.

## ECOLOGICAL NON-HUMAN ACTORS DRAW IN MANY ASPECTS OF LOCAL CULTURE

The following is an excerpt from the New York Times, Sunday, April 19, 1998. The headline reads "Meet the Fish that Might Save Seattle":

> While the Endangered Species Act, the most powerful environmental law in the land, may have been created to save

> salmon, owls, and butterflies, many policy makers are now arguing that it may really be about saving *us*, the dominant species.
>
> As Seattle Mayor Paul Schell put it, in a bit of a political haiku, 'Ironically, as we work together to save the salmon, it may turn out that the salmon saves us.'

The article goes on to say that the salmon may do for Seattle what the striped bass did for New York City: check unbridled urban development. The words that are used give the perception that salmon have taken charge: they have now taken center stage in the arena and have gained power to influence other social worlds in ways they had not before the paradigm shift. In an interview on a NPR broadcast in March, 1998 regarding the proposed Endangered Species Act listing of several stocks of salmon, King County Executive Ron Sims noted "people don't realize yet the impact of the proposed listing...we have to re-engineer all our agencies for what's important for the fish."

Salmon have always played an important cultural role for people in the region. For most of this century, they were perceived as contributing to the economies of fishing communities, as part of a good-tasting meal, and as magical-looking creatures that could be viewed at certain times of the year in their spawning beds and swimming through fish ladders. With the publication of the "Crossroads" article and its message of potential extinction for many of the subspecies, salmon have taken on new meanings. Maintaining wild salmon runs have come to be perceived as an indication of a healthy environment. The fact that many species are at risk indicates that the region is no longer as hospitable a place for salmon as it once was. Conservation biologists argue that if salmon runs

continue to decline, the people of this region will lose not only an economic and cultural resource, but will have lost a healthy ecosystem.

At the meetings where salmon policy was being constructed, I heard the following statement many times: "what we are really talking about is clean, plentiful water, healthy rivers and watersheds, not necessarily salmon.... the issue is not fish. They are a good organizing icon. The real issue is healthy watersheds, the ecosystems where fish live."[19] In a book entitled *Ecosystem Health: New Goals for Environmental Management*, edited by Costanza et al., theorists are proposing

> No less than construction of a new paradigm to guide environmental thought and action" (p. 23)... a new paradigm focusing on self-organizing systems... nature being self-organizing and about the importance of using systems theory to understand what is going on in the environment (pp. 28-29). The essence of the new, nonreductionist paradigm is to reject the assumption, implicit in the Renaissance worldview and in Newtonian mechanics, that the observer can adopt a neutral viewpoint from outside the system.

This "systems" viewpoint that makes the link between species and their habitat, where "habitat" comes to be defined very broadly to include all the people, places, and industries that are impacting the species, has served to expand the scope of the salmon problem to include a much larger field of action than before the paradigm shift.

One type of activity that has becoming institutionalized in salmon policy creation is to bring "all the stakeholders to the table" and construct a recovery plan. In all the

---

[19] Personal interview, Tom Fitzsimmons, Director, Washington Department of Ecology.

workgroups I attended where participants were trying to come up with better ways to manage salmon, everybody talked about making sure all interests were represented. Presumably this meant that a more workable solution could be found and, therefore, there would be no surprises. Indeed, all stakeholders made an effort to attend these policy-creating sessions, if only to protect their own interests as opposed to an honest desire to save salmon. For example, both hydropower companies and logging organizations such as Weyerhauser now employ experts on their staff whose job it is to deal with the "salmon issue." In an interview with a woman who was employed by Puget Power to be the point-person for salmon recovery issues, she admitted to me that she had not expected to have to learn about salmon when she was hired as a Marketing Director for Puget Power. Although she felt a little out-of-place sitting at a workgroup on fishery policy, she admitted that it was one of the best ways for her to understand the new rules of the game regarding electricity and the environment in the Pacific Northwest.

The main tool that is being used to attempt to do things differently in terms of salmon management is the Comprehensive Conservation Plan. There are hundreds of these plans housed on the desks of bureaucrats throughout the region. The Oregon Conservation Plan is one such plan, drafted in 1997 to avoid the listing of coastal coho salmon under the Endangered Species Act. A similar plan was drafted in the state of Washington to attempt to avoid the listing of Puget Sound chinook.

One of the first statements made in the plan discusses the shortcomings of past plans and states: "Past plans considered the salmon largely independent of the ecosystem and

ecological processes of the watershed, estuary and ocean. That perspective was facilitated by an emphasis on harvest and artificial propagation." This plan includes recommendations for changes in everything from logging and agricultural practices, to real estate development. As the traditional repertoires of behavior of these industries were revealed as contributing to the decline of salmon runs, actors within these organizations were brought into the field of action. For example, property owners who have land along river banks inhabited by threatened salmon runs are given incentives by local government to refrain from the use of fertilizers and to plant vegetation along the banks in order to stop erosion of the soil into the waterways.

One of the main organizational tools that have been introduced into the new style of management of salmon is the use of "Watershed Councils[20]." These councils attempt to take the perspective of what the salmon need and organize people accordingly. Presumably, since these groups would include stakeholders that are in close proximity to each other geographically, they have more motivation to work together. This compulsion to work together results in an institutionalized field of action characterized as "Salmon Managing Humans." Watershed Councils are excellent illustrations of how human activity is being re-shaped by the current biological knowledge concerning what the salmon need. At many of the conferences I attended on re-structuring salmon policy, the

---

[20] A "watershed" is the ridgeline or elevation contour that delimits drainage basins or catchments. The catchment is bounded by the watershed, and since water flows downstream from the watershed through the catchment, thereby integrating influences of natural and human disturbances within the catchment, scientists use the watershed as an important unit of analysis in the natural ecosystem (Stanford and Ward, 1992).

watershed council concept was being proposed as a new institutional form to replace the reliance of management by state and federal institutions. Watershed councils take seriously the ecological boundaries of salmon's life cycle as opposed to following the jurisdictional boundaries of counties, states, and nations. The following strategies regarding the theory behind the use of watershed councils as management tools are taken from a report by the Sustainable Fisheries Foundation, "Towards Sustainable Fisheries: Building a Cooperative Strategy for Balancing the Conservation and Use of West Coast Salmon and Steelhead Populations":

> Watershed Councils should be formed for the specific purpose of developing scientifically credible management plans and environmental standards whose focus is the local watershed.
>
> Equating watersheds to management units has both theoretical and practical value because salmon populations often segregate by drainage and, more fundamentally, the movement of water and matter is usually confined by gravity to the watershed. This makes it easier to monitor stock abundance, assess terrestrial, riparian, and aquatic impacts, and develop appropriate management prescriptions.
>
> Watershed Councils would be staffed by local citizens, representatives of major stakeholder groups, and by representatives of appropriate government agencies (1996, pp. 56-57).

The focus on the watershed as the unit analysis for strategic policy planning and the use of Watershed Councils to develop plans, have become standard implementation tools in several areas of the region. The process of creating these plans has brought once disparate groups into negotiations in an effort to maintain salmon runs. Of course, many

of these groups have their own interests in mind, and often salmon are not their priority. Conservationists argue that changing the repertoires of behavior of these stakeholders to be more in line with what scientists are now claiming are the needs of salmon, is one of the critical barriers to salmon restoration. I discuss some of the details of these struggles in the next chapter. Indeed, salmon, as ecological non-human actors, have succeeded in mobilizing both enemies and allies into a common arena of activity.

## ATTEMPTS AT MANAGING FREEDOM OF MOVEMENT

Just five years ago, one would never hear anyone talk about the possibility of removing a dam. These large structures that were costly to build were the pride of the region for decades, providing human civilization with cheap electricity, flood control, and irrigation for abundant agricultural crops. Now there is talk about breaching (removing earthen sections of dam and draining reservoirs to restore a free-flowing river) four dams on the Lower Snake River in Washington and the potential for removing one or both dams on the Elwha River on Washington State's Olympic Peninsula. The argument made by conservation biologists is that the previous mitigation techniques of using fish ladders, barges, and trucking to help salmon past the dams were ineffective. What the salmon really need is a river that they recognize. The following explanation provided by

scientists appeared in a paid supplement[21] in a late July 1997 edition of The Idaho Statesman:

> Fish ladders allow returning adult fish to migrate upstream, but the dams impede the migration of young fish downstream to the ocean. Most of the youngsters are collected and loaded into barges and trucks for a ride to the ocean. The rest face the dangerous prospects of going through turbines in the powerhouses or bypass systems or over the top of the dam. None of the technological fixes tried so far has been able to stop or stabilize salmon's slide to extinction. [After dam removal] steelhead and salmon migration would be greatly improved, and many native species would flourish in the natural river. Wildlife also would be attracted to a river environment.

Scientists argue that we need to (at least partially) restore the landscape to what it looked like before dam construction, when it was more "natural." The discussion about breaching the dams on the Lower Snake is continuing. More studies are being done, cost analyses are being run, and public debate continues surrounding the loss of electricity generation, irrigation, and flood control versus saving the salmon. The salmon (or those who claim to speak for them) have managed to open up a discussion that would have been unheard of less than ten years ago. For many of those who work within the hydropower and agricultural industries, such talk about dam removal makes no sense to them. For example, in the Idaho Statesman supplement on breaching the dams, members representing economic interests in the Tri-Cities region of eastern Washington made the following reply:

---

[21] Insertion costs paid by Clearwater Friends of Salmon, Idaho Rivers United, Sierra Club, Idaho Conservation League, Idaho Wildlife Federation, Idaho State Council of

> We read with disappointment your series of editorials that recently appeared in The Idaho Statesman regarding the breaching of dams on the lower Snake River... Those of us downriver from the Lewiston-Clarkston area rely heavily on water resources for recreational activities, irrigation water and hydroelectric power, just as do those Idahoans above the dams... River science is extremely controversial. There are many opinions about how best to revitalize the fish population, and until these debates are satisfactorily resolved, your radical solution of breaching the dams is premature and irresponsible (The Idaho Statesman, July 1997).

The conflict surrounding the removal of the dams on the Elwha River provides an illustration of the new type of negotiations over repertoires of behavior that are occurring in the salmon arena. There are two dams on the Elwha: the Elwha and the Glines Canyon. The Elwha Dam (8 km from the mouth of the river- it discharges in the Strait of Juan de Fuca) was constructed from 1910 to 1913, and the Glines Canyon Dam (about 21 km from the mouth of the river) was constructed from 1925 to 1927. The energy produced by these dams is presently used at a pulp mill in the nearby city of Port Angeles, Washington. Neither dam has fish passage facilities and therefore only 4.9 miles of the river is available for salmon spawning. The Elwha River used to be home to some of the largest chinook runs in the region, some getting as large as 100 pounds. Recently, there has been a great deal of discussion at the federal level about removal of the dams:

> In 1992, Congress authorized the secretary of the interior to acquire the dams and remove them if he determined that their removal was necessary to the full restoration of the Elwha River

---

Trout Unlimited, Kootenai Environmental Alliance, and Save Our Wild Salmon Coalition.

> ecosystem and native anadromous fisheries" (PL 102-495, Elwha River Ecosystem and Fisheries Restoration Act). A report pursuant to the act (USDI 1994) found that the removal of the Elwha and Glines Canyon Dams is the only alternative that would result... [in meeting the goals of the act]. (NRC, 1996, p.249)

Some scientists estimated that if both dams were removed, salmon runs that were once as large as 400,000 fish could return to the Elwha. Now, fewer than 4,000 return. However, because the costs of dam removal, resulting sediment management, and revegetation are so high (estimated to range from about $70 million to $240 million), only removal of the Elwha Dam is being seriously discussed. Senator Slade Gorton of Washington had originally backed the concept of removing the Elwha dam to see if salmon would return, but insisted on waiting 12 years before removing the Glines Canyon. Engineers and biologists have pointed out that waiting over a decade to remove the second dam would result in an enormous amount of sediment washing down the river and destroying the habitat that had just recovered after taking the lower dam out. They argue both need to be taken out at once. Of course, this is cost prohibitive in the eyes of the federal government – another example of the conflict between science and policy.

The conflict over the Elwha dam has brought together the U.S. government, conservationists, the hydropower industry, pulp workers, and biologists into negotiations. The controversy over dam removal illustrates the difficulties encountered when new scientific knowledge suggests new rules of management within a well-established institutionalized field of action. Some argue that by giving the fish back what they need,

human society may benefit economically as well. One of the policy analysts I interviewed pointed out:

> In fact, the Elwha dam controversy is really interesting because it really raises all these issues in a way. You look at that and in a very quick way you say that's hideously expensive and you say there's no way, that's way too much money, but then when people point out the kinds of money that has been invested in trying to maintain salmon runs through technological fixes in the Columbia River fairly unsuccessfully, that in fact that if you really did instantly get 70 miles of undisturbed habitat by tearing down those dams, it actually turns into a good investment, you know.

In the process of trying to re-create nature so that salmon can regain their freedom, scientists, engineers, and the hydropower and logging industries are all engaged in carefully structured debates and negotiations revolving around the new rules for managing nature, another illustration of the irony of how attempting to give freedom in one world ends up creating increased organization in another.

## RE-THINKING THE CREATION OF FISH

In many ways, the hatchery program could be called a success. Consider these examples:

> By 1987, hatchery-origin fish dominated adult returns in the Columbia River basin, comprising more than 95% of the coho, 70% of the spring chinook, about 80% of the summer chinook, more than 50% of the fall chinook, and about 70% of the steelhead (Columbia Basin Fish and Wildlife Authority, 1990).
>
> About 70% of coho populations in Washington coastal streams were recently classified to be of hatchery origin (WDF et al., 1993).

> Preseason forecasts, based on separate estimates of hatchery-propagated versus natural chinook salmon adults available to net fisheries in Puget Sound, were that hatchery fish would amount to 73% of available fish in 1992 and 1993 (NRC, p. 303).

Hatcheries have clearly benefited the commercial fishing industry, recreational fishing, and the tribal fishery. But, conservation biologists have now sounded the alarm that the ways in which hatcheries have been managed and operated have been detrimental to wild salmon. For example, even though hatchery-raised fish have one of their fins clipped to identify them as hatchery-raised so that fishers can let go any fish with unclipped fins (wild); trawling in a mixed-stock fishery (wild and hatchery combined) makes it too difficult to sort the fish. Therefore, many of the wild fish end up being over-harvested with hatchery-raised fish.

Another example of what is now believed to be harmful to wild populations is the "domestication" of fish in hatcheries. That is, humans select which fish to slice open to mix eggs and milt, and therefore, do not let "nature" decide how to select for genetic diversity. In many cases, the largest, early-returning fish are chosen, leading to overproduction of more "fit" fish. These fish compete with the wild fish for food supply, and often win. According to the authors of *Upstream*: "efforts to use hatchery-produced coho salmon to rebuild populations in Oregon had the worst possible result. The hatchery fish displaced the wild coho that were in the streams and the authors believed this was the result of competition between the larger hatchery presmolts and the smaller wild juveniles" (p. 310).

Given these problems with the ways hatcheries were being operated, there are negotiations between conservation biologists, ecologists, and hatchery workers to change the rules that govern the repertoires of activity of the hatchery industry. There are conflicts of opinion: one hatchery worker told me "I don't know about all this worry about wild salmon. We don't even know what a wild salmon is anymore. There has been so much interbreeding with hatchery-raised fish." There are segments of the salmon arena, such as both the Indian and non-Indian commercial fishery, who value the continuing role of hatcheries to produce a high output of salmon for economic reasons. For these actors, many suggestions for changing the rules of behavior do not make sense.

The focus on changing hatchery practices provides another illustration of how new biological knowledge has contributed to the expansion of the salmon arena:

> It is important also not to be blinded by a "salmonocentric" perspective. Although it is critically important to address the needs of all life-history stages of salmon when designing rehabilitation strategies, too narrow a focus on salmon might prevent the attainment of a goal, even if the goal itself is focused on salmon. Rehabilitation strategies designed for freshwater life stages of anadromous salmon must include conservation and, when needed, rehabilitation of important ecosystem linkages (NRC, 1996).

Conservation biologists have found evidence that the way in which hatchery production was first developed imposed different types of biological problems on salmon populations. One problem they discuss is genetic risk. Genetic risks include such things as inbreeding depression, loss of population identity (between-population genetic variation), loss of within-population variation, and domestication selection. A central

claim made by ecologists is that it is critically important to maintain the remaining genetic diversity within and between populations to conserve diversity for genes that are involved in disease defense. This is the biodiversity argument, which extends to all species at risk, not just salmon. Hatcheries are now being pressured to change their practices to better maximize genetic diversity. There is increased effort to distinguish between the health of wild populations and hatchery populations with additional pressure to change harvest practices in order to maintain wild populations. Salmon are no longer just "salmon" but are classified as wild or hatchery. Hatcheries, once a promising solution to the decline of stocks, are now seen by some actors within the arena as part of the problem. For example:

> A new paradigm that advances habitat restoration and ecosystem function rather than hatchery production is needed for many of these stocks to survive and prosper into the next century. (Nehlsen et al., p. 4)

Conservation biologists now believe they know what salmon need to survive, and argue that artificial propagation of fish needs to be carefully re-structured in order to reflect these new scientific findings. Yet changing the repertoires of behavior of hatcheries is difficult given their contribution to the commercial and recreational fishery that has been an important part of the local economy for decades.

## SALMON HAVE MOBILIZED BOTH ALLIES AND RELUCTANT PARTICIPANTS INTO A COMMON ARENA

An article in the Seattle Post-Intelligencer on July 24, 1997 reported that Lonesome Larry, the last sockeye salmon to return to Redfish Lake in 1992, had been dead for five years but his legacy lives on in a sperm bank at the University of Idaho. He sired 45 fish last year. A biologist there said he'd like to see an organized venture in the Northwest for Pacific salmon and someday maybe even a national salmon sperm repository.

The story of Lonesome Larry gives a clear indication of just how important salmon are to the region. Salmon have always been "people" according to the Indian worldview, but other groups are now coming to speak like this in some ways as well. Salmon, as ecological non-human actors, have managed to mobilize allies in support of their continued existence. The following is taken from a web page dedicated to a famous event in the salmon world that occurred in 1998: large numbers of brightly colored, Adams River sockeye salmon returned to British Columbia to spawn much earlier than usual:

> The Adams River Salmon Society is 'pleased' to inform all visitors and potential visitors to the Adams River Sockeye Run that:
>
> The fish have decided to arrive early this year!
>
> You would think that something as predictable as a 'life cycle' would not be so hard to pinpoint. Unfortunately, nobody told the fish that!
>
> It seems that some forces beyond our control have made the salmon decide to start their migration two to three weeks earlier than usual. Perhaps it is the strange weather we are having this

> year, or the increasing water temperatures of the world's oceans that have had an effect on the physiology of the 'great Sockeye'.
>
> For anyone who had planned a late visit to the site, say after October 15th, you should try to advance your visit if at all possible. For anyone who was planning a visit around the first and second weeks of October, there is no need to alter your plans. There should be plenty of fish to see. But then, only the fish 'really' know for sure!

Even the logging industry, indicted as one of the groups that have contributed to the decline in salmon runs, are almost personifying the fish:

> Forests, both public and private, play a very important role in protecting water quality – and in giving salmon a healthy place to come home to. At Weyerhaeuser, we're working with Native Americans, university scientists, government agencies, and environmentalists to study watersheds, analyze problems, and find solutions that will make life a little easier for fish in out forest streams (Weyerhauser advertisement).

The rules of behavior for many industries have changed. Foresters are now expected to leave streamside buffers to provide shade and lessen soil erosion into waterways. Agricultural farmers need to be careful with water flows off their fields and into the streams to limit fertilizer and pesticide pollution in rivers and streams. Ranchers are told to fence off their cattle so they do not tromp around in the streams and cause pollution from both their waste and by disturbing the gravel beds where salmon spawn. Real estate developers are facing severe regulations on where and how they build within watershed areas inhabited by threatened salmon species. All of these behaviors are added efforts to "business as usual" for these industries and, therefore, are often more costly. Many

policy folks recognize that incentives have to be created in order to get these reluctant participants to do what is in the salmon's best interest. When asked his opinion on what would most facilitate the recovery of wild salmon stocks, this policy analyst/economist commented:

> So I say you don't need this sort of massive construction-oriented project as much as you need a change in behavior by a lot of individuals. You asked me what would have the biggest impact. Now I would also say that in my opinion this is very hard to do. You are going to be willing to bite the bullet and take a sort of incentives approach – can't make this happen with rules. So the problem has been, and it isn't just farmers by the way, it's developers and suburbanites, people in Bellevue, exploding suburban areas, the developers and so forth...so we need to kind of look at, cast the net more broadly at a bigger group of people whose behavior is ruining stream quality, often little streams the size of this office, and come up with an incentive way to make them become good custodians (Personal interview).

The group that provides the best illustration of how salmon have managed to mobilize allies after the paradigm shift is "For the Sake of the Salmon." For the Sake of the Salmon (SOS), based in the Portland metro area, is a coalition of fishing groups, timber companies, environmental groups, Native American tribes, local, state and federal governments, utilities, and agricultural interests. In one of their promotional leaflets, SOS members explain their mission:

> One of the primary tasks of *For the Sake of the Salmon* is to support and expand the work of local watershed groups. These groups, composed of loggers, environmentalists, landowners, government workers, and fishermen, have been working to restore salmon habitat throughout the Pacific region. They work on the

> entire watershed – from the stream and adjoining riparian area to the ridgetop – recognizing that all these elements are essential to the salmon's life cycle.

The very name of the organization as well as their mission are indications of the amount of attention these fish have attained at this time – thanks to the support of new scientific findings that validate the importance of maintaining the ecosystem in which salmon inhabit. This is truly an amazing accomplishment for a creature that does not even speak.

## LANDSCAPE OF ACTIVITY OF THE SALMON ARENA TODAY

Figure 4.1 is an illustration of the actors and interactions that currently characterize the salmon problem. As in Figure 2.2, the circles indicate the social worlds and the lines represent the interactions between the social worlds. The straight lines indicate direct influence of one organization over another while the curvy lines indicate that conflict and negotiation characterize interactions. I have labeled the figure "Salmon 'Managing' Humans" because salmon have managed to create an institutionalized field of activity focused on their "needs."

The way in which humans are attempting to manage salmon has undergone significant changes since the paradigm shift. Before the shift, management was dominated by our desire to control salmon for human economic gain. Now, scientists have been calling for a "release of control," giving the salmon back what *they* need – free, flowing rivers. This change in rules from a focus on control towards a focus on freedom, ironically, has created a larger and more complex field of action revolving around salmon. Many of the

social worlds that existed on the periphery of arena one have been brought into the playing field.[22] These actors are now faced with a new set of rules that are dictating changes in their repertoires of behavior, in their ways of going about their business. In many senses, these new rules do not make sense to actors within organizations who have been following well-established patterns of activity that were institutionalized during an earlier era of natural resource management. In the next chapter I use the concepts of path dependencies and the power of inertia to explain the nature of the struggles that are occurring during this time of major shift in perspective of how to manage nature. Ultimately, this argument helps us understand why it is so difficult to do things differently in reversing the declines of salmon runs.

[22] The social world labeled as "Agencies" in Figure 4.1 refers to those organizations directly responsible for implementing fishery policies while the social world labeled as "Government" refers to those organizations and laws that are regulating the fishery, forestry, ranching, and real estate development industries.

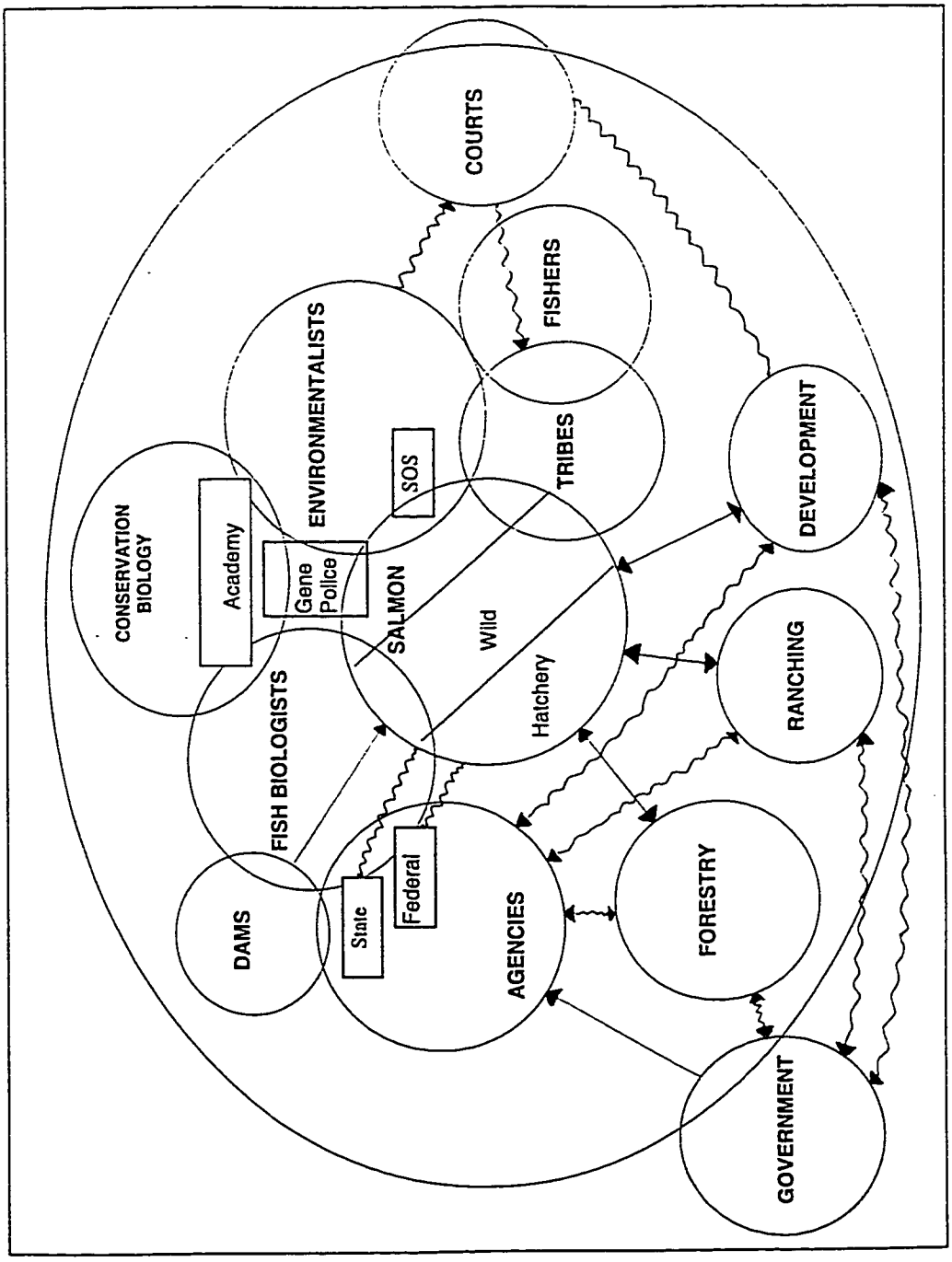



Figure 4.1 Salmon "Managing" Humans.

# CHAPTER 5: LEGACIES AND INERTIA

The report "Towards Sustainable Fisheries: Building a Cooperative Strategy for Balancing the Conservation and Use of Westcoast Salmon and Steelhead Populations" contains a section on suggestions for how to replace existing institutional and regulatory structures with new structures that would be more effective in supporting sustainable fisheries. The assessment and recommendations outlined in this section are a result of the proceedings from a meeting of resource managers, industry representatives, and concerned citizens in attendance at a conference on sustainable salmon fishery policy. The assessment of the current system is as follows:

> A wide variety of institutions and organizations are involved in the fisheries and environmental management process. In fact, the existing management framework is so complicated that even those involved in the process find it difficult to fully understand. This complexity in the management of Pacific salmonids and their associated habitats has arisen for several reasons. First, our existing management structure has evolved over a period of more than a hundred years. Over that time, our understanding of the resource and its interactions with people and the environment has increased dramatically...yet the existing management structure does not adequately respond to the challenges that we are currently facing... While technological and financial fixes have been applied successfully to many other societal problems, this approach has failed to solve difficult environmental management problems (1996, pp. 49-50).

The recommendations on how to improve management of the salmon fishery were clearly influenced by the ecosystem management perspective. Scientists are advising policy

makers that policies should be constructed in such a way as to "enable salmon populations to achieve their full biological potential" (p. 52) by allowing larger numbers of fish to survive throughout their life cycles. An increased amount of funding is available for salmon research that places greater emphasis on understanding the ecological role of salmon, and monitoring the impacts of fishing, habitat degradation, and other human interventions on salmon and their environment. In sum, the collective beliefs held by those who claim to now know what salmon need in order to exist for future generations, are no less than completely overhauling the way in which state and federal agencies, the logging, agricultural, hydropower, ranching, and mining industries go about their business. If the remedy for declining fish populations is to use the holistic approach to managing natural resources known as ecosystem management, then all types of activity that is occurring within the boundaries of the ecosystem in which salmon live has to be focused on the needs on the salmon.

The allies that salmon have managed to mobilize recognize that changing repertoires of behavior of people and organizations in the region to be more "salmoncentric" is not an easy task. The authors of the report "Towards Sustainable Fisheries: Building a Cooperative Strategy for Balancing the Conservation and Use of Westcoast Salmon and Steelhead Populations" identified several constraints to establishing institutions that support sustainable salmon and steelhead fisheries including the following: 1) Institutional inertia makes it difficult to reform institutional and regulatory structures; 2) cultural inertia makes it difficult for the public to recognize the need for more effective

fisheries management institutions; and 3) competing values exist between the management and use of natural resources (p. 53). Obviously, each of these issues are significant barriers. However, most scholars and policy-makers who are involved in building a new foundation for management of the salmon resource expend very little effort in identifying and analyzing the institutional constraints that are creating blockages towards reversing the declines in salmon stocks. The goal of this chapter is to provide some insight into the nature of the blockages.

As I explained in Chapter Four, much of the activity within the salmon arena today is dependent on the actions, events, and organizations that laid the foundation for the salmon problem during a previous era, a time of "Humans Managing Salmon." Salmon, viewed as a "resource," were managed for the benefit of the commercial and recreational fisheries, and their habitat was altered to allow for the development of the logging, agriculture, ranching, and aluminum industries. As conservation biologists gained more power to influence resource management decisions, new scientific findings regarding the needs of salmon led to a transformation of the salmon arena. After the paradigm shift, the field of action expanded to include more industries, organizations, and actors who are now expected to follow new rules of behavior following salmon's attempt to "manage" us. Yet the way in which resources have previously been managed has structured the repertoires of behavior of many actors within the arena for decades. Thus, structures like dams, and policies that manage the harvest remain intertwined in discussions of salmon

policy – legacies[23] to the past that continue to influence activity surrounding the management of salmon. Ultimately, these legacies and their associated social worlds are what make it so difficult to do things differently with respect to bringing back sustainable salmon populations. Conservationists cannot simply say "we need to change our institutional structures," for the salmon problem is organized in the way that it is now because of management decisions that built on each other throughout the century. Attempting to alter these patterns of behavior will require a long, sustained effort by those who commit themselves to the goal of environmental restoration.

Scholars of organizational studies have made it clear that once patterns of behavior become entrenched within people and organizations, they are very difficult to change (Nelson 1994, Becker 1995). Nelson (1994) explains how David's account of the QWERTY typewriter – the seemingly inefficient keyboard setup[24] persisted for so long because of its familiarity to experienced typists and the existence of typewriter training programs that teach the system. In other words, an infrastructure evolved around the technology that embedded the keyboard in social networks. Changing the technology, in this case, altering the typewriter keyboard so that the keys would be placed in a more logical pattern (e.g. alphabetically), would force people to change their habits. Retraining

---

[23] This term is used by Charles F. Wilkinson in his book *Crossing the Next Meridian* (1992) to describe natural resource policies that were created a century ago that still have an influence on how natural resources are managed today.

[24] The original typewriter keyboard was arranged with the letters in the order they remain today so that the typebars would not clash and jam together when the most common words were typed.

such a large number of hands to adapt to the new keyboard setup would cause significant losses of productivity within organizations that rely on work created by people who use keyboards.

The concept of "path dependency" is typically used to explain this phenomenon: "path dependency asserts that patterns -- paths, identities, or ideologies -- chosen at the outset of organizing something are very difficult (though not impossible) and usually costly to change subsequently" (Clarke, p.142). By observing these steadfast patterns of behavior within arenas, one can locate the centers of power and control. That is, those people and organizations who initially are put in charge of managing a process, whatever it may be, come to rely on and be relied upon for the maintenance and functioning of the system. Suggestions for abiding by new rules of action are going to be met with confusion and resistance. Viewing the salmon problem from the historical and organizational sociological perspective I used throughout this narrative reveals important insights into why it is so difficult to change the course of salmon declines, and, as I describe in the last chapter, many environmental problems.

In previous chapters, I have explained how different cultural, technological, economic, and scientific ideologies and practices have shaped the repertoires of behavior within the salmon arena over time. In this chapter, I explain how much of the activity within the contemporary salmon arena is characterized by struggles between old and new ideologies and practices. New scientific knowledge about salmon has been revealed, but in most cases, policies and technologies have not caught up with these new insights. Salmon may

have gained power to mobilize allies in support of their continued existence and are attempting to manage us now, but they face significant obstacles. I describe three categories of legacies and provide examples: 1) technologies– hatcheries and dams; 2) policies— MSY, ESA; and 3) ideologies— scientific "progress" and linear thought.

## TECHNOLOGICAL LEGACIES

Both dams and hatcheries are examples of physical technologies that became standard elements of the repertoires of behavior for managing the salmon resource for most of the century. Michael Black (1994) uses the term "serialistic policies" to describe how behaviors engaged in by natural resource managers follow a path that clearly reveals how any step forward is influenced by the steps that came before:

> Hatcheries best exemplify the regrettable sequence of plausible but unworkable assumptions that still guide state and federal fisheries policies. From the outset, those entrusted with overseeing the West's declining fisheries have carefully tailored their objectives to comply with market attitudes and behavior. Rather than challenge the profitable destruction of western rivers, institutional policies begat a compensatory holding pattern. I refer to this lineage of fish rescue strategies as "serialistic policies." Serialistic policy is a deliberately muddled pattern of agency policy goal substitution and decay, followed by the overlay of a fresh batch of technological fixes and their subsequent failure.
>
> Serialistic policies are analogous to a treadmill, in which human beings, in search of ever-greater substitutes for the self-maintaining natural world, ratcheted up the scientific and technological ante in a triumph of the artificial. However, because stability recedes in direct proportion to dramatic human intervention within nature, a stable outcome remains woefully elusive (Black, 1994, p. 277).

The U.S. government viewed dam construction as the "right thing" to do at the time in order for economic development to proceed in the West, and natural resource managers viewed the construction of hatcheries as a good way to mitigate for the loss of fish caused by dam construction. Both dams and hatcheries are now part of the geographic and economic landscape of the region, yet now both are considered to be contributing to the decline in salmon populations.

As the previous discussion of the case of the Elwha River made clear, it is difficult to remove dams, from both an economic and engineering perspective. And, in many cases, there is not a lot of support for dam removal from many segments of the population. Dams have provided the region with cheap electricity, irrigation, and flood control for decades and made it possible, among other things, for a large agricultural industry to develop in areas like eastern Washington. The dams provide many people with employment, not only directly working at their sites, but also in places like aluminum plants that are supplied with electricity from the dams. As historian Richard White explains, we have created "an organic machine" out of the Columbia River.

> To come to terms with the Columbia, we need to come to terms with it as a whole, as an organic machine, not only as a reflection of our own social divisions but as the site in which these divisions play out. If the conversation is not about fish and justice, about electricity and ways of life, about production and nature, about beauty as well as efficiency, and about how these things are inseparable in our own tangled lives, then we have not come to terms with our history on this river (1995, p. 113).

As we have seen, these technological legacies have given rise to technological "fixes" like barging and trucking of smolts. It is likely that these mitigation techniques will continue to be used for a while, for they are part of "business as usual" for the U.S. Army Corps of Engineers and are praised by some as ingenious ways to deal with the salmon problem. Indeed, when new proposals for mitigating losses of salmon are introduced, intense battles between interest groups are waged. For example, in February, 1999, a "Save the Dams" rally drew more than 2,000 people to Pasco, Washington, including about a third of Washington state's legislators (Seattle Post-Intelligencer, April 16, 1999, p. A8). The protest occurred after government agents came to the region to discuss breaching four Snake River dams to help save salmon runs. The protesters were mainly Eastern Washington farmers who argued that they would go bankrupt if shipping rates soared (barging downriver through locks in the dams is much less costly than trains or trucks) and irrigation costs would rise.

Hatcheries, many built to mitigate the loss of fish habitat created by dams, are now considered by conservation biologists to be part of the salmon problem, rather than part of the solution. Yet doing away with hatcheries will not be easy either. Again, they employ many people, both directly at the hatchery sites and indirectly as commercial fishers and those part of the recreational fishing world (e.g. fishing guides, equipment makers, owners of lodges near fishing sites, and the fishers themselves) who now all rely on hatchery-raised salmon. A policy analyst explained to me the difficulty certain groups within the arena are facing with respect to issues like hatcheries:

> I think people like the tribes would probably be typically ambivalent about this, in the sense that, sure they want habitat restoration, in fact a lot of their effort in certain ways is dedicated to that, but on the other hand they don't want that to occur at the expense of their beloved hatcheries, you see. So they get nervous when people start talking about habitat and wild salmon and not hatcheries because they want to run this commercial market fishery.

So, instead of abolishing all the hatcheries, the rules for managing hatcheries are being negotiated. Fish biologists are educating hatchery workers on how to produce fish that are more genetically diverse and are attempting to change practices in order to limit the competition between wild and hatchery-raised salmon. Yet, just as proposals for dam breaching are met with resistance and conflict, so are changes in hatchery practices. For example, in November, 1997, 300 fisherman jammed into a meeting room in Olympia, Washington to argue about proposed policy changes in a document drafted by the former Director of Washington State Fish and Wildlife, Bern Shanks (Seattle Times, November 23, 1997, p. B1). The fishers, both Indian and non-Indian, argued that abandonment of some hatcheries and reducing the number of fish released from others in order to minimize the impact on wild stocks would lead to major cutbacks in salmon fishing. Some argue that Shanks' forced resignation as Director of Fish and Wildlife was in part due to the fact that he was such an advocate for wild salmon that he lost the support of the commercial and recreational fishing community and hatchery workers (Seattle Times, June 14, 1998).

## POLICIES THAT DEFINE REPERTOIRES OF BEHAVIOR

Two policies that illustrate the struggle over old and new rules of action based on the "discovery" of new scientific knowledge about salmon are harvest management models (MSY vs. MSE) and the biological integrity of the Endangered Species Act (ESA). Conservationist biologists have argued that both have deficiencies when it comes to managing a sustainable salmon fishery, and yet changing these policies to better reflect the new scientific "facts" is difficult.

Those who support the beliefs of ecosystem management claim that traditional approaches to managing the harvest of salmon have not been ecologically based. They argue that harvest levels should not be established using single stock maximum sustain yield (MSY) models, but rather using a habitat-based conservation approach (MSE). Yet, there are many constraints to changing management practices including the following: 1) It is difficult to convince fishery managers of the importance of foregoing human uses of resources to achieve long-term ecological objectives; 2) the scientific information needed to define how many fish are needed to achieve ecological objectives is often lacking; 3) foregoing salmon harvest for conservation has short-term economic consequences (Sustainable Fisheries Foundation, pp. 10-11). Scientists can recommend ways in which the salmon resource can be better maintained, but there are many social groups that are resistant to any changes in harvest policies. Obviously, the commercial and recreational fishing industries have constructed their repertoires of behavior on the old quota system laid out by MSY models of harvest management and are struggling to maintain these.

Chris Frissell, a research biologist at the University of Montana and his colleagues have been working on a model Regional River and Interstitial Flow Simulator (RRIFLS), that uses GIS modeling techniques to understand the linkages between land and water systems and to describe the ecological consequences of human impacts on these systems. One of the applications that Frissell has been studying is with populations of salmon. He explains that scientists do not commonly acknowledge spatial dimensions. When it comes to salmon, it turns out that the most ecologically sustainable unit (ESU) of the resource is at the metapopulation level, as opposed to the stock level. Metapopulations are combinations of several species and subspecies that form "neighborhoods." These are ecologically significant because they are seen to be the most genetically "fit." Individual salmon will stray now and then and help contribute to the genetic diversity of the metapopulation. Frisell argued that what we really need to be doing is protecting a metapopulation and not individual species of salmon. That is, salmon are most adaptive when they are allowed to evolve within a regional space on the earth.

It is now believed that the best type of management of the salmon resource would be to protect certain areas of the region, both land and water, so that a regional metapopulation can be sustained (perhaps while sacrificing other regions to development). The problem is that the Endangered Species Act, the policy tool that is used to protect threatened and endangered species, focuses on single stocks (species). When the act was first proposed in the 1970's, the scientific thinking at the time was that we needed to protect individual species from extinction. Now, conservation biologists argue that both species and their

associated ecosystem need to be protected. However, conservationists do not want to do away with the ESA, for they argue that they would be left with no legal recourse for protecting species at risk. However, this focus on single species may not be the best way to achieve sustainability of the resource. Currently, a great deal of the activity within the salmon arena is focused on responding to the listing of several salmon stocks as endangered under the ESA. Many of the conflicts that will occur in the near future will revolve around how to save metapopulations of salmon and their associated habitats versus individual species.

## IDEOLOGICAL FOUNDATIONS ARE THE HARDEST TO CHANGE

Scientific progress is made when one scientist finds something wrong with another scientist's thesis and provides an alternative explanation. This repertoire of behavior that seems "normal" within the scientific community creates conflicts when it comes into contact with the repertoire of behavior of actors within the policy world. Policy-makers are not constantly seeking ways in which a particular management technique is flawed. Instead, they are attempting to implement management strategies that build on and improve, in this case, the numbers of salmon. Many of the policy people I spoke with complained about their interactions with scientists. They summarized their frustrations by saying that they finally get around to implementing some of the recommendations from scientists and then the scientists come back to them with some new findings that basically say those recommendations have changed. They explained that it is very difficult to keep up with the constantly evolving knowledge base of salmon science.

It is not by accident that salmon became the most studied fish. The reasons for this have their foundation in both the natural and social worlds. As I have said before, salmon are mysterious creatures that have intrigued humans for a long time. Their amazing migratory patterns seemed to find a home in the inquisitive minds of scientists for decades. Salmon also happen to be substantial, tasty fish. A large, commercial fishing industry emerged to take advantage of the protein and energy these fish provided for human populations. This led to the growth of the profession of salmon biologists who for decades studied how to increase the numbers of salmon using such techniques as hatchery science. There are many people whose livelihoods depend on studying both the declines of salmon and techniques on how to propagate them. In one sense, it is really not in many people's best interest to "solve" the salmon problem – if wild populations rebound, then a number of people would be unemployed.

Part of the current repertoire of activity in managing salmon populations is to commission a scientific study when evidence is found that a new stock of salmon are in peril. This is done even when significant evidence already exists, (perhaps merely anecdotal), and the reasons for decline in the stream are most likely similar to those in other streams. Once the scientific studies are completed, the results are written up as reports and passed onto the agencies that commissioned the studies. Many of these large reports end up sitting on the desks of bureaucrats in these agencies. They are filled with recommendations for management plans, many of which never get implemented, mainly

because of lack of funds or lack of personnel who have the time to do anything other than their main jobs within the agencies. But, the management plan process has been in place for years, employs numerous people, and is business as usual for the scientists and policy makers in the salmon arena.

In a speech made during the Salmon Homecoming Celebration policy conference in Seattle in 1997, Representative Elizabeth Furse proclaimed, "We have too much science, we are going to drown in it." The problem seems to lie in the interaction between the scientific world and the other worlds within the salmon arena. Many people look to science to provide them with direction for how to change their practices with respect to salmon, yet scientific ideas often change faster than what management institutions can keep up with. Policy analysts who share an ecosystem management perspective have recognized this phenomenon and have recommended the use of a technique called "adaptive management." Kai Lee (1993) describes this approach in a book called *Compass and Gyroscope: Integrating Science and Politics for the Environment*:

> *Adaptive management* is an approach to natural resource policy that embodies a simple imperative: policies are experiments; *learn from them*... . Adaptive management takes the uncertainty (in nature) seriously, treating human interventions in natural systems as experimental probes (p. 9).

He suggests that managers who use this technique should plan for unanticipated outcomes from new policies and should learn from the results whether they yield expected or unexpected results. The accumulation of knowledge from both successful

and unsuccessful management strategies is viewed as critical in the development of long-term, environmentally sustainable management plans. Lee acknowledges that there are barriers to this approach, most importantly, that unsuccessful results are often viewed by those who funded them as failures not worth repeating.

This discussion of the practical problems that emerge from the interaction of science and policy is an illustration of a broader philosophical conversation that is being debated in the field of environmental studies and in the wider intellectual community. An outgrowth of chaos theory, this "new" world view is characterized by the belief that the organization of the universe is a result of the conflict between order and chaos. Kauffman (1995) explains:

> I will suggest that, on small and large scales, we all do the best we can but will eventually be hustled offstage by some unanticipated consequences of our own best efforts. We will find a place in the sun, poised on the edge of chaos, sustained for a time in that sun's radiance, but only for a moment before we slip from sight. Untold many actors come and go, each, as a fine playwright once said, strutting and fretting its hour upon the stage. A smiling irony is our fate (p. 15).

In his chapter, "Organizational Systems and the Burden of Proof" (Stouder et al., 1997), David Bella employs this perspective in order to understand the salmon crisis. Bella argues that in complex, adapting, nonlinear systems, order emerges as behaviors coalesce into enduring forms of mutual reinforcement. The emergence of organized complexity is a systemic outcome having to do with the tendency of human activities to adaptively gravitate toward patterns of self-reinforcement (p. 621). He suggests that events as

diverse as the Challenger space shuttle explosion, the decimation of old growth forest ecosystems, and the decline of salmon stocks are outcomes of the same emergent phenomenon. All can be explained as unintended consequences resulting from a series of decisions that were made with the best intentions, given the information each actor had available to him or her at a given time.

Bella warns that "We are unlikely to protect the salmon unless we recognize how our own perceptions are transformed to conform with systemic imbalances" (p. 617). In other words, incorporating the arguments I have made here, people are caught up in complex, adaptive, nonlinear systems that shape their activities, yet the scientific research, policies, agencies, and other organizations we construct to manage resources are characterized as much more simple, non-adaptive, and linear compared to what scientists are now telling us about the way in which the natural ecosystem works. Bella does not provide specifics of how the clash between these two organizational systems gets manifested in contemporary salmon management issues. Yet the struggles over harvest policies and hatchery practices I have described are illustrations of conflicts that have their foundation in the contradictions between these two organizational systems.

## WHAT WILL ARENA THREE LOOK LIKE?

Salmon are the most studied fish. Scientists claim to now know exactly what they need to survive to future generations. Why, then, is there still a salmon "crisis"? There are many groups in the salmon arena who are claiming to be "doing things differently" this

time by focusing on managing the entire ecosystem as opposed to just the fish. It may be that these efforts will eventually be successful, and wild salmon will be returning to more and more streams in the region. It is really too early to tell in many cases, since many of these restoration efforts have been operating only for a short time.

There are many constraints as well. The people of the Northwest region of the United States have enjoyed a booming economy off and on for decades now. Many argue that this growth has come at the expense of the environment. Development, from hydropower dams, forestry, agriculture, and real estate development, has created a relatively high standard of living for people of the region. Indeed, many people migrate to the area because of the quality of life and have expectations that they want to continue to live this way. While recent public opinion poll data reveals that people of the region say they are willing to pay an average of $5 per month per household for salmon[25], it is unclear how many people will actually pay a lot more for electricity, foods that are grown in a more environmentally sustainable manner, and be able to afford to live in cities as opposed to developing more land in what is now suburban and rural space. In some senses we can say that everyone in the area is part of the "salmon problem," and therefore part of the solution. If we really want to save the salmon, we all have to change our behaviors to be more in accordance with what we now think the salmon need. But, as we know, if it is

---

[25] Smith, Courtland L., Jennifer D. Gilden, Joseph S. Cone, and Brent S. Steel (1997). "Contrasting views of coastal coastal residents and coastal restoration planners". *Fisheries*, 22(12):8-15.

hard for agencies to change their "business as usual" way of doing things, it is just as hard for individuals to change the way they go about their daily lives.

It is hard to predict if there will be another major shift in the way scientists understand the dynamics of the natural environment. In many senses, much of the activity occurring in arena two is in the early stages of adapting to the paradigm shift towards ecosystem management. It will be interesting to observe if and to what extent, agencies, policies, industries, and citizens of the region change their behaviors to reflect this new perspective. What seems to be characterizing the repertoires of behavior within the salmon arena is still a reliance on scientific knowledge. In order to make any predictions about what arena three may look like, we have to look outside the salmon arena towards another institution that is experiencing a "paradigm shift."

The health care arena provides us with one analogy. For years, both doctors and patients have relied on scientific findings to diagnose and cure medical problems. While many doctors and patients still use this paradigm, a growing number of people are now taking their health into their own hands. The "self-care" movement, which began during the 1960's (interestingly, around the same time as the environmental movement), has gained momentum very recently; many people are treating themselves with changes in diet and the use of vitamins, minerals, herbs, and alternative medicine practices, often without much reliance on scientific "findings." Indeed, some people claim to be nervous about the lack of scientific proof about certain remedies, yet those who have become true believers are those who simply say, "all that matters is that I feel better". The established

medical organizations are scrambling to react to this questioning of their core competency by acknowledging the potential benefits of alternative health care practices. The role of science in this "revolution" is critical, for if large numbers of people start to rely on their own bodies to direct to them toward health care remedies, then medical studies become less important. In many ways, these changes can be classified as changes in *values*. A growing number of people are starting to value their own feelings about their bodies and minds as more reliable than those of their doctors.

In the same way, there are faint voices within the salmon arena, and the environmental community as a whole, who are calling for a reliance on valuing the environment for what it is – a beautiful place. We do not need science to convince us that we should keep fish, trees, and clean water around for the health of humans and the earth. How activity within the salmon arena would change to reflect this perspective would parallel how things are changing in the health care arena. Centers of power shift, new organizations form, old ones die out, and the struggles between old and new repertoires of behavior define the activity in the arena.

Another parallel between the health care arena and the salmon arena is that some voices are arguing for a return to the "traditional" way of doing things – in terms of interacting with the natural world and one's own body – are attracting more attention than they have before. For example, alternative medicine has many of its roots in ancient Chinese, Native American, and other traditional cultural healing practices. The number of Americans and people throughout the developed world that have been seeking out these

"traditional" healing practices have grown significantly in recent years. Of course, the nature of these practices are transformed in modern-day society, yet the underlying value structure of these practices is what is drawing people to exploring them. In the case of healing the body, these practices rely on the method of honoring the body's own beauty and natural rhythms. In a parallel manner, valuing the salmon for their beauty and allowing them to exist freely in their natural habitat is how the Native peoples of the region speak about how they "managed" the fish:

> Survival of the salmon has always meant more than just food for the Indian people.
>
> The Indian has long recognized that if they are to survive, and if their children's children are to survive, it will be because the salmon survives.
>
> It is their legacy.
>
> (The Legacy of the Salmon People- Billy Frank Jr., Chairman, Northwest Indian Fisheries Commission)

Ultimately, the answer to saving the salmon is rooted in making people aware of the beauty of nature and making them conscious of how to honor the natural rhythms of the regional ecosystem throughout their daily behaviors. In the next and final chapter, I explain how the salmon problem can be generalized to other environmental problems and how using the analytic tools of non-human actors and the arenas perspective provides us with a unique and comprehensive view of environmental problems.

# CHAPTER 6: THE ORGANIZATION OF ENVIRONMENTAL PROBLEMS

The declining runs of salmon are an ideal illustration of an environmental problem. Like global climate change, declining water quality, and population density, the decline in salmon runs are both caused by and cause change in diverse sectors in human societies – including economic, political, technological, and cultural systems. Many environmentalists argue that the reason why humans have created so many environmental problems is because these systems that we have constructed and live under do not sustain the basic elements of the earth—the "natural" environment. They argue that in order to reverse our environmentally disorganized societies, we need to make substantial and widespread changes to the way we live our lives. Devall and Sessions (1985) summarize these changes as follows:

> • We need to live in harmony with nature as opposed to dominating it.
> • Recognize that all nature has intrinsic worth and is not solely a resource for humans.
> • Our material goals should serve the larger goal of self-realization as opposed to the economic growth of a growing human population.
> • Recognize that earth "supplies" are limited.
> • We should use appropriate technology and not allow science to dominate our solutions to problems.
> • We should do with enough and recycle and do away with consumerism.
> • We should let minority traditions and bioregions govern our behavior as opposed to a national/centralized community (p. 69).

Much of these discussions proceed as if humans are not part of nature and that by following a prescription of how to change our collective behaviors, we will succeed in

becoming a more ecologically sustainable society. In this last chapter, I explore the import of these arguments on debates about environmental issues. I then explain how viewing salmon as non-human actors through the lens of an arenas perspective provides us with insights into human society's enduring struggle over how to manage nature.

## THE NATURE OF NATURE

In an article published in the *New York Times* on December 19, 1998, entitled "People Can't Agree on What's Natural and What's Not," environmental reporter Timothy Egan describes how the word "nature" has been an ephemeral concept throughout human history. He provides a particularly ironic quote from the past governor of Alaska, Walter Hickel, in response to his belief that the moose population of his state was growing too rapidly: "We can't just let nature run wild."

The boundary between what is natural and what is not has been continuously debated throughout human history. Aristotle argued that what is "natural" is that which has its source of change within itself, while something whose source of change is outside of itself is not due to nature (Bell, 1998). Humans do have an internal source of change within their own bodies, so they can be classified as "natural," yet anything they make is not "natural." Thus, a table made out of old growth timber is not natural even though the wood is. The problem with his approach was its' inability to distinguish when humans were acting in accordance with their own internal source of change (Bell, p 211). Perhaps the way in which we constructed our economic and political institutions at

different points in our history followed our collective internal sources of change. Who is to say? Humans and non-humans are constantly inducing changes in the world around them, so the distinction Aristotle makes between natural and unnatural becomes blurred.

In contemporary environmental thought, some say that those materials that have been significantly processed and refined by humans are "unnatural." Thus, plastic, cars, and concrete buildings are "unnatural," while cotton shirts, paper grocery sacks, and organic produce is "natural." Again, the distinction gets blurry when we consider the fact that items such as designer cotton shirts, standardized capsules of St. John's wort, and a package of organic sun-dried tomato couscous have seen as much human involvement as a plastic bag, an aspirin tablet, and a bottle of orange juice concentrate. A particularly fuzzy example of a "natural" object is the manufactured woody debris mentioned in Chapter Four that is currently used by conservationists employing natural management techniques for restoring salmon habitat.

Despite the confusion over definition, most environmental sociologists agree that nature is something we make as much as it makes us (Bell, 1998, Freudenburg et al., 1995). The important point is that, as a society, we have come to view our interactions with the "natural environment" as problematic, and worthy of dedicating a significant amount of attention. Anthony Giddens, in *Beyond Left and Right* explains:

> The point at which the denaturing of nature effectively ended our 'natural environment' cannot be fixed in an exact way; but somewhere over the last century or so the age-old relation between human beings and nature was broken through and reversed.

> Instead of being concerned above all with what nature could do to us, we have now to worry about what we have done to nature.

Most "environmental" activity today is focused on studying the human causes of changes in the natural world such as the rapid extinction of large numbers of species, the rising (and perhaps cooling) temperature of the earth's atmosphere, and the increasing prevalence of new and deadly types of illnesses in human populations. Through a great deal of scientific research, we are attempting to learn more about the rhythms and dynamics of the "natural environment" with the hopes that once we have a better understanding of what the world around us needs to sustain itself, we may bring our own behaviors to be more compatible with what is "natural." As I attempted to illustrate in this study, social activity gets institutionalized following its own rhythms and dynamics, through interactions with people. Whether or not this is "natural" can be debated elsewhere, the point here is to understand the current struggles we are having with managing nature are rooted in the fluid, dynamic, and mysterious patterns of the ecological world and the relative obduracies of social organizations.

## AN ENDURING CONFLICT?

In his chapter on *The Economy and the Environment*, Johannes Berger (1994) states that the "reasons for environmental degradation can be related to a certain myopia on the part of the economic system that results in a lack of awareness of ecological interests" (p. 766). He argues that the reasons for this lack of awareness can be attributed to the

following: 1) A large population and complex production system creating a disconnect between efficient use of resources and normative ideas about what constitutes ecologically sound behavior (social dilemmas); 2) the social world operates as a system of functionally differentiated subsystems in which the environment is external and society can only react to events in the environment as opposed to acting in concert with it (functional differentiation); 3) our large-scale industrial utilization of technological innovations creates unintended and unknowable consequences (risk society); and 4) the modern belief that the objective world can be shaped and organized according to subjective will (Western culture).

Again, the conclusion Berger makes is that in order to reverse environmental degradation, we must develop a collective environmental consciousness and change our behaviors to reflect ecological "norms." This, of course, will not be easy given the long history of "myopia" that our social institutions have of the environment. Any attempt to bring "environmental consciousness" into existing social institutions will be met with conflicts and struggles.

In many ways, the ecosystem management perspective is an attempt to codify ways in which our social activity can change to respect the needs of the ecological world. Many of the struggles occurring with the adoption of this perspective by different social organizations are happening as predicted – at the intersections of existing social worlds with new ecological practices that are pushing them toward a new way of going about their business. How much these organizations are transformed by these new practices

versus how much the practices are altered by the organizations remains to be seen. In any case, the penetration of ecosystem management beliefs into natural resource organizations, as illustrated in this study with the case of salmon, is another example of the enduring conflict between society and the environment that continues to result in changes to both humans and the ecological world.

## ARENAS PERSPECTIVE AS HEURISTIC TOOL FOR EXPLORING DYNAMICS OF SOCIAL CHANGE

Like other environmental problems, the salmon problem is not just about the physical changes in the landscape that give rise to ecological disorganization. It is about how humans have interacted with the physical landscape over time and how this relationship defines the salmon problem. Like other environmental problems, the salmon problem is not solely a social construction defined and publicized by activist groups. There are real changes in the number and variation of salmon subspecies that are impacting the commercial and recreational fishery; indicating that our watersheds are not as healthy as they once were. In order to truly understand the shape and complexity of the salmon problem, as with other environmental problems, one needs to understand how the ecological world – and the role of scientists in communicating its dynamics – intersects with all aspects of the social worlds that lie within the boundaries of the institutionalized field of activity.

The methodology employed in this study can be used as a template for the study of other environmental problems. The arenas perspective is a useful heuristic tool that allows the researcher to "see" how organizational structures create repertoires of behavior that dictate the rules of action for actors involved both directly and indirectly with a particular environmental issue. Furthermore, exploring an arena as it changes over time allows the researcher to mark the significant events that both cause changes in the field of action and locate the places of inertia within the arena. Identifying the patterns of human behavior in such a manner gives one a deeper understanding of the nature of environmental problems.

Because this methodology forces the researcher to include both natural and social worlds, those who are looking at environmental problems from a natural science perspective can make linkages to the social worlds that influence and are influenced by such things as water quality, riparian zones, and number of species. Likewise, those who are looking at environmental problems from a social science perspective can make linkages to natural phenomenon that influence and are influenced by such things as technologies, industries, and cultural beliefs. The power of the perspective is that very different types of worlds can be studied, and understood simultaneously. In addition, by incorporating a historical perspective into the observation of the problem, one can gain an understanding of how these worlds evolve and influence each other over time. As I describe below, it is important to have at least one focal concept when employing this perspective, otherwise the exploration of a problem quickly devolves into an amorphous collection of thoughts

where everything is related to everything else. By employing the concept of "non-human" actors and deconstructing the term "management," I was able to structure the analysis of the salmon problem and eventually come to one explanation as to why it is so difficult to change the course of environmental degradation.

## THE ETERNAL MYSTERY OF ECOLOGICAL NON-HUMAN ACTORS

As discussed in the introduction, the concept of the "non-human" actor has typically been used by sociologists of science to study the interaction of technology and society. In many senses, the way in which salmon were perceived during most of this century by those who were in charge of managing them, were as technological creatures that could be controlled and "tooled." Institutions such as hatcheries and MSY models of harvest policy were constructed according to the scientific knowledge of the time – motivated and funded by how to use salmon as a resource and how to continue to keep them around. Unfortunately, the salmon did not act in the way that we wanted them to.

Salmon, like other elements of the natural environment, are not, and cannot, be technologies. Technologies are created by humans, using our minds. Sure, some technologies end up acting in ways that are unexpected (e.g. the Challenger disaster), but as humans, we can figure out how these things happen, since we created them in the first place. Humans did not create salmon. Scientists can learn more and more about what they think the repertoires of salmon behavior are, and learn about the type of habitat they need in order to do their thing, but we will never really know what makes them "tick."

They will always be mysterious creatures, battling their way back to their homes in an effort to survive to the next generation. All we can do is make an effort towards making their journeys through life more comfortable.

In some ways, we have made "progress" in moving beyond a vision of salmon as technological non-human actors, towards viewing them as ecological non-human actors; "progress" in the sense that salmon may have a better chance to survive now that we know more about their needs. The struggles we are witnessing in the field of activity surrounding salmon are caused by a shift in perspective regarding how social institutions should adapt to the changes in the natural environment as prescribed by some segments of the scientific community. Government, industry, and citizens of the Pacific Northwest region are now engaged in the effort of how to manage freedom instead of controlling a "resource."

## HUMANS MANAGING NATURE OR NATURE MANAGING HUMANS

Since the beginning of human's existence on this planet, we have attempted to "manage" our interactions with the natural environment surrounding us. Hunter-gatherer societies organized the hunt so that they could sustain themselves with a reliable food source. Romans built aqueducts to carry vital water supplies to developing towns throughout their societies. American pioneers cut down forests and dammed rivers to provide materials for building houses and electricity for developing cities throughout the nation.

The beliefs espoused by the environmental movement began to call into question our assumption that the rules we followed for managing nature were the "right" ones. Deep Ecology and the Ecosystem Management perspective suggest new rules for us to follow for managing nature. Most of the conflicts we see within organizations in charge of "managing nature" have appeared because these new rules to not make sense to those who are used to abiding by the old ones. Are these the "right" rules now? Do we now "know" how to manage nature?

This study provides an illustration of how, in many senses, the new rules rely on the hypothesis that we should be letting nature "manage" us so to speak. If human societies eventually adapt to these new prescriptions for an environmentally sustainable way of life, will we have succeeded in coming to terms with our relationship with our environment? These answers are a long way off. What is clear is that the human mind will continue to be curious about the mysteries of nature and will continue to view the environment through our own lenses, attempting to organize our behaviors according to our own needs from it. Of course, humans are part of the environment and nature itself. However, as evidenced by our interactions with natural "resources" like salmon, it is as if we have created filters between the social and natural worlds. Will we ever know what it means to live completely in harmony with our environment, and what would we do if we eventually figured out how to do this? Perhaps, instead of viewing the environment and society as an enduring conflict, we should take a tip from the salmon and be awed by our ability to continue to adapt to a continuously changing environment. This is not so much

a conflict as it is a struggle for survival; we construct new repertoires of behavior as we manage our interactions with the world around us, so that we can find our way back home after a long life's journey.

# BIBLIOGRAPHY

Becker, Howard S. (1974). "Art as Collective Action." *American Sociological Review*, 39(6):767-76.

Becker, Howard S. (1986). *Doing Things Together*. Evanston, IL: Northwestern University Press.

Becker, Howard S. (1995). "The Power of Inertia." *Qualitative Sociology*, 18: 301-309.

Bell, Michael M. (1998). *An Invitation to Environmental Sociology*. Thousand Oaks: Pine Forge Press.

Berger, Johannes (1994). "The Economy and the Environment." In Neil J. Smelser and Richard Swedberg, eds., *The Handbook of Economic Sociology* (pp. 766-797). Princeton: Princeton University Press.

Black, Michael (1994). "Toys in the Reservoirs: A Century of Failed Western Fishery Policy." *Illahee*, 10(4): 275-278.

Buttel, Frederick H. (1987). "New Directions in Environmental Sociology." *Annual Review of Sociology*, 13: 465-88.

Callon, Michel (1986). "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay." In John Law, ed., *Power, Action and Belief: A New Sociology of Knowledge?* London: Routledge and Kegan Paul.

Casper, Monica J. and Vivian A. Christensen (1998). "Creating and Contesting the 'Hormone Disruption' Thesis: Emergent Social Worlds in the Environmental Health Arena". Paper presented at Annual Meeting of the Pacific Sociological Association.

Clarke, Adele E. (1991). "Social Worlds/Arenas Theory as Organizational Theory." In David R. Maines, ed., *Social Organization and Social Process: Essays in Honor of Anselm Strauss* (pp. 119-158). New York: Aldine de Gruyter.

Cone, Joseph and Sandy Ridlington , eds. (1996). *The Northwest Salmon Crisis: A Documentary History.* Corvallis: Oregon State University Press.

Costanza, Robert, Bryan G. Norton, and Benjamin D. Haskell, eds. (1992). *Ecosystem Health: New Goals for Environmental Management.* Washington DC: Island Press.

David, Paul A. (1985). "Clio and the Economics of QWERTY." AEA Papers.

Devall, Bill and George Sessions (1985). *Deep Ecology: Living as if Nature Mattered.* Salt Lake City: Peregrine Smith Books.

Eyerman, Ron and Andrew Jamison (1991). *Social movements : a cognitive approach.* University Park, Pa.: Pennsylvania State University Press.

Fobes, Natalie, Tom Jay, and Brad Matsen (1994). *Reaching Home: Pacific Salmon, Pacific People.* Anchorage, AK: Alaska Northwest Books.

Freudenburg, William, R., Frickel, S. and R. Gramling (1995). "Beyond the Nature/Society Divide: Learning to Think About a Mountain." *Sociological Forum*, 10: 361-392.

Giddens, Anthony (1994). *Beyond Left and Right: The Future of Radical Politics.* Stanford, CA: Stanford University Press.

Groot, C. and Margolis L., eds. (1991). *Pacific Salmon Life Histories.* Vancouver: UBC Press.

Grumbine, Edward (1992). *Ghost Bears: Exploring the Biodiversity Crisis.* Washington DC: Island Press.

Grumbine, Edward (1994) "What is Ecosystem Management?". *Conservation Biology*, 8(1): 27-38.

Hannigan, John A. (1995). *Environmental Sociology: A Social Constructionist Perspective.* London: Routledge.

Harper, Charles L. (1996). *Environment and Society: Human Perspectives on Environmental Issues.* Upper Saddle River, NJ: Prentice Hall.

Huppert, Daniel D. (1996). "U.S./Canada Salmon Wars: Why the Pacific Salmon Treaty Has Not Brought Peace." *New Directions in Marine Affairs A report series from School of Marine Affairs.* University of Washington: No. 1.

Kauffman, Stuart (1995). *At Home in the Universe: The Search for Laws of Self-Organization and Complexity.* Oxford: Oxford University Press.

Kempton, Willett, James S. Boster, and Jennifer A. Hartley (1995). *Environmental Values in American Culture.* Cambridge: MIT Press.

Kline, Benjamin (1997). *First Along the River: A brief history of the U.S. environmental movement.* San Francisco: Acada Books.

Kormondy, Edward J. and Daniel E. Brown (1998). *Fundamentals of Human Ecology.* New Jersey: Prentice Hall.

Latour, Bruno (1987). *Science in Action.* Cambridge: Harvard University Press.

Lee, Kai N. (1993). *Compass and Gyroscope: Integrating Science and Politics for the Environment.* Washington DC: Island Press.

Lichterman, Paul R. (1992). "When Is the Personal Political? Class, Culture, and Political Style in US Grassroots Environmentalism." Paper presented at the annual meetings of the American Sociological Association.

McEvoy, Arthur F. (1986). *The Fisherman's Problem: Ecology and Law in the California Fisheries, 1850-1980.* Cambridge: Cambridge University Press.

Melucci, Alberto (1989). *Nomads of the present: social movements and individual needs in contemporary society.* Edited by John Keane and Paul Mier. Philadelphia: Temple University Press.

Mighetto, Lisa and Wesley J. Ebel (1994). *Saving the Salmon: A History of The U.S. Army Corps of Engineers' Efforts to Protect Anadromous Fish on The Columbia and Snake Rivers.* Seattle, WA: Historical Research Associates.

Morrissey, W., J.A. Zinn, and M.L. Corn (1994). *Ecosystem Management: Federal Agency Activities.* Washington, D.C., Congressional Research Service. 124p. Report 94-339 ENR.

Murphy, Raymond (1998). "Social Constructivism, Structural Constructivism, and the Human Redeployment of the Processes of Nature." Paper presented at the annual meetings of the International Sociological Association.

Nehlsen, W., J.E. Williams, and J.A. Lichatowich (1991). "Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington". *Fisheries*, 16:4-21.

Nelson, Richard R. (1994). "Evolutionary Theorizing about Economic Change". In Neil J. Smelser and Richard Swedberg, eds., *The Handbook of Economic Sociology* (pp. 108-136). Princeton: Princeton University Press.

National Research Council (NRC) (1996). *Upstream: Salmon and Society in the Pacific Northwest.* Washington, DC: National Academy Press.

Oelschlaeger, Max (1991). *The Idea of Wilderness.* New Haven: Yale University Press.

Rapport, David J. (1992). "What is Clinical Ecology?". In Robert Costanza, Bryan G. Norton, and Benjamin D. Haskell, eds., *Ecosystem Health: New Goals for Environmental Management.* Washington DC: Island Press.

Scarce, Richard J. (1995). *The Social Construction of Salmon: Nature in the Making.* Dissertation, Washington State University.

Southerton, D., and S. Shove (1998). "Frozen in Time: Convenience and the Environment". International Sociological Association Paper.

Spector, M. and Kitsuse, J. I. (1973). "Social Problems: A Reformulation", *Social Problems*, 21(2): 145-59.

Stanford, J.A. and J.V. Ward (1992). "Management of Aquatic Resources in Large Catchments: Recognizing Interactions Between Ecosystem Connectivity and Environmental Disturbance". In Robert J. Naiman, ed., *Watershed Management: Balancing Sustainability and Environmental Change.* New York: Springer-Verlag.

Stern, P.C., Young, O.R., & Druckman D., eds. (1992). *Global environmental change:Understanding the human dimensions.* Washington, DC: National Academy of Sciences, National Academy Press.

Stouder, Deanna J, Peter A. Bisson, Robert J. Naiman, eds. (1997). *Pacific Salmon and Their Ecosystems*. New York: Chapman & Hall.

Strauss, Anselm (1978). "A Social Worlds Perspective." In Norman Denzin, ed., *Studies in Symbolic Interaction*, Volume 1: 119-128. Greenwich, CT.: JAI Press.

White, Richard (1995). *The Organic Machine: The Remaking of the Columbia River*. New York: Hill and Wang.

Wilkinson, Charles F. (1992). *Crossing the Next Meridian*. Washington DC.: Island Press.

# VITA

Tanya Alexandra Pergola

University of Washington

1999

## EDUCATION

**1999** **Ph.D. degree in Sociology**, University of Washington.
Dissertation chaired by Gary Hamilton.

**1994** **Master of Arts degree in Sociology**, University of Washington.
Thesis chaired by Sharon Reitman and Judy Howard.

**1990** **Bachelor of Arts degree in Sociology/Anthropology**, Special Honors, Washington and Lee University, Lexington, Virginia.

## PROFESSIONAL POSITIONS

**1997-Present** **Cultural Analyst/Retail Anthropologist**, The Hartman Group, Bellevue, WA.

**1998-Present** **Advisor**, Program on the Environment, University of Washington.

**1994-1997** **Instructor**, Department of Sociology, University of Washington.

**1993-1997** **Researcher**, USGS, Field Station for Protected Areas Research, University of Washington.

**1996-1997** **Research Consultant**, School of Nursing, University of Washington.

**1991-1994** **Teaching Assistant**, Department of Sociology, University of Washington.

**1990-1992** **Market Research Analyst**, Leigh Stowell & Company Inc., Seattle, WA.

## HONORS

**1997-1999** United States Environmental Protection Agency, Science to Achieve Results (STAR) Graduate Fellowship.

**1993-1994** Departmental Award for Excellence as a Teaching Assistant, University of Washington.

**1990** Department Award for Outstanding Achievement in Sociology and Anthropology, Washington and Lee University. (Sole recipient).

## PUBLICATIONS AND WORK IN PROGRESS

**1999** Pergola, Tanya, Mary Salazar, Katherine Graham, and Julie Brines. "Providers' Perspectives of Nursing Case Management Services." American Association of Occupational Health Nursing (AAOHN) Journal, Summer.

**1999** Brines, Julie, Mary Salazar, Katherine Graham, and Tanya Pergola. "Return-to-work Experience of Injured Workers in a Case Management Program." AAOHN Journal, Summer.

**1999** Brines, Julie, Mary Salazar, Katherine Graham, and Tanya Pergola. "Injured Workers' Perceptions of Medical Case Management." AAOHN Journal, Summer.

**1996** Pergola, T., Johnson, D.R., Paschel, J. M. & Vande Kamp, M.E., (October 1996). Ebey's Landing National Historical Reserve 1995 Visitor Survey. National Park Service Cooperative Park Studies Unit, College of Forest Resources, University of Washington. Subagreement No. 23, Co-op Agreement No. 1443-CA-9000-95-019.

**1995** Pergola, Tanya. Review of Mathew Schneirov, The Dream of a New Social Order: Popular Magazines in America, 1893-1914. Modernism/Modernity, (2)2 (April, 1995): 107-108.

**Forthcoming** Pergola, Tanya. "Was This Land Made For You And Me?" An Invited Chapter Prepared For Nature, Environment & Me Edited By Michael Aleksiuk And Thomas Nelson, Mcgill-Queens University Press.

## PRESENTATIONS

**August, 1994** "Shaping Movement Identity: Another Side of Environmentalism." Presented at the American Sociological Association Meetings.

**April, 1996** "Grumpies and Pollyannas: New Evidence in the Search for Understanding a Visitor's Recreation Experience." Presented at the Pacific Sociological Association Meetings.

**April, 1996** "Rational Capitalism Hunts Down the Endangered Species Act." Presented at the Pacific Sociological Association Meetings.

**April, 1998** "How Much is a Salmon Worth?: Understanding an Environmental Arena." Presented at the Pacific Sociological Association Meetings.

**June, 1998** "Managing Nature: The Decline of Salmon in the Pacific Northwest." Presented at the US EPA Graduate Fellowship Conference.

**July, 1998** "Managing Nature: Understanding an Environmental Arena." Presented at the International Sociological Association's XIVth World Congress of Sociology.

**Oct., 1998** "Humans' Desire to Control: A Look at the Meaning of Management within the Salmon Arena." Presented at the Society for Phenomenology and the Human Sciences.

## AREAS OF CONCENTRATION AND INTEREST

### Substantive Interests

Environmental Sociology
Social Organization
Sociology of Science
Social Movements
Economic Sociology
Statistics and Methodology

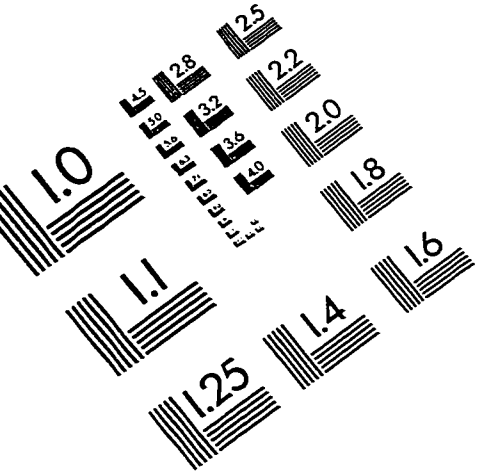
### Teaching experience

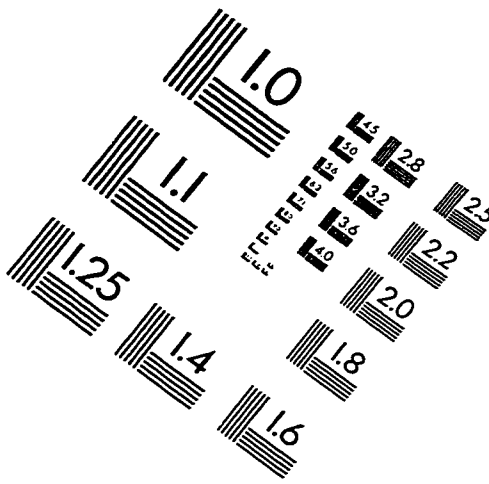
Introduction to Sociology, Statistics and the Methodology of Sociological Research, Theory and Process of Social Change, Sociology of the Environment.

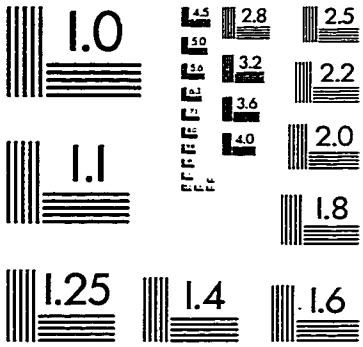
## REFERENCES

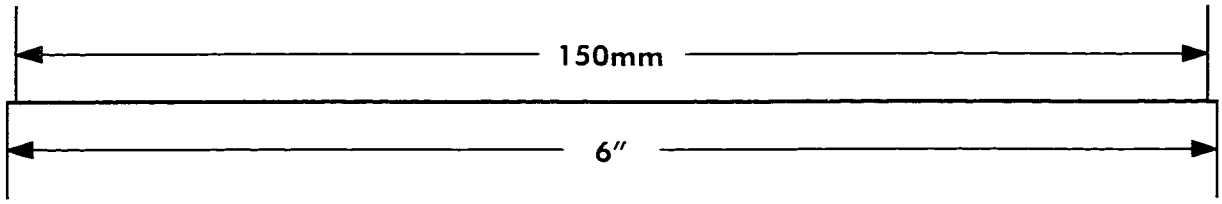
Howard Becker, Department of Sociology, University of Washington
Gary Hamilton, Department of Sociology, University of Washington
Darryll Johnson, College of Forest Resources, University of Washington
Harvey Hartman, The Hartman Group, Bellevue, Washington

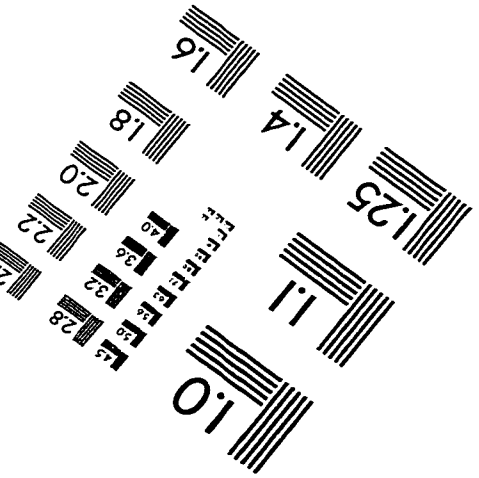
# IMAGE EVALUATION
# TEST TARGET (QA-3)

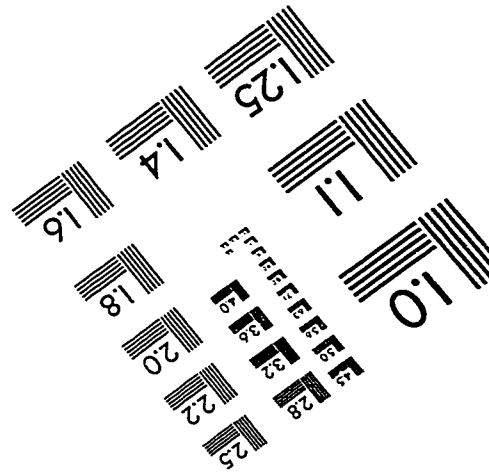



APPLIED IMAGE, Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989