1. Introduction

The research upon which this report is based had two objectives, to identify fishing communities in the New England region and more specifically, to assess the fishing-dependency of these communities. The communities of interest are those whose fishing fleets work in the exclusive economic zone (EEZ) under the jurisdiction of New England Fisheries Management Council.[1] Despite almost 25 years of regional fisheries management, New England's fishing communities are facing economic and social uncertainty due to declines in a number of fish species and the resulting management efforts to rebuild those stocks.

Information about the impact of regulatory change on communities has been constrained by a dearth of long-term, systematic studies of fisheries dependent communities in New England. Shortly after the New England Fisheries Management Council was established in 1976 by the Magnuson Fishery Conservation and Management Act (the Magnuson Act), a flurry of useful studies were published. Some attempted to characterize New England's fishing industry[2] or a limited number of ports[3]. Later reports focused on the economy[4] or attempted to measure the social impacts of specific management regulations.[5] Nowhere, however, was there a database of consistently gathered information about fishing dependent communities (FDCs) in the region.

While some of the recent studies have given managers and social scientists an improved understanding of the impact of regulatory changes on individual communities, neither their cumulative impacts nor the reverberation of impacts across communities and regions coincident with regulatory change have been assessed. In order to begin to monitor these dynamic and complex consequences of change, consistent data-collection over time is needed.

This MARFIN-funded study is an attempt to lay the groundwork for regional and community data sharing among fishery managers, policy makers, and fishing industry participants and communities. This study of the social and cultural parameters of the fisheries is complemented by an economic model (based on IMPLAN) being developed at Woods Hole Oceanographic Institution. Future in-depth or more specific analyses of the human aspects of fisheries issues in New England will benefit from the baseline drawn by these two studies.

The Magnuson-Stevens Fishery Conservation and Management Act (SEC. 303 (a) (2))[6] requires fishery management plans to: "contain a description of the fishery, including, but not limited to, the number of vessels involved, the type and quantity of fishing gear used, the species of fish involved and their location, the cost likely to be incurred in management, actual and potential revenues from the fishery, any recreational interest in the fishery, and the nature and extent of foreign fishing and Indian treaty fishing rights, if any. . . "

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[1] The portion of the EEZ controlled by the New England Fishery Management Council lies off of the states of Connecticut, Rhode Island, Massachusetts, New Hampshire and Maine.
[2] Smith and Peterson 1977, 1979; Peterson and Smith 1981; Acheson et al 1980;Danowski 1980; Dewar 1983; Gatewood & McCay 1988; Gersuny, Poggie &Marshall 1976; Ladner et al 1981; Penrose 1981
[3] Acheson ed. 1980; McConnell and Smith 1979; Poggie and Pollnac 1980; Dewar et al 1978; Husing 1980; McCay 1980; 1989; Miller and Van Maanen 1979
[4] Doeringer, Moss and Terkla 1986; Fox and Lesser 1981; Holmsen 1976
[5] Hall-Arber (1993); Griffith and Dyer (1996); Dyer, Poggie and Hall-Arber (1998)
[6] 16 U.S.C. 1853

In addition, plans must "(9) include a fishery impact statement for the plan or amendment (in the case of a plan or amendment thereto submitted to or prepared by the Secretary after October 1, 1990) which shall assess, specify, and describe the likely effects, if any, of the conservation and management measures on—-(A) participants in the fisheries and fishing communities affected by the plan or amendment. . ."

Discretionary provisions of the management plans include permission to establish a "limited access system for the fishery in order to achieve optimum yield. . ." If this is done, however, "the Council and the Secretary take into account-- (A) present participation in the fishery, (B) historical fishing practices in, and dependence on, the fishery, (C) the economics of the fishery, (D) the capability of fishing vessels used in the fishery to engage in other fisheries, (E) the cultural and social framework relevant to the fishery and any affected fishing communities, and (F) any other relevant considerations". . .

When the Magnuson-Stevens Fishery Conservation and Management Act was amended in 1996 by the Sustainable Fisheries Act, a number of standards were identified as requisite for fishery management plans. Among them, National Standard 8 dictates "Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities."[7]

In its section on definitions, the Act defines the term "fishing community" as "a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such a community."[8]

Thus, the fishing community is defined as a "place" and the legislation requires that the impact of regulations on fishing communities be analyzed. The question then arises, how should the boundaries of that "place" be drawn and its dependency measured? Does the whole setting have to be included in the measure or can a "fishing community" be abstracted from the whole and its dependency quantified? Furthermore, is the focus on dependency the only critical assessment to be made or is there another parameter of equal value? Those of us who are interested in fishing communities know that the answer is critical. The success or failure of fisheries management may be inextricably bound to notions of "community." Co-management and community quota systems are two of the most promising steps towards making fisheries sustainable without eliminating a "fishing way of life." Both require a defined community.

A general absence of social and cultural longitudinal data on fishing communities in the U.S. has led to an effort to fulfill the requisite of National Standard 8 through simple economic assessment. Unfortunately, such an approach is inadequate, and maybe even harmful, when applied to specific cases.[9] Measurement of fishing dependence must include a complex of features that takes into account fishing history, infrastructure, specialization, social institutions and gentrification trends, in addition to economic characteristics. Most importantly, fishing communities must not be viewed as economic isolates but as contributing partners in regional networks of total capital flows and transformations associated with Natural Resource Regions.[10]

While the three principal investigators collaborated on each portion of the project, each of us took the lead in a particular approach to identifying fishing communities and ranking their fishing dependency. Chris Dyer and John Poggie, in collaboration with Dr. James

[7] SEC. 301. NATIONAL STANDARDS FOR FISHERY 16 U.S.C. 1851 http://www.nmfs.noaa.gov/sfa/
[8] SEC. 3. DEFINITIONS 16 U.S.C. 1802
http://www.nmfs.noaa.gov/sfa/
[9] E.g., the spiny dogfish fishery.
[10] Dyer and Poggie (2000)

McNally of the University of Michigan, were responsible for the theoretical context based on a regional consideration of fishing-related employment. John Poggie formulated the approaches that measure the complexity of the fishing infrastructure and the degree of gentrification of specific communities. Madeleine Hall-Arber was principally responsible for the port profile approach that provides a more detailed consideration of individual ports, revealing patterns of contacts, characteristics of the community's culture and institutions, and some perspective on local residents' views about their way of life and about fisheries management. All of the principal investigators interviewed key respondents and wrote portions of the profiles. In addition, Renee Gagne wrote the profile of Chatham, Massachusetts.

These three methods, along with economic analyses, offer a way to approach a comprehensive analysis of human ecosystem dynamics in coastal regions. Ultimately, our goal is to take fisheries management development one step closer to the incorporation of knowledge about the whole "resource system from the resource base to the fishermen,[11] their families and communities, and the broader networks of policy distribution, and consumption of which they are also a part."[12]

We propose that the regional theory and method outlined here reflect the reality of contemporary coastal communities having a fishing component in their economies. Furthermore, we suggest that this method be tested in other regions to determine if it should be accepted as the standard for the analysis of the fishing industry and fishing-dependent communities nationwide in fulfillment of the requisite associated with National Standard 8.

While we present this publication as an important step toward understanding fishing communities in New England, we do so with the caveat that we are aware of three major lacunae. The first is that our dependency measures do not incorporate comparative economic data. Since the dependency of a community on particular resources is necessarily affected by the value of those resources, the economic profiles are requisite for a more complete profile. Likewise, the second insufficiently covered pertinent aspect is history. While each community profile incorporates a small historical sketch, these sketches hardly do justice to the rich, complicated history of fishing in New England and so provide only the barest context for what exists today. Finally, because the Census numbers are based in part on samples, they seem to undercount the numbers of individuals involved in the fishing industry.[13] Nevertheless, when the regions are compared using the indices based on Census data, the relative dependency of communities on the fishing industry seems to be fairly accurately indicated. Even so, we caution that the indices should not be relied upon for absolute numbers. The ultimate dependency of the communities must also be weighed according to the infrastructure differentiation, gentrification scale, analysis of total capital flow and, importantly, according to the perspective of community stakeholders as described in the profiles.

[11] Both men and women who fish in New England seem to prefer to be referred to as fishermen rather than the academically-popular term 'fisher." The term fisherman is used in this study as though gender-neutral.
[12] Durrenberger and King (2000)
[13] Another difficulty in using Census data that is easily accessible (via the Internet, for example), is that the area being referred to is not always clear. Many of the fishing communities are "CPD" (Census Designated Place)— "a statistical area defined for a census as a densely settled concentration of population that is not incorporated but which resembles an incorporated place in that it can be identified with a name." Or they are a subdivision of a county. Other Census data is based on school districts.

2. Conceptual Framework

2.1. A Regional Ecosystem Approach

The conceptual framework for this report is based on a regional approach that has its foundation in ecosystem modeling. Internationally, the ecosystem paradigm is emerging as a dominant approach to large-scale management of natural resources. For example, resource managers and social scientists concerned with the degradation of the worlds' seas suggest focusing on large ecosystems as a way to recover ecosystem health and make the utilization of renewable resources sustainable. Emergence of this paradigm has also been spurred by the failure of single species approach to management. Yet, theoretical and applied paradigms linking human systems and large-scale ecosystems are undeveloped.

Some fundamental issues that ***are*** being addressed include the spatial and temporal scales of governance and policy-making arrangements that structure the institutional linkages between marine ecosystems and their governance. However, the dynamic between regional natural systems and human actions at the individual, household and community level is generally not included in ecosystem modeling and praxis. Given the worldwide state of decline in ecosystem health, there is an urgent need for marine policy bodies to develop and apply conceptual-theoretical models of human action that complement the large-scale ecosystem approach.

This report examines fishing-dependent communities in a regional context. We use a community and regional (large-scale) approach to the analysis of the New England fisheries in a way that complements Sherman et al.'s work on Large Marine Ecosystems (LMEs). LMEs are geographic areas of oceans that have distinct bathymetry, hydrography, productivity, and trophically dependent populations. The LME approach attempts to link the management of drainage basins and coastal areas with continental shelves and dominant coastal currents. Our report provides a framework for monitoring and assessing socio-economics and governance of the associated Natural Resource Regions (NRR) of the US Northeast Shelf LME. The Natural Resource Regions are defined through identification of networks of communities acting as nodes of regional total capital flow. Communities are not viewed in isolation, but are defined internally through social, ethnic, and historical ties and externally through networks of regional and extra- regional total capital flow.

2.2. Space and Place in Human Ecosystems

Although not conceptually linked to large-scale marine systems, the study of uses of space and place, including degradation by human action, is receiving some renewed attention from social scientists.[14] These studies contribute much to our understanding of how people perceive their connection to place. Yet most efforts to understand induced changes in environment suffer from a parochialism of scale. At the extreme are interpretations of human-environment interactions that take a person-centered (ego centered) approach to place as modified through human action.[15] By emphasizing localized, individual or community-level outcomes, yet ignoring potential impacts and connections to regional and extra-regional factors, researchers can miss much of what determines the ultimate direction and magnitude of human-induced environmental change. While providing valuable insights into the localized interpretation and use of space and place, such foci also miss the connection of humans, communities, and the places they occupy as well as change as a ***regional process,*** dominated by human behavioral and value systems interfaced with environment.

[14] Aihoshi and Rodman (1992); Auge (1995); Basso (1988); Hirsch and O'Hanlon (1991); Kahn (1990); Munn (1990); Myers (1991); Pandya (1990); Parmentier (1987); Stewart (1988); Wassman (1991); Weiner (1991); Feld and Basso (1996)

[15] Berdoulay (1989); Entrikin (1989); Nir (1991); Shields (1991); Tauan (1991); Yoon (1986)

The political ecology of change does provide us with some parallels to a regional human-environment approach. For example, Giblin describes how the 19th century politics of environmental control created famine for farmers in Northeast Tanzania.[16] In this case, the ability of farming communities to control disastrous cattle infections and subsequent starvation depended on how external forces affected patronage and redistributed wealth. The most important relations of production were between patron and client, so the policy of patronage determined whether pre-colonial farmers succeeded in controlling disease, accumulating livestock and food reserves, and preventing drought from causing famine.

Adaptation to disruptive events within social systems has also been explored. For events such as cyclic ecological problems of drought, earthquakes, or floods, many societies are noted to possess adaptive flexibility, also described as "equilibration."[17] Equilibration is adjustment to changed environmental conditions in the face of new socio-technological exigencies, and is well documented in the ethnographic literature.[18] However, no parallel models of regional change exist to guide governance of marine natural resources. Modeling of natural resource management in fisheries has been dominated by biologists using, for example, such tools as the Schaefer-Gordon curve in fisheries management, with collaborating contributions from economists. A lack of a regional perspective that includes social and cultural aspects of human action makes such bio-economic models inadequate as vehicles for the thorough understanding of human transformations of natural resources.

Moreover, with the recent exception of economic modeling, input of social scientists to natural resource models has historically been trivialized by policy and management bodies. For example, the standard requirement for social science assessment of U. S. fisheries management stipulates use of the "best available information." Unfortunately, due in part to the lack of longitudinal studies and/or consistent data collection and analysis, the "best available" often consists of collected anecdotal opinions from public hearings as well as out-of-context and dated information applied from one fishery to another. Furthermore, what information is available is often reviewed in a very hurried and reactive manner.

Social science data often fall into the category of add-ons to dominant biophysical or bio-economic models, which leave little room for human thought and action, and give even less consideration to the human consequences of resource management schemes.[19] Yet, the very nature of the critical resource transformations that are the target of management are founded in human perceptions and actions. It is not surprising that resource managers are not aware of the powerful influence of most non-bioeconomic factors in resource transformations, as their policy mandates are frequently swayed by participation in specialized intellectual environments that are inflexible in their consideration of new forms of interpretation.[20] Social scientists too are partly to blame, as resource managers have not been provided the necessary 'human' models to manage such human actions at the same regional scale in which they strive to deal with ecosystem transformations. The consequences of this shortcoming are potentially severe, and can include the collapse and degradation of the resource base despite the best intentions to manage it. One of the intents of this chapter is to help rectify this situation.

A remarkable pioneer formulation of a regional human resource model is Bennet's study of adaptive strategies of social groups of the Canadian Great Plains.[21] Bennet describes how his regional approach differs from prior intellectual traditions: "In defining an approach for this study we had available the following academic research traditions: human or cultural geography, with its descriptive emphasis on cultural-environmental correlation; economic development, with its concern for the ways agrarian populations use resources to forge a

[16] Giblin (1992)
[17] Torry (1978)
[18] Zaman (1991); Dirks (1980); Waddell (1976); Brookfield and Brown (1967); Spencer (1959)
[19] Poggie ( ); Dyer (1994)
[20] Ward and Weeks (1994)
[21] Bennet (1969)

viable economy; or cultural ecology, with its emphasis on the important role played by economic and technological adaptations in shaping institutions. None of these approaches by itself seemed to provide a suitable format for the synthesis of a large quantity of data from a particular geographical and human region."[22]

Bennet chose a regional approach over a community-based one in part because the complexity of resource flows of the Great Plains setting demanded it: "We selected a regional instead of the usual nucleated community studied by anthropologists and sociologists because of the way human activities are distributed in the Great Plains. Since resources are unevenly distributed, people who depend entirely on livestock production will occupy different portions of the region than those who depend on grain crops. Indians are confined to marginal "bush" areas of the hills. Some towns will have many services, others are highly specialized."[23]

Another early precursor to our model is the work of Pelto and Poggie in which they outline the utility of regional approaches to the understanding of processes of culture change. "The community approach used in anthropological studies produces rich and detailed descriptions of how rapid social and cultural changes have transformed the lives of individuals and local groups. On the other hand, such studies often depict local developments without sufficient attention to the ways in which the local community is articulated to the larger regional and national socioeconomic and political systems. Moreover, anthropologists frequently have placed heaviest emphasis on the unusual and different—the exceptional cases of modernization, good and bad. Thus it is not clear how these studies can be built into a more generalized theoretical framework."[24]

2.3. The Natural Resource Region

We propose a regional model for New England to understand human-environmental interactions as shaped and transformed by various forms of capital in their interface with large-scale marine ecosystems. This approach builds on Bennet's and Pelto and Poggie's work, but differs in that it defines regions through a network of communities acting as nodes of regional total capital flow. Communities are not viewed in isolation, but are defined internally through social, ethnic, and historical ties and externally through networks of regional and extra- regional total capital flow.

Capital—tangible or intangible resources that contribute to the long-term adaptation of a person, group, or population—is used here in the broadest sense to include human, social, cultural, biophysical, and economic transformations and exchanges, which we refer to as 'flows.' An empirical question in regional studies is the extension of 'capital' beyond the economic. In some cases, economic capital may predominate as the most significant driver in a community and regional system. In most cases, we suspect other forms or combinations of capital forms (social, human, cultural, and economic) may predominate, with economic capital being one of a complex mix with others. The patterns and importance of various combinations of capital flow must be ascertained by empirical research and not assumed to be the same everywhere.

Economic capital is conceived to include more than monetary resources, but involves formal and informal exchanges of goods and services, with the primary source derived through production and transformation of biophysical capital (e.g. marine resources). For example, groundfishing in Downeast Maine traditionally includes exchange of labor (human capital—helping offload fish) and information (cultural capital—letting folks know where the fish are) among community residents without any formal monetary exchanges.[25] Such reciprocity results in the flow of long-term sustainable benefits that carry much more than narrowly conceived economic value.

[22] Ibid, p. 26
[23] Ibid, p. 27
[24] Pelto and Poggie (1974), p. 114
[25] Griffith and Dyer (1996)

Elsewhere, in a community-based assessment of the Native response to the Alaska Native Claims Act (ANCSA), Berger found overwhelming rejection by Alaska Natives of proposed economic incorporation.[26] Incorporation meant dividing up the natural resources (land, minerals, trees) into corporate stock, from which the corporations were to benefit. Berger demonstrated that the social and cultural capital associated with the Native subsistence way of life and resources were considered to be of much greater importance (value) to Native communities than any economic capital to be accrued through incorporation of Native lands and communities.

Since Berger's work, virtually all the Native corporations under ANCSA are bankrupt. Outside investors with no stake in maintaining the social and cultural capital of native Alaskan communities have been purchasing land and associated resources since a 1992 ANCSA sunset clause on stockholder control. Subsequent social problems and community decline in these Native populations confirms Berger's assessment that the natural resources possessed greater long-term social and cultural value in sustaining Alaska Native communities and their nature-focused life-ways than what was derived as short-term economic gain for corporate (community) stockholders.

Besides recognizing the importance of capital in all its forms, we propose that marine resource policy and management can benefit from a regional approach. We argue that by taking an isolated community, overall statistical, or individual perspective on place-space transformations, social scientists have misinterpreted cause and effect, seeing only disconnected pieces of what are actually wider processes of a regional and extra-regional dynamic of human-environment interaction.

There may, in fact, be inter-cultural diversity, communities may vary and there may be differently linked networks in the same region, but these are empirical questions that must be addressed in each specific NRR studied. Our focus is on networks of communities linked to ***marine resource utilization.*** Other regional use networks focused on such enterprises as agriculture, the service industry, manufacturing, and tourism necessarily overlap and integrate with the marine resource networks.

Variation in levels of capital exchange in marine-resource dependent regions reflects a continuum of community isolation and integration of capital flows. More isolated maritime communities are often economically marginal, have limited control over regional natural resources, are frequently culturally or ethnically distinct and geographically distant from more structurally differentiated communities in a region. [27] More integrated maritime communities are economically tied to regional networks; can represent a complex mix of ethnicity and cultural practices; and are less distinctive from and geographically closer to other such communities. [28]

The regional model proposed here, the Natural Resource Region (NRR) unifies elements of human actions and values to allow for interpretation and application of human factors by natural resource managers working within the framework of Large Marine Ecosystems (LMEs). [29] The LME model outlines five linked modules to assess ecosystem sustainability: productivity of the ecosystem, fish and fisheries, pollution and ecosystem health, socioeconomic conditions, and governance.[30] Modules of governance and socio-economics are at present undeveloped for LMEs.

The NRR is focused on the 'socioeconomic' module, but takes a much broader perspective in that it expands 'socio-economics' to include social, cultural, human, economic and biophysical capital and their dynamic interactions. In the interface with LMEs, primary

[26] Berger (1985)
[27] Dyer and Leard (1994)
[28] Griffith and Dyer (1996)
[29] Sherman et al (1998); Sherman et al (1993); Sherman et al (1992); Sherman et al (1990)
[30] Ibid

units of human-environment interaction—individuals, families, or communities—are to be viewed as interconnected within regional networks held together by forms of capital. The community as a nodal form of human organization helps structure regional interactions and capital flows. In aggregate, communities provide for points of spatial reference by which to study the LME/NRR dynamic. We begin detailed discussion of the model with the building blocks of NRRs—Natural Resource Communities (NRCs).[31]

2.4. The Natural Resource Community as a Regional Base Unit

In a collection of case studies on folk management in fisheries around the world, Dyer and McGoodwin draw upon the concept of the Natural Resource Community (NRC) to characterize fishing communities worldwide.[32] The NRC is a social unit anchored in local history and local understandings of ecological relationships, consisting of " a population of individuals living within a bounded area whose primary cultural existence is based on the utilization of renewable natural resources."[33] Residents of fishery-based Natural Resource Communities tend to hold in common a localized worldview, and locally developed assertions about how to best manage local natural resources. As such, NRCs can come in conflict with management regimes that impose external controls without acknowledging local interests, as often occurs in developed fisheries regimes.[34]

Although fishermen interact, often quite regularly, with individuals and institutions who have few or no ties to fishing, "where they [fishermen] live and work is still a localized, specific place, and quite often they perceive that they take their catches from a specific, bounded, marine ecosystem, which from their perspective has unique systemic attributes."[35] Thus, the NRC model provides a useful spatial context upon which to begin the study of regional and extra-regional ecosystem dynamics.

Nevertheless, unlike the original conceptualization of the NRC, which describes communities as spatially 'bounded,' most contemporary fishing NRCs are not isolated from national governance nor from the commercial and other institutions of the cities, towns and villages which share their region. Also, residents in marine-dependent communities do not perceive the ecosystems upon which they depend as closed systems. Moreover, extra-regional influences such as global market systems can dominate or even destroy regional networks and the communities they comprise. For example, in the late 19th century, the marine fisheries of Maine were tied into a three-way trade of sugar cane, dried fish, and salt with Europe and the Caribbean.[36] When the external demand for dried cod collapsed, the offshore marine fishery also collapsed, resulting in significant social, cultural and economic decline in the coastal Maine NRR.

Gallaher and Padfield, in their theory of the 'dying community', describe such declines as including (1) abandonment of a natural region, (2) decay of a sociocultural system or civilization and (3) extinction of a particular form of association.[37] Their 'form of association' is synonymous with the totality of interdependent relationships—or total capital—that define a community. Furthermore, the social and cultural fabric of ***individual communities*** is interwoven through a series of regional exchanges—economic, ritual, and otherwise. These exchanges define the degree of community dependence on the marine environment, and can be linked to varying regional and extra-regional influences of the marketplace, changing environments (e.g. sea level rise), governance, and extraction technologies and their associated innovations (e.g. nylon versus cotton nets).[38]

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[31] Dyer, Gill and Picou (1992)
[32] Dyer and McGoodwin (1994)
[33] Dyer, Picou and Gill (1992)
[34] McGoodwin (1990)
[35] Dyer and McGoodwin (1994)
[36] O'Leary (1966); Gallaher and Padfield (1980)
[37] Gallaher and Padfield (1980), p.20
[38] Firth (1946)

Dyer and Griffith isolated five variables that help identify community dependence on a fishery.[39] These are relative isolation or integration of fishery-dependent people into alternative economic sectors; vessel types/ gear strategies within the port's fishery; degree of regional specialization; percentage of population involved in fishery or fishery-related industries; and competition and conflict within the port among different components of the fishery.

While each of these components is considered in the profiles that follow, our analyses combine them in different ways. For example, the indices based on occupational categories combines the variable of relative isolation or integration into alternative economic sectors with the variable concerning the percentage of population involved in fishery-related industries. The profiles also describe vessel and gear types, specialization and to some extent, the competition within ports.

Clearly, the components of community dependence on fishing define the social, economic and cultural relationships between fishermen and their communities. Benefits that flow from these relationships are multiplied through a series of networked community exchanges and transformations based on different forms of capital. Understanding the various forms of capital and their relationships provides the basis for our regional model.

2.5. Forms of Capital

Complementary forms of capital and their interactions allow for the production and reproduction of systems of marine resource utilization such as fisheries. Social, cultural, human, biophysical and economic capital maintain production units such as households and fishing crews and over time allow for recruitment of new community members into the occupational hierarchies of the fishery.

Social capital

The concept of ***social capital—***the configuration and functions of people's personal ties—was explicitly articulated by the late James Coleman but earlier versions have appeared in sociological and anthropological theory.[40] Drawing on several works in sociology and anthropology that demonstrate ways in which social ties influence and organize economic behavior, Coleman arrives at a definition of social capital that returns to his central themes of behavior as the product of self-interest and control: "Social capital is defined by its function. It is not a single entity, but a variety of different entities having two characteristics in common: They consist of some aspect of a social structure, and they facilitate certain actions of individuals who are within the structure. Like other forms of capital, social capital is productive, making possible the achievement of certain ends that would not be attainable in its absence. Like physical capital and human capital, social capital is not completely fungible, but is fungible with respect to certain activities. A given form of social capital that is valuable in facilitating certain actions may be useless or even harmful for others. Unlike other forms of capital, social capital inherits the structure of relations between persons and among persons. It is lodged neither in individuals nor in physical implements of production."[41]

In Coleman's sense, social capital enables individuals with reduced or no access to investment capital to accumulate the symbolic and material means to participate successfully in an economic activity such as fishing. Social capital depends, however, on the social field in which people give and receive jobs, information, low-interest or no-interest loans, gifts, and so forth. It is that social field which gives social capital life, transcending the individual without leaving her or him out of the equation, "…both accounting for different outcomes at the level of individual actors and making the micro-to-

[39] Griffith and Dyer (1996)
[40] Colman (1990, 1988); Coase (1960)
[41] Colman (1990)

macro transition without elaborating the social structural details through which this occurs."[42]

The social relations that engender social capital also assure its circulation through the group and its continual replenishment and reproduction. Drawing on social capital carries with it the obligation to replenish the fund, depending on trust, expectation, normative values, cultural rules, etc., and some means—authority, shame, gossip, force—to enforce the obligation. In the context of the regional resource model proposed here, we define social capital as the configuration and functioning of social ties that occur within and between communities. Social capital is key to the flow of other forms of capital, as well as central to the dynamics of governance and resource utilization.

Human and cultural capital

Closely related to social capital is human and cultural capital, which are key to understanding fishery dependence. These forms of capital are similar to social capital in that they depend on social ties that have meaning for the individuals who benefit from them. Human capital includes people and their individual occupational and familial roles, achieved through schooling, apprenticeship, experience, and other formal and informal training. This concept is better known among economists than either social or cultural capital, and is recognized by the general public (including potential employers) as something, if not entirely tangible, certainly useful.

Cultural capital is less familiar to and less widely recognized by the general public. Nevertheless, most potential employers inadvertently consider cultural capital in selecting employees. Cultural capital consists of specific behaviors, values, and skills transmitted among and between members of a population, including across generations, applied to their adaptation to specific environments including the transformation and utilization of natural, human, and social resources in those environments.

Cultural capital can be either subtle or overt characteristics and learned skills and behavior. The use of language and slang, notions of personal space, appropriate dress, presentation and learned use of specific technologies is part of a group's cultural capital. In addition, the myriad parts of personal cultures, such as personal preferences that make one more or less satisfied, comfortable and, most importantly, predictable to be around are part of cultural capital. People acquire cultural capital through families, peer groups, neighborhoods, special cultural centers such as bars or exclusive college campuses, churches or other voluntary associations.

Function of social, human and cultural capital

Berkes and Folke define cultural capital as "factors that provide human societies with the means and adaptations to deal with the natural environment."[43] We extend the adaptive character in our formulation to include human, social, and economic capital variations and their interactions. If these interactions are disrupted or modified in a way that significantly reduces utilized marine resources, they may be modified to allow the system to recover, or if the disruption is too great, systematic collapse may take place.

It is assumed that the sociocultural evolution of specific adaptive strategies and occupations in a natural system such as a fishery can involve considerable individual and intergenerational investment to develop appropriate social, cultural and human capital networks necessary for the cultural and biological production and reproduction of households and families. This also entails long-term investment in gaining and applying knowledge necessary to compete for marine resources. As long as a healthy fishery exists - one that continues to promote the generation, mobilization, and use of the various forms of

[42] Ibid, p. 305
[43] Berkes and Folke (1994)

capital - current individuals operating within the industry will be able to weather economic and ecological downturns and reproduce the fishery through adaptive shifts in resource utilization patterns.

Understanding the interplay of social, human, cultural, capital with economic and biophysical capital has rarely been attempted. In their discussion of the share systems that characterize payments to labor and capital in the New England groundfishing industry, Doeringer, Moss, and Terkla recognize the importance of these alternative forms of capital without explicitly defining them as we have.[44]

Like the communities that make them up, Natural Resource Regions can be variably 'open' or 'closed' depending on the dynamic flow of biophysical, cultural, and human capital. A fishery can also be the sole socioeconomic entity in a region or it may be embedded in a more complex socioeconomic whole, as is the case in New England.[45] We propose that NRRs are interconnected by the flow of total capital – information, ideas, people and their behavior, technology, money, resources and seasonal and annual changes in fishing strategies.

A fundamental premise of the regional model is that use of natural resources for one's primary livelihood engenders relationships of dependence between the extractors (e.g. fishermen) and their support networks. Significant changes in access to fisheries resources thus has a multiplier effect across these personal networks that affects all levels of the social structure, including communities, businesses, organizations, families and individuals. These networks are both formal and informal, and fluctuate with changes in participants and communities within the region. Dependence on renewable natural resources such as fisheries presents an opportunity, but also limits the degree to which participants can engage in alternate activities. As one fishery-dependent informant in Downeast Maine puts it: " when I first went inland 10 or 12 miles from the coast and I looked around, I asked myself, how can these people possibly make a living?"

2.6. Total capital and the NRR

The direction of life activities towards natural resource extraction enlists various forms of capital—human, cultural, economic, and social, that when interfaced with the biophysical resources of the adjacent marine environment define the character of the region in which communities interact. The forms of capital which make up this dynamic in their whole are the total capital of the regional human ecosystem or NRR.[46]

Components of total capital are the same as those for NRCs with the addition of marine biophysical capital. Total capital is conceptually defined as the sum of all the component units of capital and their interactive states within a region. The interface between a regional natural system of extractive NRCs, their capital flows and the associated LME is here defined as a Natural Resource Region (NRR). An NRR is conceptualized as a network of Natural Resource Communities, linked to the marine resources of a Large Marine Ecosystem, whose existence is defined by the interactive flow of total capital. The context of this conceptualization may have a marine and fisheries focus depending upon its linkage to LMEs. The 'marine' NRR overlaps with the LME in both the terrestrial and marine sectors. For example, a fishing boat out at sea is a production-extraction unit of the NRR, relying directly on the physical attributes of the ocean to tap into the biological productivity of the fisheries of the LME (the NRR's biophysical capital). The fishing boat is thus an extension of the NRC from which it came, carrying with it social, cultural, and human and economic capital in its hunt for fish resources.

[44] Doeringer, Moss and Terkla (1986)
[45] Doeringer, Moss and Terkla (1986)
[46] Dyer and Poggie (1998)

Non-marine manifestations of large ecosystems, such as the Great Plains or the Amazon River Basin, have their own NRC networks and capital flows, and thus also represent NRRs. Linkages to biophysical capital can be dominated by economic, cultural, or social capital, but most commonly in a NRR is a complex mix of these—comprising what is often described in fishery-dependent NRCs as a "way of life." The conceptualization of capital flows within an NRR network lends understanding to the occupational valuation placed on a "way of life." For example, Doeringer, Moss and Terkla show how kinship support systems—a form of social capital in our formulation—allow fishermen to maintain labor linkages to the fishing industry despite seemingly debilitating economic conditions. [47]

The Natural Resource Region model provides a spatial-temporal framework that links the biophysical with the human-ecological, and most importantly points the way to understanding system dynamics over space-time as forms of total capital flow in the system. The interaction between human, cultural, social, biophysical, and economic forms of capital in an NRR represents a continuous dynamic that changes over time and is subject to both internal and external influences. The NRR model provides managers with a powerful tool to help to anticipate the consequences of proposed policies and human-resource interactions arising as direct and indirect consequences of policies, often so lacking in attempts to 'manage' the environment.

2.7. Externalities to the NRR

Regional studies of human ecological processes help make possible systematic examination of the range of variation within particular political-ecological zones rather than depending on single fishery-dependent communities as type cases. The externalities presented for each capital form are idealized, non-exhaustive lists, and for any specific case must be empirically studied to ascertain the contemporary political ecology and environmental history of the NRR under consideration. Local inventions would not be considered externalities in that they would be part of the dynamic component of cultural capital.

Externalities

As an externality, ***technology*** refers to the means by which resources are extracted and transformed for human use, and is most frequently developed in extra-regional locations and "imported" into NRRs under study. ***Governance*** is an externality that identifies the form and function of decision-making bodies, including the nature of policies and how resource policies are implemented. ***Markets*** refer to the linkages of the producers in any particular NRR with buyers in other NRRs and/or with extra-national entities such as global markets (e.g., what Jentoft refers to as the "global fishing village" or Greider the "global capitalist system"). [48] ***Environment*** as a regional externality refers to processes and consequences of changes such as global climate, ecosystem-wide shifts in temperature regimes, or sea level rise associated with anthropogenic factors of pollution (e.g. the greenhouse effect), or as part of other large-scale cycles of natural changes.

Population

Population as an externality refers to the pressure of migration into coastal NRRs. Throughout the developing world, the coastal zone represents one of the last refuges for the impoverished and dispossessed. Coastal regions of Southeast Asia are under pressure from landless immigrants seeking new resources, or from those moving from one environmentally degraded coastal area to another that still supports viable marine-based communities. In the developed world, coastal areas attract economic entrepreneurs, the elite, and others desiring the recreational-cultural capital offered by life near the sea.

Different forms of capital are equally weighted in our ideal model to avoid ***a priori*** valuing or devaluing any specific criteria at the expense of others. This does not mean their

[47] Doeringer, Moss and Terkla (1986)
[48] Jentoft (1995); Greider (1996)

importance cannot differ across NRRs, as they clearly do. Such differentiation is guided by the nature of associated LMEs, and the ethnohistory and political ecology of associated human communities and their governance aggregates (e.g. states, counties). The operationalization and empirical measurement of these domains of capital and associated changes in externalities are currently being developed by the co-authors in field research in two diverse parts of the world—New England in the US, and Palawan in the Philippines.

Once assessment of total capital is completed, measured capital importance is ranked and compared. With this information, it is possible to anticipate the magnitude and direction of policy agendas (a governance externality) on the total capital flows of the NRR in question. This gives decision-makers the capacity to determine the most favorable policy options to apply in a specific Natural Resource Region in order to maximize desired management goals and minimize negative outcomes. This analysis considers the assessment of 'total capital value' to include ***direct value*** (derived goods and services), ***indirect values*** (e.g. ecosystem and NRC maintenance), ***option values*** (future potential uses), and ***existence values*** (derived from some esthetic appreciation of biophysical capital). An example of existence value derives from the knowledge of the continued existence of some marine species, whether personally observed or not.[49]

2.8. Flows and Changes in Total Capital

Natural Resource Regions have been described here as consisting of networks of Natural Resource Communities, held together by the flow of total capital. These networks include communities directly interfaced with the biophysical capital and communities on the interior margin, connected by roads or by waterways to the marine environment. To understand the interactive flows of the different forms of capital, we must examine the conditions under which residents of Natural Resource Communities operate within the system. A basic assumption here is that there is some degree of reliance on natural resources, in this case, the biophysical capital of a Large Marine Ecosystem. The concept of biophysical capital used here is similar to "natural capital," first introduced by Vogt.[50]

The occupational roles involved in biophysical capital extraction define NRC residents as extensions of their environment. [51] However, this does not mean that such systems are static and unchanging. NRRs are constantly in flux, in rhythm with the changing availability of biophysical capital to residents. For example, a downward trend in the availability of one targeted fish species, for whatever reason, is often associated with shifting effort towards other species by fishing units.[52] Innovation and invention in resource extraction can also shift the balance of resource availability, at times favoring one group over another, or at times resulting in the total collapse of exploited fishery stocks. Also, seasonal shifts in effort from one species to another are often practiced in NRRs. Pelagic seasonal stocks are supplemented in the off-season with benthic shellfish or crustaceans (e.g., combining lobster fishing with seasonal herring fishing by weirs in the eastern part of the Gulf of Maine sub-LME).

Response to biophysical capital decline

When environmental factors result in a significant decline in available biophysical capital in an NRR, residents respond in culturally patterned ways. Unfortunately, the dynamic equilibrium in many world NRRs and their associated LMEs is being disrupted beyond normal recovery from intense anthropogenic pressures degrading the ability of environments to recover and ultimately leading to environmental disaster. The identified human-nature relationship that follows disaster in an NRR can be conceptually linked by the ecological-symbolic approach. [53] This approach recognizes the existence of culturally

[49] Goulder and Kennedy (1997)
[50] Vogt (1948)
[51] Dyer (1993)
[52] Dyer and McGoodwin (1994)
[53] Kroll-Smith and Couch (1991)

based responses to extreme environmental disruptions. Its basic tenants are: "(1) people exist in exchange relationships with their built, modified, and biophysical environments, and (2) disruptions in the ordered relationship between individuals, groups, and communities, and their built, modified, and natural environments are labeled and responded to as hazards and disasters."[54] Disasters exceed the limits of the system to recover, and reaching such a state through poor policy or management, or failure of a technology externality (e.g. a major coastal oil spill) can permanently damage an NRR to the point of non-recovery.[55]

As a fundament of total capital flow in an NRR, it is assumed that there are limits to the system. Ecological models predict such limits in natural systems, but economic growth models generally do not. The explanatory power of the NRR relies on understanding limits and options presented by the total capital in the system. However, accepting and working within natural limits is antithetical to the economic strategy practiced by the wider capitalist society. [56] This worldview is best portrayed using what Catton and Dunlap call the Dominant Social Paradigm (DSP).[57]

The assumptions of the Dominant Social Paradigm are:
1. Humans are fundamentally different from all other creatures on earth over which they have domination.
2. Humans are masters of their destiny; they can choose their goals and learn to do whatever is necessary to achieve them.
3. The world is vast, and thus provides unlimited opportunities for humans; and
4. The history of humanity is one of progress, for every problem there is a solution, and thus progress need never cease.

A corollary to DSP is the construct, Economic Man, the idea that everyone acts individualistically to maximize satisfaction of their needs or desires. Hardin's "Tragedy of the Commons," the most commonly quoted rationale for fisheries management, limited access, and privatization, is based on a belief that "Economic Man" will inevitably overuse any property held in common.[58] As a result, the argument continues, common property should be privatized so that self-interest constrains the owner and improves stewardship.

Certainly, there were limits to natural systems. Unlimited access to resources without constraints on manner or means of extraction could lead to system collapse. However, examination of cooperative and co-management systems of fisheries management suggest there are alternatives to privatization. Furthermore, this project suggests that management is more appropriately conceived within the conceptual framework of the Natural Resource Region and the natural resource communities (NRC) of which they are composed.

Characteristics of NRCs that contrast them to the DSP model, and act as a buffer against degradation of the natural resource base are as follows:

1. Residents of NRCs are strongly linked to their resource base by behavioral and ideational patterns that blend with the natural order.
2. To the extent that anthropogenic activities may destroy renewable resources, NRC residents frequently attempt to practice local management of resources within their NRR. This allows for sustainable reproduction of total capital in the region.
3. Because natural resources are utilized and renewed within bounded areas of LMEs, they are viewed as limited and limiting in the variety of opportunities they provide their human stewards.

[54] Ibid, p.361
[55] Dyer (in press)
[56] Goulder and Kennedy (1997)
[57] Catton and Dunlap (1980)
[58] Hardin (1968)

4. Progress, as in change towards a DSP model, is resisted to the extent that it threatens the sustainability of the community network and the capital flows that hold it together. [59]

The ideal NRC relies exclusively on renewable natural resources, but most contemporary fishing communities are not 'pure' NRCs. They are instead modified NRCs existing on a continuum of community somewhere between the ideal DSP and NRC types. The character of social capital is a key in distinguishing between a primarily DSP type community and a NRC, with the contrast between DSP social capital and NRC social capital being a central point of conflict.

An example of such conflict is the gentrification process and its impact on coastal fishing communities. [60] As more community space is gentrified for tourist and associated recreational pursuits, the squeeze on the commercial fishing sectors inhibits the maintenance of total capital within the functioning NRR network. There are other less apparent costs as well. Social capital within an NRR is based on kinship and cooperative social ties. This has positive effects on household maintenance and occupational continuity within families. Other benefits include lowering social service costs and maintaining mental and physical health.[61]

Although impersonal social contracts predominate between residents and outside organizations, they are not prominent within the NRC units. Extended networks of family and worker relationships (e.g. fishing crews) allow for intense cooperative interaction in the occupational roles of natural resource extraction. By comparison, a DSP community within the same region relies heavily on social contracts both within and without the community. A social contract can be defined as a voluntary and mutual agreement to engage in purposefully limited cooperative endeavor.[62] Emphasis on "social contract" versus "social relationship" can limit the degree of traditional stewardship expressed toward other capital components (e.g. biophysical capital). We illustrate the NRR model with an analysis of the contemporary Multispecies groundfish fishery of New England.

2.9. The New England NRR and the Multispecies Groundfish Fishery

The 1976 Magnuson Fisheries and Conservation Act (re-authorized in1996 as the Magnuson-Stevens Act), was instituted to protect the marine resources of the United States. It established a 200-mile Exclusive Economic Zone (EEZ) to regulate fisheries in the federal zone. Four years prior to the passage of the Magnuson Act, in an effort to 'revitalize' community-based fisheries, the National Marine Fisheries Service (NMFS) was authorized to provide low-interest loans to build up a domestic fishing fleet.[63] At the time, there were virtually no social scientists advising NMFS on policy and no assessment was made of the potential impact of increasing the economic production capital (boats and gear) of US fisheries communities.[64] This loan program can be conceptualized as a "strong market externality" that artificially increased the available economic capital in the region. We suggest that the loan program was based on a DSP worldview that saw only economic opportunity in the EEZ without consideration of the potential long-term biophysical, social, cultural and human impacts to communities.

In New England, investors quickly took advantage of the loan program (which was open to anyone) and the fishing capacity of domestic fleets increased dramatically. Just about every major East Coast port including Gloucester, Boston, and New Bedford (Massachusetts), Portland and Rockland (Maine), Newport and Point Judith (Rhode Island)

[59] Dyer (1993)
[60] Margavio (1992)
[61] Caritas Christi Health Care System (1996)
[62] Hillery (1982)
[63] The Fishing Vessel Obligation Guaranty Program was implemented in 1972 when Congress amended Title XI of the Merchant Marine Act of 1936 at the instigation of both the New England and California congressional delegations (Fricke, P., personal communication, 2002).
[64] McGoodwin (1990)

dramatically built up their fleets with powerful stern trawlers under the Fishing Vessel Obligation Guaranty Program.

Besides the buildup of the large dragger fleet, many small and medium size vessels were built, putting increased fishing pressure on both inshore and offshore stocks. Some of these smaller boast even ventured offshore to such rich areas in the Gulf of Maine and beyond as Cashes Ledge, Franklin Swell, Three Dory Ridge, and Platts Bank.[65] Contributing to the pressure on fishing stocks was the loss of prime areas of Georges Bank under a 1984 United Nations World Court decision. When the Court drew the Hague Line allocating parts of the Gulf of Maine and most of the Georges Bank's productive Northeast peak to the Canadians, fishing effort concentrated on the remaining grounds and accelerated stock declines.

Key respondents in fishing communities claimed that many of those who took advantage of the fishing vessel loan program were newcomers to the fishery.[66] Specifically, they claimed that from 1977-1980 many new vessel owners were outsiders whose primary occupations (e.g., doctor or lawyer) identified them as fishery "investors," not fishermen. As fishery "investors," they had no prior social, cultural, or human capital networks in the local fishing communities, and were thus not bound by the responsibilities and reciprocal exchanges of total capital that marked traditional fishing families, households, and networks. Furthermore, the sustainability and reproduction of the social, cultural, and human capital in the NRC fishing communities occupying the Natural Resource Regions of the New England Fisheries Management Zone was of no concern to these outsiders. This "outsider only" rationalization does not explain why Congress continued to reauthorize new funds until 1995.[67]

Build up of the Groundfish fleet resulted in intense pressure on stocks, both inshore and offshore. As competition for groundfish resources increased, the breakdown and loss of capital (human, social, cultural, and biophysical) also increased both within and between fishing dependent communities.[68] Competition and acrimony increased between both the fleets of different ports and gear types in the same ports: "…The draggers really believe that gillnets are one of the major problems because there are ghost nets that get left out in the ocean, and they fish forever." (Dragger; Gloucester, MA); "I mean, they should say, "it is the large scale mobile gear fleet tearing up the bottom (and) …negatively impacting the food chain at its source." (Gillnetter; Gloucester, MA).

With the increase in fleet capacity and the pressure to provide "return on investment," overfishing of stocks followed. "NMFS representatives and Senators Gravell and Chaffee consistently made the point that the majority of overfished stocks on the East Coast were being overfished by domestic fishermen."[69],[70] Despite NMFS advice in the late 1970's urging the New England Fishery Management Council (the Council) to address this problem, no effective measures were taken until implementation of Amendment 5 to the Multispecies Fishery Management Plan, a long negotiated plan to gradually cut fishing effort by 50 percent over 5 years. When NMFS scientists established that the primary groundfish stocks were more seriously depleted than originally thought, emergency regulations were imposed closing large portions of Georges Bank. The Council quickly drafted Amendment 7 to the Multispecies plan, drastically cutting the number of allowable days at sea (DAS) for the groundfishing vessels. It also eliminated significant exceptions to effort control regulations and broadened area closures to protect juvenile and spawning fish.

A 1998 National Research Council review of the New England groundfish stock assessment concluded that there was a significant overfishing capacity that could be directly traced to

[65] Prybot (1999)
[66] Griffith and Dyer (1996)
[67] Fricke (2002), personal communication.
[68] Communities dependent primarily on groundfish include Galilee (Rhode Island), Chatham, New Bedford and Gloucester (Massachusetts) and Portland (Maine)
[69] Fricke (2002), personal communication.
[70] Dewar (1983)

the government loan program. "When foreign harvesters were excluded when the exclusive economic zone (EEZ) was introduced in the 1970s, various public plans were put into place to increase the capacity of the Northeast fishing fleet. The plans encouraged recruitment of harvesters and increased investments in the industry, evidently in excess of what the fishery could sustain." [71]

The overall impact of the groundfish declines and subsequent regulations were catastrophic. In 1980, there were 3,500 finfish harvesters and 5,700 workers in the processing sector in Massachusetts. By 1992, finfish harvesters had decreased to 1,500 and processing workers to 2,700 (a respective 58% and 53% decline in 12 years). Related social impacts ranged from declines in attendance and participation in local fishermen organizations, outmigration (some older fishermen even returned to Sicily and Portugal "in disgrace"), and fierce gear conflicts between draggers, gillnetters and longliners of groundfish. In addition, there was a withdrawal of economic support from local banking systems, attrition of fishermen (human capital) and loss of portside support facilities such as marine railways, and declines in health insurance holders in the industry.[72]

Notable household impacts included increased domestic strife and avoidance behavior: "We used to go out to the club and go to church, but I don't do that anymore. What is the point? There is nothing good to talk about. We just go from the boat to the house. Sometimes we go to church, but it's usually now only on Easter or other holidays." In Gloucester, MA, participation in the local fishing association ***Societa Siciliana*** decreased from 304 in 1991 to 89 in 1995 (a 70% decline) and Sons of Italy from 200 in 1991 to 79 in 1995 (a 60% decline). By comparison, non-fishing associations such as the Gloucester Elks, whose membership consisted of newly arrived Boston suburbanites, increased from 76 members in1991 to 185 in 1995.

In the health care sector, increasing health care costs and the changing nature of eligibility for public programs led to a high proportion of the industry being left without health insurance. Lack of insurance caused even greater hardship as regulations restricted fishing effort and incomes declined, forcing already stressed fishing families out of the industry. A survey of 485 finfish fishing industry households in Massachusetts found that increased insurance costs and declines in income forced many families to go without health insurance.[73] In 1996, forty-seven percent of surveyed male adults, 37 percent of women, and 34 percent of children were uninsured at least one month during the year, representing an overall ten year decrease in insured fishing family members for the region of 35 percent.

The total at risk from lack of health insurance was 52 percent, including 43 percent uninsured and an additional 9 percent who were uninsured at the time of the survey but had a period of insurance during the last year. By comparison, the National Medical Expenditure Survey found that only 20 percent of the U.S. population was uninsured for all or part of the year 1989.[74] For the state of Massachusetts, the rate of uninsured was 13 percent for adults. Thus, the 1996-uninsured rate in fishing communities was at least three times higher than the statewide average.

Government reaction to the crisis included a $25 million buy-back program for groundfishing vessels, and retraining programs for fishermen. According to Andrea Marcaurelle, loan specialist for the NMFS Northeast Financial Services Office, the goal of the program "was to take out the most fishing capacity for the amount of money we had." Beginning with a $2 million pilot program which bought out 11 vessels, the initiative progressed with another $23 million and a final buyout count of 67 East Coast fishing vessels and their fishing permits. Bought out vessels where either scraped, sunk at sea, or transferred to non-fishery use such as research vessels for organizations such as the Maritime

[71] NRC (1998:37)
[72] Griffith and Dyer (1996)
[73] Caritas Christi (1996)
[74] http://www.meps.ahrq.gov/

Discovery Center in Rochester, NY.[75] Ironically, the buyback program represented an attempt to decrease the over-capacity in economic (fishing) capital originally created by the vessel loan program. Unfortunately, a recent evaluation of the buyback program indicated that it ultimately failed to reduce capacity.[76]

Retraining programs represented an effort to redirect ***human capital*** into alternate occupational roles. Some characteristics of fishermen arising from their collective cultural capital posed challenges to the retraining effort. For example, many fishermen have independent natures and they find it difficult to comply with set (clocked) schedules within a workplace. Others have difficulty relating to support personnel with different worldviews and there are often linguistic barriers to retraining. In addition, fishermen who were 40-45 years of age regarded participation as evidence of having given up on fishing and considered it losing face in front of their peers.[77] Despite these barriers, by 2000 the retraining program run by the Gloucester Fishermen and Family Assistance Center, under the guidance of the Gloucester Fishermen's Wives Association, had successfully trained 305 fishermen and other eligible workers, 137 of who obtained new employment.[78]

The overall loss in social, cultural, and human capital during the groundfish crisis was accompanied by the breakdown of capital flows within and between fishing NRCs of New England. A cascade of multiplied effects reduced fish production, broke down credit relationships and social contracts, decreased cooperation and sharing on shore and at sea (e.g., sharing fishing information), and increased social problems as job satisfaction plummeted.[79]

The New England NRR groundfish case study illustrates how a strong market externality (low interest federal loans for purchase of fishing vessels) combined with the loss of a historically utilized and significantly important fishing area through the 1984 Hague Line decision (a governance externality) contributed to drastic declines in available biophysical capital (groundfish stocks). This destabilized the fishery-dependent NRCs of New England, creating subsequent declines in total capital and disruption of capital flows in the system. These declines continue to have severe community impacts that are socially and economically devastating to fishing families and households in the region.

An anthropologically informed, community NRC-based assessment guided by a NRR/total capital model could have mitigated the decline in the multispecies fishery and the associated human impacts that followed. For example, a careful assessment of the community impacts of the Fishing Vessel Obligation Program informed by the NRR model could have led to checks on overfishing capacity by restricting the program to community residents having direct and historically dependence on the fishery. This could have reduced overfishing and sustained the total capital networks of the now (belatedly) recognized Fishing Dependent Communities of the region. [80]

Successful operationalization of the NRR approach requires adaptive flexibility in natural resource governance strategies **-** a flexibility that is only now being considered in New England. Funding of regional community studies of fisheries in New England and the recent creation of a Social Science Advisory Committee by the Council, should lead to improvements in the nature and direction of future management decisions.[81] The

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[75] Prybot (1998)
[76] Federal Fisheries Investment Task Force (1999) http://www.nmfs.noaa.gov/sfa/ITF.html
[77] Griffith and Dyer (1996)
[78] Angela San Filippo, personal communication.
[79] See Pollnac and Poggie 1988; Gelles 1974; Strauss 1979
[80] See discussion of National Standard 8 of the Sustainable Fisheries Act discussed in the introduction.
[81] The Social Science Advisory Committee consists of 14 social scientists from the New England region familiar with current issues and problems facing regional management and fishery-dependent communities. Their mandate includes advising the NEFMC on policy, reviewing fishery management options and FMPs, and advising on ways to improve communication and collaboration among communities and managers.

potential impacts on fishing dependent communities and the total capital upon which they depend would be identified and, hopefully, mitigated.

2.10. Developing an NRR Model for New England

Development of fisheries management plans for New England is complicated by the diversity and complexity of the historical ecology and geography of the region. Because of this complexity, understanding the social and economic outcomes of any particular management measure is fraught with pitfalls. What may seem obvious as a likely outcome in one sub-region may not apply elsewhere. Relying primarily on stock assessments to select management options without consideration of the diversity of human communities and strategies across the region can result in deleterious oversimplifications.

Regional management needs to be refined with timely and in-depth understanding of the complexities of critical aspects of the human use equation. In each region, the unique dynamics of the fishing people and their communities stem from the history of their interactions with the environment and the opportunities afforded by the biophysical capital of the region. For example, in the Downeast Maine Sub-Region (Downeast), poor soils, community isolation, and underdeveloped transportation systems have resulted in few economic alternatives to fishing.

Many Downeast communities approach the 'pure' NRC type, with strong dependence on local natural resources, a high degree of environmental awareness among residents, and few inroads by forces of gentrification (economic externalities). At the opposite extreme, the DSP community of Stonington, Connecticut, historically a Portuguese fishing enclave with in-town residences dominated by fishing families, is highly gentrified. Most fishing families cannot now afford to live in the upscale water front neighborhoods, and live in lower cost areas away from the water.

Commercial fishing activities in Stonington constitute a small portion of the local economy. The fishing pier has no room for expansion, is surrounded by tourist facilities such as seafood restaurants and souvenir shops, and is just down river from a large marina for recreational boaters. While folks Downeast talk of fishing as a sustainable way of life, fishermen in Stonington talk about fishing as an economic survival act, their struggle to "keep their job," and the general lack of community ties among fishermen. Fishing, as everywhere, carries with it a great degree of uncertainty, but in Stonington this is magnified by the lack of expansion opportunities, numerous regulations and paperwork, the overall decline in fish stocks, days-at-sea restrictions, and market limitations.

One of the first respondents interviewed in Stonington (October 1998) operated one of two dockside fish wholesale operations. Six months later, he was out of business and his facility stood empty. This represented 50% of the total fish processing capacity in the port. Thus, the "Connecticut" sub-region (Stonington plus several smaller enclaves of finfish and lobster operations) is highly DSP oriented with fishing a tenuous but steady enterprise. In contrast, Downeast is much more NRC oriented and fishing intense. Overall, we divided New England up into ***eleven*** distinct subregions, centered on major ports or clusters of fishing or fishing-related industry. We then considered the social, cultural, human, and economic capital devoted to fishing enterprises in each of these subregions.

3. Measuring Fishery Dependency and Externalities in the New England NRR

As noted in Chapter 2, after the Magnuson Act effectively eliminated foreign fleet competition by creating the 200-mile exclusive economic zone, the US government substantially expanded the fishing capacity of the domestic fleet by granting low-interest loans for fishing vessels. This change occurred virtually over night without analysis of the potential impact of such an expansion on fishery stocks and fishery-dependent populations in the coastal zone.

This promotion of vessel ownership, combined with technological advances in navigation and gear development, led to a great expansion in fishing capacity and effort and ultimately, proved disastrous for both fishing stocks and fishing communities and regions.[82] For several years in New England, losses in fishery stocks combined with losses in regional total capital—social, cultural, human and economic capital characterized a declining industry and lowered fishing productivity.

Partially in response to such declines, the Sustainable Fisheries Act (SFA) amended the Magnuson Fishery Conservation and Management Act (renamed the Magnuson-Stevens Fishery Conservation and Management Act) in 1996. SFA amendments and changes to the Magnuson Act include numerous provisions requiring science, management and conservation action by the National Marine Fisheries Service (NMFS).[83] Importantly, this Act provided fishery management guidance by establishing National Standards on such topics as overfishing, by-catch and fishing communities.

SFA reflects changes in the political ecology of management that has experienced an increase in the number and complexity of stakeholder groups and special interest agendas. Now commercial harvesters, recreational fishermen, fisheries managers, fishery scientists, fish processors, fishery unions, and environmental organizations are all part of the debate over the future and uses of fishery stocks. Out of this debate has come a recognition of the "fishing community" as a unit of management, and of fishing dependence as a potential gauge of regulatory impact.

Specifically, National Standard 8 states: “Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.”[84]

As a result of National Standard 8, all fishery management plans (FMPs) are now required to account for and assess the potential social and economic impacts to fishing communities of any particular management option under consideration. The caveat is that fishery conservation supercedes consideration of specific human (i.e. community) impacts from regulations. In many cases, councils use a regulatory impact review (RIR) in lieu of a community-based social impact assessment (SIA). An RIR differs from an SIA in that an RIR does not consider as important the historical dependence on and participation in a fishery by fishermen and communities (NMFS 1998).

A proper SIA requires that fishing dependence be measured in some way. Just what is a 'fishing community', and how we can measure 'fishery dependence' is not wholly answered in the legislation. Section 3(16) of the MSFCMA (16 U.S.C. 1802(16)) defines fishing community to mean "a community which is substantially dependent on, or engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes

[82] Griffith and Dyer 1996; Dyer and Poggie 2000
[83] http://www.nmfs.noaa.gov/sfa/
[84] SEC. 301. NATIONAL STANDARDS FOR FISHERY 16 U.S.C. 1851 (104-297)

fishing vessel owners, operators, and crew and United States fish processors that are based in such a community." The NOAA General Counsel has interpreted "fishing community" as simply any place where vessel owners, operators, and crew or U.S. fish processors are based.

Small boat fleets run by family fishermen are not given specific consideration yet clusters of such boats are spread throughout New England and make up a large proportion of the total number of licensed vessels in the region. As coastal communities have developed, fishing has declined in its overall percentage contribution to local economies. Nevertheless, small-scale fishing enclaves or fishing 'villages within towns' define themselves not by their local community alone but through a network of connections with other such villages within other towns.

Such embedded villages have become more common as fishing fleets have shrunk and the value of commercial fishing dock space has risen. The small-scale fishery is presently endangered in places such as Cape Ann and the Gulf of Maine, where a shutdown of the inshore fishery via enlarged closed areas threatens the sustainability of the family-owned fleet. Commercial fishermen and processors are also concerned that a geographically based (site-specific) interpretation of dependence could harm "fishing communities" that are based on shared interest rather than shared place.

Efforts to develop a baseline description of New England fisheries have been sporadic and not linked to any conceptual-theoretical framework. Baseline data provides for measurement of change and adaptation brought on by adoption of new management measures or through other vectors of community change such as gentrification or environmental degradation. Baseline data collection should strive to establish a set of plainly understood benchmark terms and concepts that once communicated to managers become part of their decision-making tool kit. Research priorities can also be tailored to the identification of immediate and relevant information from a region or community.

Social scientists engaged in fisheries or fisheries-dependent community research may intuitively understand why a port profile or regional assessment is significant for anticipating the impacts of regulatory change. However, such understanding must be linked up to a theoretical framework that is understood by managers and social scientists alike for the data to have any cognitive relevance in their decision making. Explanations should build on what is known (the baseline template, or community profiles, regional assessments, and variables such as 'educational level' and 'ethnicity').

Since much of the government's statistical database is aggregated to the county level, the county is a highly convenient unit for statistical interpretation of change processes. One solution to the problem of shifting baselines with a system under stress is to use measures that are independent of immediate flux in particular communities. Such measures can identify dependency at levels above the community, and thus fit well with a regional approach to dependency analysis and policy making.

While we suggest the use of this approach as one step towards improving knowledge about the likely impacts of regulatory change on fishing communities, we do caution that frequent "sampling" at the community level is needed to confirm the analyses. Furthermore, because the proposed measures rely on statistical data (regional census data) that is extremely limited in the numbers of parameters of interest, we strongly encourage the funding and use of in-depth studies on a regular basis.

3.1. Using Dependency Ratios

Although measuring fishery dependence is considered crucial to recent management goals, few attempts to do so have been made.[85] Developing comparative dependency ratios is one solution to the measurement of fishery dependence. Ratios of various forms

[85] Griffith and Dyer 1996

are measures commonly used to analyze and compare independent population units with different age, income or social structures. A dependency ratio is a special application of the ratio approach that provides a summary measure of the relationship or dependency between two related but independent populations. This measure represents one of a family of standardization techniques commonly employed in demography to examine and describe aggregate population phenomena. Dependency ratios are useful because they allow one to make direct comparisons between independent groups rather than just describe a group's proportionate share within the sample or universe of interest. An added advantage of the dependency ration is that, unlike Hoover and other dissimilarity indexes, dependency ratios are statistically insensitive to population size and so allow for direct comparisons across regions**.**

Dependency ratios compare some sample population (the numerator) against a base population (the denominator). The higher the ratio the higher the hypothetical dependence of the numerator population upon the denominator population. The youth dependency ratio is a common example of this type of application as employed in demographic research. In this case, the population aged 0 to 15 is divided by the total working aged population 16 to 64 years of age. The higher the resulting ratio the more young people the working aged population has to support. The lower this resulting ratio is the fewer young people the working-aged population has to support.[86]

Dependency ratios are used by economists,[87] demographers,[88] and both ecologists and coastal resource management researchers.[89] Because of their flexibility of application and wide array of use within the social and physical sciences they are commonly recognized as a useful diagnostic tool for comparative research. However, our review of the literature found no direct application of dependency measures in the analysis of the regional management of fisheries, or in the delineation of fishery dependent communities. We are hopeful this application will add an additional useful diagnostic tool to this research discipline.

3.2. Community Measures of Fishery Dependence

An ideal measure of the dependence of a community on a production sector accounts for the complexity of that sector and the contribution of that and other sectors to the overall community dynamic. Fishery components include the fishing fleet, transportation, processing/marketing, and related supply and repair businesses. However, management focuses on the fishing sector, with little attention paid elsewhere. Unfortunately, the regional census data we use to generate our comparative dependence measures also focuses on this sector. Our comparative fishing dependence measure is thus best viewed as a comparative tool to be tempered with the local ethnography of communities and regions. For example, Boston has historically had a central role in regional and international marketing of fishery products, yet has a small contemporary fleet for the size of the port. Thus, focusing on the harvesting sector for this port would underestimate the contribution of the marketing/transportation sectors to the overall fishing industry of Boston and the region. What should not be overlooked in the search for fisheries dependency is the equally important consideration, what we term "Essential Provider." While Boston's harvesting sector is modest, the service Boston provides to other fishing communities is essential to their survival. The port profiles highlight the importance of retaining local-level data collection to complement the systematic regional efforts described herein.

One conceptualization of community that addresses dependence is the Natural Resource Community: "a population of individuals whose primary cultural existence depends upon

[86] Weeks (1989).
[87] Mason (1988), Horrell and Humphries (1992) and Frankel (1992)
[88] Massey (1987), Ahlburg (1993), Ahlburg and Vaupel (1990) and Jiang (1994)
[89] Howarth (1988), Levitan (1992), Johnson and Carpenter (1994), Livingston (1991), Mangel (1993).

the utilization of renewable natural resources."[90] Dependence in this community model is linked to cultural dependence on sustained fishery stocks. Declines in fishery stocks are therefore key to measurement of temporal changes in the fishing culture of communities and regions. However, external changes in the place and space of fishing communities (gentrification) can also force fishermen out of their occupational roles despite the ongoing sustainability of any available fishery stocks. This is accelerated when fishing efforts are reduced due to regulation or market influences.

Another community-centered attempt to measure fishery dependence stems from identification of social, cultural, and economic indicators, such as fishing monuments, fishing unions, and numbers of processing facilities to derive a Fishing Dependency Index (FDI) of the major ground fishing ports.[91] Although Dyer and Griffith's cumulative index included diverse indicators, it was not a comprehensive and dynamic measure. It did not link communities across common regions or measure changes in total capital forms across fisheries, since it was confined to the five identified primary ground fishing ports (New Bedford, Gloucester, Chatham, Point Judith, Portland) in New England.

3.3. Community Vulnerabilities and Externalities Affecting Fishery Dependence

Change between and within fishing dependent communities is occurring at an ever-accelerating pace. Driven by externalities of development, changes transform the linkages between communities and regions and modify the contexts within which people live and work. In New England, the significant forces of gentrification are modifying the coastal areas. Gentrification is a nation-wide trend as more people of means are attracted to coastal areas as places to live, play, and own property. This trend often plays out as a direct threat to established enclaves and communities dedicated to commercial fishing.

The mystique of commercial fishing is often evoked in posters and brochures advertising the quaint characteristics of New England by the sea, despite the fact that in many of the places depicted, gentrification has forced commercial fishing to the brink of extinction. For example, in highly gentrified Hyannis, Massachusetts, fishing interests in the community have been squeezed into a small piece of the overall town dock with the highest docking and unloading fees ($1.00/foot of vessel length/day) in New England. This decline of space and place has occurred despite the fact that significant runs of valuable fish such as fluke are still found in waters off Hyannis. Fishermen, who would prefer to dock in Hyannis for safety and convenience, come from other ports specifically to target this rich resource. However, landing fish amounts to a potential 'crash derby' as boats wheel and turn in the small space to offload their fish product one at a time to an out-of-town fish trucker.[92]

Such transformations strain the ability of fishing enclaves and communities to reproduce their particular forms of total capital. Thus, social networks, access to marine resources, and commitment to the occupation of fishing are devalued, while other aspects such as recreational fishing, tourism, and vacation residence construction begin to dominate. The argument can be made that maintaining a mixed economy, which allows for both fishing dependent populations and new wave populations to co-exist, is a viable option. Yet, evidence shows that when the momentum for transformation to non-traditional (gentrified) processes takes hold without protection for existing fishing operations, essential and irreplaceable fishing infrastructure (ice houses, marine railways, fish processors) is often lost.

Essential fishing infrastructure is impossible to replace once an upward shift occurs in property values and uses.[93] In the past, traditional fishing communities have not had any need for protective adaptations to resist such change. The energy to fight such changes

[90] Dyer et al (1992).
[91] Griffith and Dyer (1996)
[92] Dyer, Poggie and Hall-Arber (2000).
[93] Griffith and Dyer (1996), Bergeron, personal communication (1999)

divides the attention and efforts of fishing populations to survive such a dynamic. This is particularly true when they are also burdened by increasingly numerous and complex fishing regulations, described as regulatory layering.[94]

A recent example of this is the transformation of the Mississippi coast from a multi-ethnic fishing culture of Southeast Asians, Black and Whites to a gentrified row of gambling casinos (dockside gambling). Shoreside, nothing remains of the once thriving fishing cultures of Biloxi and Ocean Springs. Remnants struggle to survive in the backwaters and upstream inaccessible for casino development. In the New England sub-NRRs, the strong dependence on marine biophysical capital makes it crucial to recognize how management choices can affect community sustainability.

Downeast Maine, with a rugged coastline and strong dependence on fishing is one of the poorest areas in the region. Any curtailment of access to the fisheries could seriously hamper the ability of locals to make a living. In a social impact assessment of the New England herring fishery, Dyer, Poggie and Hall-Arber demonstrated crucial dependence on the herring-processing sector in several coastal communities.[95] At that time, fishery managers were considering allowing offshore processing of the fish. Locals anticipated that such a step would effectively put the onshore processing sector out of business, disenfranchising up to a thousand workers and creating economic hardship and total capital losses across these fishing-dependent communities.

3.4. Fishermen Individual-level Characteristics and Dependence

Not everyone can be a fisherman, and once a person becomes a successful fisherman, it is very difficult for him or her to assume other occupational roles. The steps to fishing success entail a highly selective process characterized by investments of time and behavior. Individuals who are thus selected tend to be uniquely suited for this occupational role, which tends to preclude their being selected to other ones.

Fishing is a hunting activity that has psycho-cultural requirements unmatched in any other contemporary occupation. Because the hunting lifestyle is rare today, it is hard for persons who have not studied or experienced this life strategy to understand the motivations and requirements that make one a successful hunter at sea. Nevertheless, we argue that fishing is unique in our contemporary space and time and requires special understanding and consideration in its management.

Dependence on natural resources necessarily limits occupational roles of residents and can result in an intense assimilation of some offspring to the fishing lifestyle.[96] Part of the assimilation process occurs through the incorporation of appropriate newcomers and youth into existing social relations and cooperative networks. Another part of this process comes in the form of self-selection by those who have the necessary psycho-cultural prerequisites to be successful in this way of life. Assimilation coincides with the creation of boundaries that protect these established networks of social capital against external (competing) networks.[97]

Boundaries are also defined by the sharing of special knowledge on where, when, and how to fish targeted species. These boundaries can be distinctive enough to delimit fisheries even within communities by gear type, ethnicity, or by generation.[98] In communities homogeneous by gear type, such as the lobster gangs of Mid-coast Maine studied by Acheson, knowledge is shared by distinct groupings that have territories established by tradition and effort, and which are informally protected and respected.[99] Other

[94] Dyer, Poggie and Hall-Arber (2000)
[95] Dyer, Poggie and Hall-Arber (2000)
[96] Firestone (1967), Ruddle (1994)
[97] Acheson (1987); Palmer (1994).
[98] Acheson (1987); Griffith and Dyer (1996); Dyer and Leard (1994)
[99] Acheson (1985)

characteristics include limits on the sharing of knowledge between kin and gangs and a high degree of personal independence.[100]

On the psycho-cultural level, Poggie provides strong support for the idea that a deferred gratification orientation is inherent in being successful at small-scale fishing and is therefore one of the psycho-cultural components of a maritime life.[101] Deferred gratification provides the psycho-cultural underpinnings for anticipation and management of uncertainty in resource availability. This is clearly adaptive in fishing communities where fluctuations in annual catch and market conditions contribute to high periodicity of income. For example, this attribute allows individuals to save monetary resources when abundant to provide a reserve for potentially leaner seasons ahead. Those who are unable to defer gratification are unlikely to be successful as fishermen or to remain long in this occupational culture.

The indices we are advocating in this paper should not be taken to mean that fishing is a highly fungible activity. In other words, alternative occupations are not easily substituted or exchanged for fishing as an occupation or as a way of life. A cultural dependence on renewable natural resources that must be hunted and the behavioral characteristics of fishing populations has long insured the continuity of a tradition of fishing.[102]

This argument is most applicable to the small to medium-scale operations characteristic of inshore lobstermen, day, and short-trip fishermen that also have a high preponderance of owner operators. Larger-scale operations such as scallop boats out of New Bedford that formerly employed as many as 13-15 men (before regulations set a 7-member crew limit) were less likely to rely on “traditional” fishermen. Crewmembers tended to be “young men with strong backs” rather than necessarily individuals with particular psycho-cultural characteristics, members of fishing families or a fishing way of life. Interestingly, Pollnac and Poggie found fishermen in the port of New Bedford had the lowest overall level of job satisfaction in their New England regional sample.[103] Nevertheless, when the large-scale operations were scaled back due to restrictive management measures, some of the vessels returned to a more traditional crew composition with kin and friends having first priority for job retention.

Factors such as ethnic barriers and economic marginality can also affect measures of fishing dependency among individuals. Before the Gloucester dragger fleet was decimated by stock declines and regulations, many crew were middle-aged Sicilian immigrants with poor English language skills and little occupational experience outside of fishing, and thus were highly dependent on fishing.[104]

Such dependence is not easily modified because it is so specifically linked to utilization of a particular biophysical resource—fish. This affects how people work and live, the schedule of their lives, their desires and needs as well as the uncertainty and risk required for success in this way of life. Given the occupational characteristics and the special forms of cultural capital needed to extract resource from nature, it is very wrenching for individuals to attempt to change their way of life and pursue a different occupation. In many cases it is impossible for individuals to do so. This fact can lead to severely negative psychological, family, and social consequences.

In their study of the structure of job satisfaction among New England fishermen, Pollnac and Poggie used nine different measures of this construct.[105] These were drawn from a

[100] Palmer (1994; 1991; 1990), Griffith and Dyer 1996, Dyer and Poggie (2000)
[101] Poggie (1978)
[102] Characteristics typical of successful fishermen include: ability to defer gratification, ability to adapt to working non-traditional hours, and a profound need for personal independence as well as a proclivity for working on the sea and a devotion to family traditions.
[103] Pollnac and Poggie (1988)
[104] Griffith and Dyer (1996)
[105] Pollnac and Poggie (1988)

principal component analysis of the 22 items shown in Table 1. Two of the most significant questions asked whether the respondent would still go into fishing if he had his life to live over and whether he would advise a young person to go into fishing. Whether or not the respondent said he would go into fishing if he had his life to live over is a measure that is considered by many researchers to be the best single indicator of job satisfaction.[106]

While the relationship of job satisfaction to other variables such as port, age, owner-skipper status, and type of fishing is very complex, for the overall New England sample (Maine, Massachusetts, Rhode Island), the high level needs factor is the strongest predictor of the job satisfaction measure. Thus, the factor considered the best single indicator of job satisfaction is whether a person said he would go into fishing if he had his life to live over. This finding indicates that self-actualization is an important component of job satisfaction among New England fishermen.[107] This is contrary to the opinion expressed by some that fishermen only care about making money (the 'greedy' fisherman/tragedy of the commons stereotype).

Table 1. Rotated factor loadings of job satisfaction items on middle-level, basic, and high-level needs factors (modified after Pollnac and Poggie 1988).

	Needs Factors		
	Middle–level	**Basic**	**High-level**
Time away from home	***. 81***	.09	.21
Hours spent working	***. 72***	.25	.17
Time for recreation/family activities	***. 71***	.06	.12
Ability to come and go as desired	***. 61***	-.12	.41
Time it takes to get to grounds	***. 47***	.21	.14
Doing deckwork on vessel	***. 41***	.12	.40
Opportunity to be own boss	***. 39***	- .21	.34
Community in which live	***.39***	.12	.21
Cleanliness	-.03	***.59***	.02
Physical fatigue of job	.03	***.56***	.02
Predictability of earnings	.11	***.49***	.08
Mental pressure on job	.18	***.48***	.03
Job safety	.19	***.45***	.11
Earnings	.19	***.36***	-.15
Healthfulness	.21	***.31***	.26
Being out on the water	.14	- .02	***.71***
Adventure	.16	.05	***.71***
Challenge of job	.18	- .01	***.66***
Working outdoors	.23	.08	***.57***
Feeling job is worthwhile	.12	.28	***.51***
Peace of mind	.28	.24	***.34***
Performance of state and federal officials	.20	- .15	.22

Given the argument that fishermen must be uniquely psycho-culturally adapted to be successful at their work, it stands to reason that people who have been in fishing for an extended period would tend to have the greatest number of these characteristics. Individuals lacking such characteristics would be likely to seek alternative employment. Over time there would be a tendency for such characteristics to dominate a fishing fleet. Furthermore, this argues that any group of successful fishermen would be unlikely to be suited to a 9 to 5 working environment. This is anecdotally confirmed with fishermen who

[106] Robinson, Athanison and Herd (1969).
[107] Maslow (1954)

have tried other occupations such as engineer, oceanographer, gas station attendant, or truck driver but found that they were dissatisfied and returned to fishing. These were all people with prior experience fishing and who returned to it because it better suited them. These observations suggest why fungibility (or interchangeability) of fishing with other occupations is so difficult. This not only affects how one looks at the construct of "dependency on fishing" but also raises the important issue of job satisfaction and its many known implications for health and well-being of individuals and families.

In the aforementioned analyses by Pollnac and Poggie, they argue that job satisfaction is a pivotal variable in people's lives. Job satisfaction profoundly impinges on people's mental and physical health, and low job satisfaction can result in increased family violence and other psycho-cultural and psychosocial maladies. Fishermen as a group express a high degree of job satisfaction:
"***I have been in this business for 45 years, and if I had to go back and do it over again – I would."***
"Fishing is my life – I love being out there on the water"
'This is the greatest job in the world – because you have no boss, and are free out there on the water."
"In fishing you set your own hours – you can work hard or not, depending on how much money you want to earn – it's all up to you."

A reduction in job satisfaction can accompany fishermen who are well adapted to and selected for fishing when they are forced to transfer to jobs they are not well suited for. Fungibility thus is a key consideration that amplifies the dependency factor of individuals on fishing and collectively of populations of individuals within communities and regions on the fishing industry. This is especially true in populations of well-established fishermen who remain in the industry even though it is difficult to do so at this time because of low stock levels and corresponding government regulations.

3.5. Precautions in Defining Dependency

It is extremely important to note that strictly defined, "fishing-dependent communities," as stand-alone, independent entities are very rare in contemporary settings. As the core of fishing's cultural, social, and economic activity is surrounded by non-fishing development, the percentage contribution of the fishing-related activity to the total capital of the community may be diminished, particularly with regard to occupational numbers. Just fifteen years ago, there were over 90 medium to large-scale draggers with 5 to 7 men crews in Gloucester Harbor, today fewer than a dozen are in operation, most with smaller crews. Nevertheless, the economic impact of fishing activities remains high in Gloucester with significant landings and exchange associated with the two-year old display auction.

Other smaller ports, such as the fishing communities of New Hampshire, may retain infrastructure and fleet size despite an increase in surrounding coastal development. A 1978 study (Acheson et al) of Seabrook/Hampton, Rye and Portsmouth describes extant fishing activities and infrastructure within a context of surrounding gentrification and development. In 1978 the Seabrook /Hampton fishing complex consisted of 35 lobster boats and 12 vessels that participated in dragging, gillnetting, and/or switched gear to pursue herring or sea urchins. Twenty years later, the number of vessels has remained essentially unchanged, although over half the draggers are inactive because of closures and other restrictions on catch. Other changes include declines in numbers of individuals hired as crew. Many fishermen are "going it alone" and often migrating seasonally to other areas to fish species such as monk fish and dogfish.

Overall, fifty commercial fishing vessels, both the operative and idle, still grace the port facility near Seabrook. However, tourist development in nearby Hampton has increased tremendously over the last twenty years. During the summer peak, fishermen and their families are lost in a swarm of thousands of daily visitors taking advantage of the nearby diversions - beach facilities, restaurants, hotels, bars, and nightclubs. Thus, the overall

contribution of the fishing sector has declined dramatically in twenty years, but the scale of fishing remains essentially constant, although seriously threatened by recent fishing regulations. Moreover, even though the contribution of fishing to the local economy has declined, and no one could describe tourist-driven Hampton as a "fishing dependent community," the infrastructure and social yield of fishing has been sustained. However, looking at our dependency indices puts the New Hampshire ports in the lowest third of fishing dependency (Table 2).

Consequently, we cautiously use the concept of dependency and ask: (1) what is the total collective contribution of such communities to local and regional fishing commerce, and (2) what would be the total capital replacement costs if we allowed such communities to be destroyed by management regulations that fail to take into account regional and spatial differences in total capital interactions in fisheries?

The tourist restaurants and hotels of Hampton, for example, have no real substitute to offer their customers if the fresh fish and traditional ambiance provided by the local fleet is lost. Moreover we cannot discount survivorship of total fishing capital in the face of surrounding development and growth. Managers should identify and conserve fishing facilities and populations that collectively provide a substantial benefit to the overall fishery commerce of a region, even if such commerce does not dominate the economy of a specific town or city.

If "fishing dependent communities" are so narrowly defined that only towns or cities that are "substantially dependent on … fishing resources …" are considered in the analysis, a large portion of the regional total fishing capital, and therefore, fishery commerce, of the New England Natural Resource Region could be ruined. In fact, we contend that the only communities that could possibly fit such a narrow interpretation of the Magnuson-Stevens Act's definition of 'fishing dependency' would be relatively isolated lobstering villages such as Jonesport, Cutler, or Beals Island in Downeast Maine.

While we use occupational census data to identify dependency on fishing in the context of the surrounding village, town or city, and offer further analysis based on the degree of gentrification, individual community profiles reveal critical details (cultural capital variables) that temper the number-driven rankings of dependency. For example:

- Ethnicity: ethnic and language barriers make it difficult to transfer to alternate occupational roles. Examples include Portuguese and Sicilian fishermen (New Bedford, Gloucester) faced with language and educational barriers, and less obviously, Downeast Mainers faced with cultural and dialectical differences. For example, Mainers face job discrimination from a telemarketing firm that will not hire locals "because of their accent" (key respondent, Jonesport, Maine).
- Adaptive specialization, meaning people successful at fishing are not well suited for other occupational roles, and may be limited by these characteristics to fishing. Adaptive specialization includes a strong need for independence, inability to tolerate fixed temporal (9 to 5) schedules, deferred gratification orientation, and tolerance of temporal periodicity in familial and other social relationships.
- High job satisfaction in fishing, and a correspondingly strong resistance to switching jobs due to the characteristics noted above.
- A strong sense of place, meaning fishermen and their families identify with a location on land and water that serves as a nexus for their sense of community. Connection to this specific place also helps build their self-reliance, meaning their ability to utilize local, on-hand (spatially bound) resources for daily problem solving, survival, extraction, and exchange. Further, sense of place both limits and grounds fisher folk's experiences to their location, while giving them familiarity and constancy—things leads to a high quality of life including social, emotional, and cultural stability. This accounts for the high mental, social and physical health of fisher folk under normal conditions compared to the wider populace (Caritas Christi 1996). Conditions which can abrogate this sense of place include forced seasonal migration when local stocks cannot provide income or fishing them is restricted by regulations, or complete collapse of local

resource from environmental disaster or overexploitation.

What this Model of Dependency Does Not Yet Include

Alluded to above, dependency measures used here do not incorporate comparative economic data. While this project complements one refining an economic model, the work is being done simultaneously, so we are not able to compare the results of the different approaches. Held in abeyance, then, is a fourth index of dependency that should be compared to the three indices described here, that is, economic value of landings and/or product sales within a community.

Dependency of a community on particular resources is necessarily affected by the value of those resources. It is conceivable that the ratio comparing numbers of individuals dependent on fishing relative to those in other occupations could be small even though the value of the landings are high. Yet incomes and expenditures associated with the value of the landings may provide tax-generated revenue and other benefits to the community that make it more dependent on fisheries-related activity than is predicted by the dependency model suggested here. This deficiency is, we believe, partially countered by the richness of the depiction of total capital flow (social, cultural and economic variables) and the community profiles in this report. Nevertheless, as the model is applied elsewhere, the importance of the fishing industry's revenue generation should not be ignored.

3.6. Establishing Dependence by Sub-Region

Using the individual human characteristics and community dynamic of the NRC model, we propose a regional approach. In this approach, the New England NRR is divided into sub-NRRs consisting of networks of NRCs that are held together by flows of total capital (Dyer and Poggie 2000). Although each is not totally unique, it is clearly distinct in its combination of characteristics from its adjacent sub-Regions.

Sub-regions consist of one or more coastal counties, and hence represent useful clusters for socioeconomic and demographic analysis of the changing human dynamics of coastal fisheries. The dynamic includes the human, social, cultural, and biophysical components that make up the system. This system can then be modified or transformed in ways that can either negatively or positively influence the sustainability of fishery dependent communities (the NRCs within the system). A negative impact would be one where the fishery dependent sector (fishing boats, families, fish processors, transporters, and suppliers) and the total capital it comprises would be lost from the system, or transformed in a way that leads to its loss at some proximate future point.

Embedded within any of the eleven sub-NRRs are both dispersed clusters of fishing vessels-fishing households, related infrastructure, and communities sharing both fishing place and culture. Whether fishermen and their families and support networks live and work from "clusters" or from more distinctively identifiable communities, defining dependence within regions is key in the mitigation of harmful regulatory impacts.[108] Even though each of our indices is distinct and emphasizes particular aspects of dependency, we suggest that they are sufficiently similar in that they should co-vary and hence provide a measure of convergent validity of our measures of the underlying construct of fisheries dependence.

The eleven sub-NRRs of New England are, from south to north, (1) the Connecticut Seacoast, (2) Rhode Island, (3) New Bedford and the South Shore, (4) the Cape and Islands, (5) the Boston Area, (6) Gloucester/the North Shore, (7) New Hampshire Seacoast, (8) Southern Maine, (9) Lower Mid-Coast Maine, (10) Upper Mid-Coast Maine, and (11) Downeast Maine.

[108] Dyer and McGoodwin (1999)

Dependency Indices

We propose to systematically measure fishery dependence in the eleven sub-NRRs using three indices. These are: (1) the percentage of labor force in fishing, (2) the percentage of related occupations within the Bureau of Labor Statistics category of fisheries /forestry/ farming, and (3) a summary measure of a series of dependency ratios that explore the number of fishermen per hundred to various alternative occupational roles that fishermen could enter with their particular skill profiles. Of the three, the most heuristically useful, and the one that provides the best tool for comparison across sub-NRRs, is the occupational alternatives index, discussed in detail below.

Measures 1 and 2, examine other aspects of the relationship of fishing to the region. Measure 1 is the simple percentage of fishermen to other occupations in the sub-NRR region.

$$\frac{\sum fishermen}{\sum all\ occupations} * 100 \qquad \text{Measure 1}$$

This measure reflects the assumption that the higher the overall percentage of fishermen making up the labor force, the more dependent the particular sub-NRR is on fishing. Our second measure, the proportion of fishermen in relation to other occupations in the Bureau of Labor Statistics defined category of fishing/farming/forestry also assumes the higher the percentage of fishermen in this category, the more dependent a sub-NRR is on fishing**.**

$$\frac{\sum fishermen}{\sum BLS\_category(I)} * 100 \qquad \text{Measure 2}$$

This measure is useful since most analysis of economic regions do not look specifically at fishermen but rather look at their broader occupational group of fishing/ farming/ forestry. The use of this measure provides us with a conservative estimated that can be compared across other studies related to the sub-NRR regions using economic or BLS based analysis of economic activity. Caution needs to be employed, however, as the measure represents a mixed category with fishermen as only a portion.

Our third index is, the Occupational Alternative Ratio Summary (OARs). This measure is more complex than the more straightforward proportion and ratios described above. OARs is an attempt to summarize a standard array of independent occupational alternative ratios within regions in a manner that provides a single measure of the impact of fishing upon the region in relation to other occupations available to people engaged in commercial fishing. The OARs measure emphasizes both the importance of fishing as an occupation to individual participants in the local labor force and the dependency of the local economy on the fishing industry.

The OARs measure is constructed in a series of steps. First, a series of occupational alternative dependency ratios (OAR) are calculated for a predetermined set of occupations. These OAR measures represent a standard set of alternative occupations that are compatible with the basis skills and training that are part of the fishing occupation. It is assumed that a fisherman could take up any one of these occupations but chooses not to, due to satisfaction with their current position as a fisherman. The alternative occupations identified and employed in this analysis consist of 13 occupations ranging from

mechanical trades to unskilled labor and active unemployment.[109] While this occupation set is not argued to be exhaustive, it is felt to represent a reasonable approximation of the potential occupation set open to fishermen in all 11 of the NRRs identified above. The OAR measures are calculated using the standard formula for a dependency ratio:

$$\frac{\sum fishermen}{alternative\_occupation\ (i)} * 100 \qquad \text{Measure 3}$$

where (i) is the total number of individuals engaged in the ith alternative occupation.

Once the 13 OAR measures have been calculated they are then summed into a single measure of the total impact of fishing on an economic region.

$$OARs = \frac{\sum_{n}^{1} OAR}{\mathbf{N}} \qquad \text{Measure 4}$$

Where N=13 in this specific instance.

The OARs measure summarizes the average potential impact that the size of the fishing industry has upon the supply of labor for alternative occupations within individual NNRs. The OARs measure provides two valuable insights into the importance of the fishing industry. First, it tells us the relative competitiveness of the fishing industry within a specific NRR. The higher the OARs score the more important fishing is as an economic occupation within the NRR compared to the alternative occupation set. A score of 100 or greater suggests that, on average, fishing serves as the primary employment for as many individuals as are employed in any one of the typical alternative occupations. A score below 100 suggests that, on average, fishing serves as the primary employment for fewer individuals than are working in any one of the typical alternative occupations. Second, the OARs score suggests the potential impact on the local labor force of a specific NRR if fishing should suddenly cease as viable occupation.

Looking at the Downeast Maine NRR for example, it is seen that this sub-region has an OARs score of 255, indicating the powerful impact that fishing has on the region as a primary occupation. If fishing should suddenly cease however the OARs score suggests that there would be two and one half fishermen for every individual working in a single alternative occupation on average. Thus, if any one occupational alternative were more attractive to former fishermen, then the labor supply for this occupation would immediately be saturated. This could result in the driving down of wages and depressing the overall labor market as alternative but less attractive occupations were sought by fishermen.

In contrast, the Connecticut Seacoast NRR with an OARs score of only 2.61 shows that fishing has little or no measurable impact on the overall economic strength of the sub-region. If fishing were to end as an occupation in this NRR then the dispossessed fishermen would represent an increase in the labor pool of only two and one half workers per hundred workers in any average alternative occupation. In this case, fishermen could easily be absorbed into the existing labor force economy without significant disruption to the NRR occupational structure.

[109] The thirteen occupational categories are: (1) security guard, (2) food service/janitor, (3) trees and farming, (4) mechanics, (5) skilled construction, (6) machine operators, (7) manufacturing, (8) hand workers (9) truck drivers (10) marine related, (11) laborers & helpers, (12) manufacturing/other, and (13) unemployed.

The OARs index is a straightforward and easily interpreted measure but it represents only a summary measure that fails to capture the richness of the cultural life that underlies fishing as an occupation and as an avocation. Specifically, the OARs does not address the question of occupational fungibility (i.e., interchangeability). While the movement of fishermen to other occupational roles is clearly possible, Measure 3 implicitly assumes that the skills involved in fishing are readily transferable. As we have discussed, this assumption is contrary to the characteristics of fishermen, the nature of their community dependencies, and consequently the very form and direction of capital flows within regions.

Sample Design

The file used in this analysis is the 1990 Equal Employment Opportunity (EEO) Special File (US Bureau of the Census, 1994). The EEO data files and tabulations have represented the primary recognized source of national and subnational estimates of detailed employment for the United States during the decades of 1980 to 1990 and 1990 to 2000. The information is drawn directly from civilian labor force data gathered as part of the Decennial Census and is primarily intended to provide occupational and educational attainment data to support affirmative action planning for equal employment opportunity. The EEO file for the 1990 Census year consists of two sets of cross tabulations for the United States civilian labor force. The first set of tables, which is used for this analysis, provides data for 512 occupational categories by sex, race, and Hispanic origin. The second set of files that we employ in this analysis provides detailed information on educational attainment.

The EEO data files used to generate estimates is based on the 1990 census sample. The data are estimates of the actual figures that would have been obtained from a complete count. When all Census samples on occupation are accounted for across the Nation for the 1990 Census period, approximately one out of every six households in the United States were included in the 1990 EEO census sample file on occupation. It is the size of the EEO sample that makes it particularly attractive to the purposes of this analysis. Fishing as an occupation does not include a sizable portion of the total US population and as a result most samples are too small to allow us to look at the concentration of fishermen in any specific area.

While studies that focus on fishermen and fishing communities do exist, the number of individuals included in the study are generally small and cannot be generalized to the broader population. Because the EEO files provide detailed occupation down to a sub-county level we are able to exactly reconstruct the total population of fishermen within each of the 11 defined NRR's in the New England area. Using the EEO files we can also reconstruct total employment within each member of our set of alternative occupations that fishermen could engage in. At present, no other data set of this size and detail exists so it represents the best tool available for our research design**.**

Assessment of Indices

In Table 2, we have rank ordered the sub-NRRs by our first index (% related occupations), with Downeast Maine being the most fishing dependent and Connecticut Seacoast the least. It is quite clear from the correlation coefficients between and among the indices (Table 3) that there is a high degree of concordance, indicating a strong convergent validity for the measures.

A second observation from inspecting the data in these three indices is that there are three fairly homogeneous clusters of rankings, with Downeast and Upper Mid-Coast Maine, and Cape Cod and the Islands (I) being the most fishery dependent sub-NRRs. New Bedford/ South Shore, Rhode Island, Lower Mid-Coast Maine, Southern Maine, and Gloucester/North Shore (II) form an intermediate cluster of dependency. New Hampshire Seacoast, Boston Area and Connecticut Seacoast (III) cluster as the least dependent grouping. We shall discuss in detail the characteristics of each sub-NRR as reflected in the ethnographic and geographic setting of each region and as evident in our OAR ratio index.

Table 2. Comparative Fishing Dependence Indices for the Eleven Sub-NRRs of New England

Sub-NRR	A. % Related Occupations	B. % Of Total Employed	C. Alternative Occupation Ratio Summary
Downeast Maine	45	3.6	255.54
Upper Midcoast ME	36	2.0	171.05
Cape and Islands	27	0.79	104.43
Lower Midcoast ME	23	0.46	51.32
New Bedford/ South Shore	27	0.40	38.95
Southern Maine	23	0.39	36.94
Rhode Island	24	0.31	30.86
Gloucester/North Shore	20	0.21	24.91
New Hampshire Coast	8	0.09	9.46
Boston Area	7	0.05	6.39
Connecticut Coast	2	0.01	2.61

Table 3. Comparing the Three Dependency Ratios Using Pearsons r-Correlation

Dependency ratios	A. % Related Occupations	B. % Of Total Employed	C. Alternative Occupation Ratio Summary
A. % Related Occupations	r = 1.0	r = .833	r = .869
B. % Of Total Employed	r =.833	r = 1.0	r = .984
C. Alternative Occupation Ratio Summary	r = .869	r = .984	r = 1.0

Downeast, Upper Mid-Coast Maine and Cape Cod and the Islands

The three sub-NRRs in the high dependency cluster share some characteristics that give them strong links to the fisheries resources of New England. Downeast and Upper-Midcoast Maine share a common topography and isolation from other parts of Maine and New England. Inland, the Downeast sub-NRR is characterized by rocky, shallow soil and pine forests, with most of the near-coast interior being wetlands mixed with forest. The convoluted coastline however provides a plethora of islands and harbors offering easy access to extraordinarily rich fishing grounds.

The peninsula of Cape Cod is also bordered with natural harbors and associated fishing dependent communities such as Sandwich, Chatham, and Provincetown. Nearby islands such as Nantucket and Martha's Vineyard have a strong historical connection to fishing and a geography which gives fishing residents ease of access to nearshore stocks of finfish and shellfish. However, the Cape and Islands are a magnitude below the NRRs of Maine (2.87 on Index C. compared to 5.50 for Upper Mid-Coast Maine and 8.92 for Downeast Maine) since they have experienced intense pressures from tourism and gentrification. For example, Provincetown, MA has long been a summer mecca for artists and those with an alternative lifestyle, while maintaining a separate but equally thriving, year-around fishing industry. As the summer season has started to extend into the spring and fall, the relative balance may be shifting. Due to the diminishing groundfish catches and regulatory response, the fishing fleet is currently down to a dozen vessels from over thirty a decade ago.

On the other end, Chatham, MA continues to support a thriving small boat fleet that engages a good third of the active (non-retired) working force of the township. Within Chatham, a strong sense of place and enjoyment of the fishing lifestyle keep people involved in the industry even in years when low catches force some into alternative occupations or seasonal out-migration.[110]

3.7. Summary

The use of dependency indicators in the eleven sub-NRRs of the New England management region provides a new way to conceptualize the significance of fishing to local economies and regions.[111] Using these indicators, we can clearly see a distinction

[110] Rene Gagne, personal communication.

[111] Because our findings are based on the most recent available census data – 1990, it is important that our measures be interpreted as ordinal, not interval, measures. The assumption underlying this is that the relative size of populations of fishermen and others have remained the same. We know that absolute numbers have changed in all regions since 1990. It is important that our work be replicated once the 2000 census data become available.

between the most and least dependent regions, and these differences are supported by regional and community ethnographies.

There is also a high level of agreement between the indices with r-values of .833 (A-B), .869 (A-C) and .984 (B-C). Using the most differentiated ratio (C), Downeast Maine, Upper Mid-Coast Maine and Cape and the Islands form a cluster as the most fishing dependent sub-NRRs, ranging from 255.54 –104.43, with a mean of 176.88. The sub-NRRs 4 through 8 range from 51.32 (Lower Mid-Coast Maine) to 24.91 (Gloucester/North Shore), with a mean of 35.59. Sub-NRRs 9 through 11 (New Hampshire Seacoast, Boston Area, and Connecticut Seacoast) have the lowest scores, from 9.46 to 2.61, with a mean of 6.1.

Within all these regions, however, fishing infrastructure and fishermen populations are intermixed with gentrified coastal economies and communities that overtly subsume and mask total capital contributions of fishing. Though the distribution of fishing infrastructure and activities make it difficult to identify and characterize particular communities as "fishery dependent," examination of the networks of fisheries activities (total capital flows) reveals significant fishery dependency. In other words, consideration of its collective impact on regional economies and its historical contribution to localized secondary economies (i.e., the "multiplier effect") suggests the valuable contribution of fishing in several regions.

Any index has as its underpinning assumptions of about how the world works. The three dependency indices we have derived assume that fishermen are able to move into alternative occupations. As we indicate above, however, there are compelling reasons why this is not an accurate assumption. We would like to add this observation to the debate on how one should assess dependency of a fishing population. The analysis of impacts of fisheries regulations must include consideration of traditional fishing populations that have survived the biological and regulatory downturns in the fishery. Just as biologists extol the use of the precautionary principal in fisheries management, we propose a corresponding precautionary principal for extant fishing populations. The baseline economic, social, and cultural needs of surviving fishing enclaves, populations, and communities within the eleven sub-NRRs of New England should be given equal importance with conservation principals. Along with fish stocks, fishing populations and their communities are highly vulnerable. If measured too simplistically, their overall contribution to regional economies may be missed in an adherence to strict measures of contributions to site-specific community economies.

The myth that ***laissez-faire*** economies are both desirable and sustainable is contradicted by the inexorable destruction traditional communities can suffer when such economies run unchecked over established patterns of community living and their unique forms of human, social and cultural capital.[112] Preserving human uniqueness can be compared to conservation development that strives to preserve landscape and existing ecosystem structures while allowing for the creation of built environments. While change is inherent to the human condition and can provide welcome improvements in a community's or individual's quality of life, if the full range of social, economic, political and ecological variables are ignored, the consequences may be detrimental to individuals, communities, and the ecosystem.

In applying measures of fishing dependency to the sub-NRRs of New England, we outline the uniqueness of each unit, but also caution that for purposes of application to dependency issues, only detailed sub-regional and community analysis can reveal the whole story. Since this study represents the establishment of a baseline index, we suggest that comparative regional analyses must be linked to in-depth studies of the full range of variables to predict impacts of fisheries policy and regulation.

[112] Gerdsen (1997)

4. Vulnerability, Infrastructure and Gentrification among Fishing Dependent Communities

Like most of the nation's coastal areas, New England's coast is under increasing pressure from population growth and related development. It is estimated that half of the nation's total population now lives in coastal areas and that by 2010, that population will have grown almost 60 percent. Inevitably, conflicts arise between competing interests and demands for access to and the use of coastal resources. While an Internet-based "Town meeting on America's Coastal Future" sponsored by National Ocean Service (NOAA) found "strong support for conserving cultural heritage and diversity" as well as "traditional occupations," in truth, competition for space threatens fishing infrastructure and culture in many areas.[113]

When working harbors are transformed to address the demand of the middle-class for upscale housing, recreation, and entertainment rather than maintained in support of the productive activities associated with the commercial fishing industry, they may be said to be undergoing gentrification. The subsequent loss of localized community character and culture is termed delocalization and affects rural and coastal communities throughout the world. Delocalization decreases diversity and thus the adaptive flexibility needed to respond to localized changes in environment. Fishing populations undergoing delocalization lose access to total capital as values change, making it difficult for them to pursue a fishing lifestyle. This process is particularly rapid during times when the NRR is undergoing stress from reduced stocks as is currently the case.

The process of gentrification and coastal transformation is accelerating in New England as it is in most coastal areas of the US. For example, now that seals are found in Chatham, MA year round, possibly due to changes in local water temperature regimes and fish migration patterns, an operator of seal tours has started a new business. The tour operator wants a 'no wake zone' in an area where commercial boats pass through on their way to and from the harbor, because waves disrupt the water so the tourists can't see the seals on the surface.[114] As these processes accelerate, it becomes more difficult to identify 'fishing dependent communities', since the fishing industry's percentage contribution to total capital and local economies is diminished. At the same time, fishing families within these communities have necessarily adapted by increasing their networked capital flows to other communities in the NRR, intensifying the process of ***regional dependency*** in place of ***community dependence.*** Thus, the very nature of fishing in the community context has changed, as trucks, boats, and people shift and move from place to place in order to respond to opportunities to optimize capital gain in the face of reduced community infrastructure and market, and increased regional dependence and market flows.

By definition, gentry are "landed proprietors" who "typically wield large social, political and economic power."[115] Gentrification, then, of a fishing community implies a shift in power from the working men and women of the fishing industry to "those from away," those in white-collar jobs, or tourist (service) industries, and/or those who do not value the reality of a working waterfront. When intense external capital flow comes into a community, it necessarily increases the vulnerability of existing total capital networks. Traditions—existing ways of working, socializing, sharing, learning, and extracting economic capital—are lost or weakened as new, often mono-cultural, patterns come to dominate. Boat owners stop sharing fish at the dock, and banks stop giving loans to the fishing industry.[116] More frequently, land use patterns change, shoreline property prices inflate and the fishing industry is displaced, with less access to the waterfront. In those areas that attract only seasonal visitors, the attractive centers are apt to be boarded up in the off-season leaving

[113] http://coast2025.nos.noaa.gov/pdfs/sum_results.pdf
[114] Renee Gagne, personal communication
[115] ***Webster's Third New International Dictionary***. 1976. Springfield, MA: Merriam Company Publishers.
[116] Griffith and Dyer (1996).

the year around population without a community center. Such external influences can engulf and transform unique fishing cultures and communities following the natural resource way of life.

Regulatory layering is an additional external influence that has negative impacts on the maintenance of a fishing way of life. As the numbers of regulations mount to increasingly constrain fishing in response to perceived stock declines, fishermen attempt to adapt by switching gear and fishing locations in order to take advantage of available species. However,

"Many of the fishermen we interviewed had the sense that the regulations were confining them or "boxing them in" to one fishery at the expense of allowing them to take advantage of developments in other fisheries. This reduces the flexibility that is a hallmark particularly of smaller and medium-sized vessels, as well as contradicts current government and private efforts to promote underutilized or newly developed fisheries."[117]

Adaptation to changing conditions has made the fishing industry of New England resilient for over two centuries. When necessary, fishermen have changed gear, changed fishing areas, changed target species, trip patterns, and crew and in some cases even vessels to remain in the industry. In some areas in the region, a yearly round may include, for example, a combination of lobstering, shellfishing, shrimping and groundfishing to sustain the fishing household's livelihood. What is different now is that traditional flexibility is being harnessed and restrained by regulatory requisites associated with permits, limited access, and a recorded history of landings.[118]

Furthermore, as gentrification pressure has increased, and fishing infrastructure subsequently diminished, remaining infrastructure, supply outlets, and market connections have become increasingly de-localized. A fishing boat pulling into Boston Harbor is not likely to get repairs or buy fishing gear nearby. They can buy ice and fuel and they do offload product to regional and international seafood brokers. In fact, Boston has become specialized as the major international/ national transshipment site for seafood product in New England. This same vessel may get their fishing supplies and gear from New Bedford and Gloucester and their crew from the Cape or Portland. As this process of regional interdependence accelerates, dependency on remaining services and infrastructure is magnified and concentrated, creating an impetus for remaining dominant fishing sites to consolidate and specialize. As with the transshipment monopoly of Boston, the development of large, capital intensive fish auctions in Portland and Gloucester is an example of such a process of regional consolidation and specialization in the fishing industry.

The result is increased mobility of product as well as boats, gear, and fishermen, as they interact with the specialized centers, supply points, and seasonally changing fishing areas. Nevertheless, the maintenance of social and cultural capital resides at the local and community level. As fishermen are forced to practice a regional strategy, human networks and social ties can become strained for the occupational nomads. Where it is no longer possible to be a permanent part of a year round fishing crew that socializes and fishes together, social capital declines. Onshore, networks of families and friends often reflect the fishing crews and networks. These networks diminish along with the breakup of crews, resulting in a more atomized community with more social problems and decreased participation in community activities.

"Fishers are embedded in households that represent a shoreside extension of fishing activity. Wives and families of fishers are often intimately involved in management of fishing operations, including tracking of finances, attending public hearings on new regulations, and providing political and public input on fishery issues. Management policies that do not

[117] Griffith and Dyer (1996:29).
[118] The recorded history requirement is particularly onerous for the small vessels that rarely maintained official records of their catch. NMFS did not generally collect statistics from small vessels, so only those who retained sufficiently detailed receipts from buyers are able to prove their history.

recognize this can negatively impact the social, psychological, and economic well being of the fisher household. Costs to fisher households can range from wives being forced to work multiple jobs outside the home to foreclosures on homes whose mortgages are tied to fishing vessel mortgages."[119]

This is compounded by increasing competition under new stricter regulations, including declining collaboration at sea:

"Crew reductions, of course, result in more work aboard vessels per crew member and the neglect of certain activities associated with safety. Increased competition and conflicts between vessels and between fishers from other ports, due to the perceptions that fishers are having to divide up an ever shrinking pie, have decreased the extent to which fishers help one another out of trouble on the open seas."[120]

Stress is placed on families, children, and marriages as fishermen are forced to work across regions and even outside of their region, to make ends meet. In Gloucester, it is not uncommon to find owners of family boats who will spend time dogfishing to the south in the winter or even join a summer Alaskan fishing venture as crew in the summer. In this context, surviving fishing infrastructure represents an increasingly valuable capital investment in a way of life.

4.1. Historical and Total Capital Determinants of Infrastructure

Complexity of infrastructure is one measure of a community's dependency on fishing. However, the scale of fishing activities and the size of the community in question must be considered when using infrastructure as a signal for dependency. For example, a lobster fishing community in Maine may lack many of the indicators of complexity (e.g. ice house, fish processor), fishermen may purchase their supplies from a nearby town, ship their product on regional truck carriers, and have their boats built in Nova Scotia. Yet, most of the households can still be directly or indirectly dependent on the harvest of lobsters as a primary means of maintaining total community capital.

At the opposite extreme, a historical fishing port can have many of the indicators of complexity. Yet, it may be losing families through migration, retraining and job switching. Out-migration may be spurred by declining economic vibrancy of the local fisheries, reflected in a decline in the quality and quantity of port facilities, and loss of dock space to the externalities of gentrification. However, if the port still possesses sufficient remnants of key infrastructure, it may be designated as highly fishing dependent, even though it is in decline and at risk of collapse from change externalities. Thus, while fishing infrastructure is one measure of dependency, the analysis must take into consideration local ethno-historical conditions, community scale and type of fishing pursued, and degree of external pressure from gentrification, along with total capital flows.

In this context, surviving fishing infrastructure represents an increasingly valuable capital investment in a way of life. As fishing infrastructure is lost, whichever community in a region that retains such critical infrastructure may become vital to nearby communities who lack or have lost such economic capital. Active protection and improvement of such critical infrastructure or core facilities is a proactive measure that could be taken by managers to help preserve the viability of the New England fisheries. Persistence of industry as well as fish stocks should be a strategic goal of the fisheries management agencies.

Vital regional facilities can become vulnerable when inadequate product is available from the production sector. For example, in Hampton/Seabrook, New Hampshire, a fishing cooperative is the major landing and marketing facility for the small local fleet. Recent

[119] Griffith and Dyer (1996:31).
[120] Griffith and Dyer (1996:30).

restrictions on daily landings of groundfish such as cod are making it difficult to keep the facility going with so few fish to market. The port of Rockland in Maine has a central role in the distribution of herring for lobster bait. Rockland is the only regional port with a functioning dockside pump-out mechanism for offloading herring. Rockland pier represents a core facility for dozens of bait dealers from nearby towns and hamlets supplying many hundreds of lobster fishermen in scattered small ports and coves throughout the region. If the facilities as well as stocks are not protected, once the biophysical capital rebounds, communities dependent on facilities like those in Rockland and Hampton/Seabrook will not able to take advantage of the improved stock conditions to generate fisheries capital for the region and nation.

At the same time, the declining numbers of fishermen make it more difficult to constrain the land use demands associated with gentrification. For example, in a recent development at the state pier in Galilee, Rhode Island, a proposal by a private firm to berth a 120-foot catamaran ferry there threatens space traditionally used by local fishermen to repair their boats or to load and unload gear. Although one ferry already operates across the harbor from the proposed business, the new ferry is being touted for its ability to save five minutes on the crossing to Block Island as well its luxury value:
"…the boat would include carpeting, air conditioning, and televisions. 'It's like going to an amusement park… Fast food, fast cars, fast everything – that's what people want.'"[121]

From the fishermen's perspective: "***All of us use this dock," says Narragansett skipper Cliff Sambrook, who recently used the pier to paint the Laura Jean, a 40-year old fishing boat. 'Where are we going to go?"…'It's a huge concern among commercial fishermen," said Jim O'Grady, a commercial fisherman. 'The boat's too big."***[122]

4.2. Measuring Infrastructure Differentiation

For this report, the baseline conditions of fishing infrastructure are measured using a set of variables identified through visits to diverse community sites in New England (Table 4). Eighteen infrastructure components were tracked for 35 communities in the New England NRR. These communities are representative of the entire region, and are dispersed through the eleven sub-NRRs. We used principal component analysis to derive a scale of infrastructure differentiation. The scale provides a weighted empirical measure of the construct. The total variance explained equals 29.7%.

Table 4. Principal Components Analysis of Fishing Infrastructure Differentiation

Item	*Item loading*
NMFS Extension Office	0.710
Icehouse in-town	0.679
Boat Insurance	0.633
International Fish Brokers	0.630
Diesel Fuel Dockside	0.621
Fishing Monument	0.585
Fish Auction	0.578
Local Trucking	0.574
Fish Processor	0.572
Fishermen supply house	0.539
More than two fishing associations	0.533
Boat welders	0.531
Vessel haul-out facility	0.507

[121] Davis (2000:C3).
[122] Davis (2000:C3).

Local net maker	0.459
Marine Supply House	0.412
Bait House	0.374
Fish retail store	0.359
Two or fewer fishing associations	0.336

Prime (top six) components of dependency include icehouse, NMFS extension office, dockside diesel fuel, international fish brokers, and boat insurance. The lower level (bottom six) components include bait house, more than 2 fishing associations, marine supply house, local net maker, fish retail store, and two or fewer associations.

Middle range items include local trucking, fish processor, fishing monument, boat welders, fishermen supply house, and vessel haul out facility. These eighteen total items load on a single factor of fishing infrastructure that allows us to rank order the sampled ports in the region by means of their particular factor scores on the scale. Those that score highest have the highest correlation to the factor, while those that score the lowest, the least. We assume there is some link between these scores and the level of one aspect of fishing dependency in the port.

However, it is critical to note that other economic activities besides fishing go on in a port, and can mask the importance of fishing infrastructure in any single community. This is an argument against using strict economic valuation (amount of total community economic capital measured against amount supplied by the fishing industry in any port) to identify a community as fishing or non-fishing dependent. As noted earlier, fishing dependency is best measured by examining communities in a regional context of total capital exchanges, not by measuring each community as economic isolates having no regional value outside their non-fishing economies.

4.3. Classification of Community Sample by Categories

The list of 36 communities (Table 5) shows seven ports that can be classified as having "primary" infrastructure (New Bedford, Portland, Gloucester, Chatham, Point Judith, Portsmouth) with the remainder being secondary and tertiary ports. Also, some ports contribute more to the regional flow of total fishery capital than others do. For example, New Bedford, that tied for top ranking of 1.5 and factor score of 1.999, is often mentioned by nearby communities in Massachusetts and Rhode Island as a source of fishing supplies and the site where vessel haul-out and repair is done. Portland serves a similar role in Maine and New Hampshire.

Table 5. Fishing Infrastructure Differentiation Scale for the New England NRR.

Port Ranking	New England Fishing Port	Factor Score
1.5	New Bedford, MA	1.999
1.5	Portland, ME	1.999
3	Gloucester, MA	1.678
4	Chatham, MA	1.614
5	Point Judith, RI	1.350
6	Portsmouth, NH	1.000
7	Stonington, ME	.789
8	Rockland, ME	.759
9	Vineyard Haven, MA	.598
10	Stonington, CT	.440
11	South Norwalk, CT.	.428
12	Port Clyde, ME	.337
13	Newport, RI	.248
14	Sandwich, MA	.175
15	Kennebunkport, ME	.061
16	Beals Island/ Jonesport, ME	.036

17	Plymouth, MA	-.015
18	Tiverton, RI	-.035
19	Niantic/Waterford, CT	-.096
20	Belfast, ME	-.145
21	York, ME	-.231
22	Cape Porpoise, ME	-.240
23	Searsport, ME	-.252
24	Provincetown, MA	-.319
25	Hingham, MA	-.329
26	Hyannis ,MA	-.364
27	Jamestown, RI	-.406
28	Scituate, MA	-481
29	Boston, MA	-.629
30	Bridgeport, CT	-.823
31	Eastport, ME	-1.051
32	Cutler, ME	-1.184
33	Sakonnet Point, RI	-1.446
34	Northport, ME	-1.628
35	Woods Hole, MA	-1.844
36	Bucksport, ME	-1.989

The infrastructure complexity results for New Bedford, Portland, Point Judith, and Gloucester are consistent with information generated from a 1996 study of the Multispecies (groundfish) fishery.[123] Table 6 shows that in 1996, infrastructure, as measured by number of marine equipment suppliers and fish dealers/processors, is consistent with the rankings generated using the infrastructure index presented herein. At the time, numbers of groundfishing permits ranked high for these ports, however there has been a significant decline in permits and infrastructure related items for groundfishing since then.

Table 6. Comparative Fishery Dependency Table for the Five Primary Ports in the MGF in 1996

	New Bedford	Gloucester	Chatham	Portland	Point Judith
Repair/supply facilities	35 (5)	12 (2)	15 (3)	21 (4)	11 (1)
Fish dealers/processors	77 (5)	43 (4)	29 (1)	42 (3)	32 (2)
Religious art/architecture dedicated to fishing	(1)	(1)	(0)	(0)	(1)
Secular art/architecture dedicated to fishing	(1)	(1)	(1)	(1)	(1)
Number of MGF permits	128 (4)	219 (5)	110 (3)	60 (1)	78 (2)
Number of MGF vessels	241 (4)	322 (5)	84 (3)	80 (2)	55 (1)
Fishing Dependency Index Score	21	17	11	11	7

[123] Griffith and Dyer 1996.

In 1996 groundfishing supported a core part of the industry, accounting for between 44 and 53% of their seafood dealing and processing capacity and significant employment. Amendment 7, the groundfish vessel buyback program, reductions in Days at Sea (DAS), and recent closures in the Gulf of Maine have significantly reduced the groundfish fleet as well as the supporting infrastructure for this part of the industry.

Significant groundfish-related infrastructure were also recorded in 1996 for Portsmouth, NH, and Newport, RI and they retain high rankings at 5 (factor score of 1.024) and 12 (factor score of .287) on our 1999-2000 fishing infrastructure scale. According to key respondents, however, development interests are presently threatening Newport's commercial fishing infrastructure. These interests would like to see the commercial fishing dock space converted into a tourist site, to complement nearby gentrified areas of shops, recreational dock space, and restaurants. The fishing infrastructure, then, is not considered an integral part of the dockside tourist ambiance in Newport. It is instead separated in an enclosed area between a yacht building and docking facility and the gentrified dockside and recreational boating waterfront of the town. Overall, the comparative fishing dependency in 1996 identified five primary ports that remain the top five based on the differentiation scale used in this study.

Other significant ports in 2000 include Rockland, ME (rank of 8, factor score of .759), and Stonington, ME (rank of 7, factor score of .789). Rockland is important as a docking and distribution center for the herring fleet, and individual bait dealers congregate in Rockland and purchase herring dockside. They supply hundreds of fishermen in some fifty nearby communities in the region with herring. The Rockland fishing infrastructure is thus mostly dedicated to serving herring vessels. The infrastructure includes a pump-out facility for herring, and a separation tank for herring scales, used in the manufacture of cosmetics and jewelry.

Stonington (rank of 7, factor score of .789) is the most developed Maine port community dedicated to lobster fishing. Several hundred lobster fishermen live on the Stonington peninsula and dock at the Stonington port and nearby lobster "camps." Lobster camps are located in small coves and harbor a dozen or more boat moorings and nearby shanties for equipment storage. Stonington port also services a few scallopers and groundfishing vessels, and two large fish processing plants lie dormant on the docks. These were previously used to process herring and other finfish, but are now used as storage facilities. Stonington sits on the tip of a peninsula, and is the principal embarkation for fishing families inhabiting residential clusters and villages up and down the peninsula.

Vineyard Haven is a unique port on the island of Martha's Vineyard, MA, and is best known as a summer tourist mecca. Despite its historical importance as a refuge for the upper class, it has a surprising fishing infrastructure differentiation rank of 9 and a factor score of .598. This port has basically just one of each infrastructure item, but is home to a small but thriving commercial and artisanal fishery of part-time clammers, hook and line fishermen, lobster fishermen, and draggers. These fishermen fill the local demand for fresh seafood products, for local residents year round and for the large number of summer residents. The isolation of the site and its value as a recreational destination for upper class tourists and celebrities contributes to the reliable local demand for seafood products. Thus, being one of the most gentrified of ports does not threaten the small but active commercial fishery. The fleet benefits from high local product demand and the ability of the upscale consumer clientele to pay above average prices. Moreover, the fishing infrastructure, in contrast to Newport's, is integrated into the local ambiance of the town enhancing the "saltiness" of this island community and continuing to attract appreciative wealthy visitors.

Stonington, CT, with the largest fleet of draggers in Connecticut, ranks 10 on the scale (factor score of .440). Stonington has the only integrated commercial facility in the state where all fishing vessels can dock, and which is protected from incursions by developers through a set-aside agreement with the township. South Norwalk, CN also scores high with a ranking of 10 and factor score of .468. South Norwalk is unique in that it is the operations

center for the Talmadge Oyster Co., the largest shellfish operation in the region. Talmadge has dock space for vessels unloading product, and in nearby Bridgeport also has a dockside presence and a shucking operation for oysters. The difference between Stonington, with its set-aside dock, and South Norwalk is that commercial fishing vessels in South Norwalk are not located in one dock area, but are dispersed up and down the river.

This is the case with practically all other commercial fishing enclaves in Connecticut. For example, Groton, with 31 commercial fishermen, and New London, with 24, represent a considerable commercial fishing presence, but the vessels are found in dispersed clusters up and down the river, with no central docking facility for commercial fishing and no plans to construct one. New London does have an older docking facility, dominated by lobster vessels, but this is in considerable decay and only serves about a half dozen vessels.

This dispersed pattern of vessels by port makes it difficult for local economic leaders to recognize and identify with the fishing industry. Such a lack of recognition can be a threat to the survival of existing infrastructure and fishing operations. For example, Bridgeport has no significant fishing infrastructure (rank of 30, with a factor score of -.823), yet there is a cluster of 18 lobster boats that use rented recreational dock space. A major dockside development is planned, but there has been no consultation with or the fishermen or integration of the commercial lobster fishing cluster into the plan. As plans now stand, the 18 vessels in Bridgeport will be displaced from their present docking spaces without being provided with alternative spaces.

4.4. Gentrification and Loss of Infrastructure.

Loss of existing port fishing infrastructure stands out as one of the potentially most harmful threats to the health of fishing dependent communities and regions in New England. Many ports now have just the bare minimum of supporting infrastructure, particularly with the losses associated with the regional decline in the groundfishing fleet. The diminishing numbers of fishermen, vessels, processors and supporting services also affects the ability of communities to retain social and cultural capital. Because of the decline in social and economic capital associated with the fishing industry, gentrification is much more difficult to resist.

As demand and prices for shoreside property rise, real estate taxes also mount and owners with modest incomes or life styles are forced to sell their property. Bought out and disenfranchised from their historic spaces and places, their networks of social and cultural capital can be lost. Gentrification can lead to undesirable social and human costs and an overall loss of communal identity. Once such transformations take place, it is difficult or impossible to reverse the process. As fishing infrastructure is lost, space it occupied can be permanently transformed for alternative uses.

Nevertheless, gentrification, like other processes of cultural transformation, is influenced by historical trends. Some ports and regions have adapted well to a history of gentrification, and are able to accommodate varied uses by tourists and seasonal residents. Generally, such communities are accessible by major highways and roads, have adequate support services for development, and have dockside and seaside space for expansion and/or transformation**.**

Not all communities with a history of gentrification, however, continue to support their fishing industry. Provincetown, MA, at the tip of Cape Cod, is in a very scenic area with wide expanses of natural beaches and dunes. Formerly a thriving fishing village, it has preserved its architectural heritage in its evolution into a summer art colony with a tourist shop and restaurant center that attracts thousands of weekend and summer visitors.[124] As the

[124] Griffith and Dyer (1996). On August 9, 2000, ***The Boston Globe*** reported that Rhode Island's Department of Environmental Management was denied permission to use the State Fish Pier because of the potential negative impacts on Galilee's fish industry.

tourist season has extended, the tourist industry has encroached over more of the town. At the same time, the fishing presence has diminished as regulations, an unsympathetic town council, increased operating costs, and declining fish stocks combined with an aging fishing fleet make the occupation more difficult to sustain.

In Downeast Maine, the isolation of the region and lack of beaches and support services makes the small, coastal fishing communities less likely to experience gentrification. Places such as Cutler and Jonesport/ Beals Island, Maine, are on isolated, rocky peninsulas, serviced by long, winding narrow roads that end in sheltered coves and dock areas crowded with lobster fishing boats and an occasional dragger or scalloper vessel. Far from the flow of tourist capital and with little space to offer for alternative developments such as restaurants and hotels, their potential for gentrification is limited. As long as their local biophysical capital holds up, they are unlikely to experience major pressures for change. Nevertheless, interviews with individuals indicated that "those from away" are beginning to make incursions even into some of the isolated communities.

The Stonington peninsula is experiencing gentrification, as are other coastal areas of northern Maine with isolated summer homes being bought up and small artists colonies developing. Lack of highway access keeps the pace of change in many of these areas down. However, recent proposals to build a bypass connecting Wiscassett, Maine to the interstate have residents concerned about losing the quiet character (loss of social and cultural capital) of their communities to tourist traffic.

Introduction of external values goes along with an increasing number of residents 'from away.' In Cutler, a newcomer 'from away' built a home right near the town dock that blocks the view of a long time resident and interferes with access to a storage facility for local fishermen. This structure was erected despite the pleas of the nearby resident, who has lived in Cutler all his life. According to him, ***"a local wouldn't have built it if we asked him not to— and that is a big difference between people from away and people from here— they don't listen to each other***."

Another explanation is that there are few social ties—and consequently little invested social capital—between the newcomers and the long-term residents who have a stake in the traditional fishing "way of life" that has historically held the community together. New coastal residents may be less likely to integrate with the traditional community social networks, resulting in a decline in local social capital and loss of community character—the 'small town' effect. This is especially true if the community is used as only a seasonal, retirement residence or if the new residents are part of a suburban influx with jobs outside the community boundaries.

The values newcomers bring are DSP-dominant and emphasize competition and individual success over community solidarity and social cohesiveness. The concomitant loss of local institutions and knowledge could have serious consequences for fisheries management. Co-management and community-based fisheries management show promise for building sustainable fisheries.[125] However, fragmentation of fishing communities (loss of social capital) could hamper such efforts.

The model used here reveals a pattern of change that is consistent with the present gentrification pattern. In general, the farther north you go, the less gentrification you find. The gentrification scale consists of sixteen principal components that explain 36.7% of the sample variance (Table 7). Visitors' bureaus (.775), marinas (.775), and upscale condominiums (.727) have the highest loading values for gentrification, while whale watching tours (.311), lobster retailers (.330), and maritime museums (.345) rank the lowest. Using these principal components, we have generated rankings of gentrification (Table 8).

[125] Pinkerton, Evelyn (1989)

Table 7. Principal Components Analysis of Gentrification Indicators

1. Visitors bureau	0.775
2. Marinas	0.775
3. Upscale condominium	0.737
4. Recreational bait shop	0.732
5. Fish retailer	0.722
6. Recreational tackle	0.720
7. Fishing excursion vessels	0.708
8. Trendy retail shops	0.669
9. Recreational boat tours	0.576
10. Seaside restaurants	0.571
11. Whale watching tours	0.530
12. Recreational boat dealers	0.450
13. Hotels/Inns dockside	0.372
14. Maritime museum(s)	0.345
15. Lobster retailers	0.330
16. Whale watching tours	0.311

Table 8. Gentrification Rankings of Ports in the New England NRR.

Port Ranking	*New England Fishing Port*	*Factor Score*
2	Kennebunkport, ME	.959
2	Plymouth, MA	.959
2	Portsmouth, NH	.959
5	Newport, RI	.852
5	Vineyard Haven, MA	.852
5	Rockland, ME	.852
7	Point Judith, RI	.842
8	Portland, ME	.808
9	South Norwalk, CT	.708
10	New Bedford, MA	.702
11	Jamestown, RI	.701
12	Scituate, MA	.663
13	Provincetown, MA	.660
14	Chatham, MA	.621
15	Niantic / Waterford, CT	.584
16	Hyannis, MA	.542
17	York, ME	.491
18	Hingham, MA	.452
19	Belfast, ME	.362
20	Stonington, CT	.288
21	Gloucester, MA	.269
22	Bridgeport, CT	.157
23	Eastport, ME	.070
24	Sandwich, MA	-.024
25	Bucksport, ME	-.041
26	Boston, MA	-.200
27	Tiverton, RI	-.211
28	Stonington, ME	-.808
29	Woods Hole, MA	-.887
30	Sakonnet Point, RI	-.939
31	Port Clyde, ME	-1.315
32	Searsport, ME	-1.545
33	Cape Porpoise, ME	-1.612
34	Beals Island / Jonesport, ME	-2.2090
35	Cutler, ME	-2.131
36	Northport, ME	-2.554

The most gentrified ports are Kennebunkport, ME, (factor score .959), Plymouth (factor score .959), and Portsmouth, NH (factor score .959). All three of these ports have

developed tourist attractions based on their history. Plymouth and Portsmouth especially herald their historical backgrounds with designated cultural sites and museums, as well as provision of hotels, restaurants, and other facilities to appeal to a wide general population. Kennebunkport, the smallest of the three, is gentrified, but rather than for tourists, it appeals to upper class residents and local owners of historic homes. Though Kennebunkport residents enjoy their exclusivity (even banning food chain restaurants) they recognize and celebrate the town's historic fishing and farming roots. A bronze statue that rivals the famous fishermen's statue of Gloucester is a larger than life size statue portrays the revered 'ancestors' of the local community – a man and woman reaping the harvest of the sea (a cod fish) and the soil (a basket of food crops).

It is important to note that even though these three communities are the most gentrified, they are also able to support healthy local fishing populations and infrastructure, and do so with enthusiasm. Portsmouth (scale rank of 6th for fishing infrastructure—7th overall) has a state built commercial fishing dock that provides outstanding facility support for the modest but well-sustained local fleet. The commercial facility is protected from development because of its state-sponsored status, and all requisite fishing infrastructure is concentrated around this dock area.

Plymouth ranks fifth overall in fishing infrastructure differentiation for Massachusetts ports and has a rank score of 17th (18th overall out of 36 ports) for fishing infrastructure. The commercial dock at Plymouth is also state funded and the local fishing culture is incorporated into the cultural attractions of the port. Dockside restaurants, for example, are positioned to give patrons a view of the commercial fishing activities, and tourists stroll the docks and take photos of the fishing fleet unloading their catch.

Kennebunkport (scale rank of 15th, 16th overall) with only a dozen commercial lobster boats, supports their fishing activities with an exclusive commercial dock that includes a storage facility for bait as well as dockside ice and fueling. Running a Pearson Correlation between fishing infrastructure differentiation and gentrification, we get a value of 0.467, which is significant for the N = 36, with a Barlett chi-square value of 8.224 and DF = 1. This suggests there is a significant and positive relationship between gentrification and presence of fishing infrastructure when gentrification is historically founded (i.e. it is not a recent process, but one that has roots in the historical development of extant fishing communities).

Community sites with the greatest conflict and potential threat to infrastructure from gentrification are those with waterfronts that are 'industrial' in appearance. Places such as New Bedford, Gloucester, and Portland have extensive dockside areas devoted to fishing and fish marketing infrastructure. Built for utility rather than beauty, such places seem antithetical to gentrification. Where the fishing industry is less financially viable than in the past, towns are interested in diversifying and, in particular, attracting tourist dollars. A public official in Gloucester, MA., expressed a desire to see the dockside area transformed for tourism, but as a state "designated port area (DPA)" only true maritime use is currently allowed. Other ports where attempts are being made to reduce industrial scenery include Westport and Newport.

In Newport, though commercial fishing activities have moved away from the tourist center, they continue to be pressured to move farther away. Commercial fishing participants compete for space with a highly active tourist trade and recreational boating sector. Respondents claim competing tourist businesses complain about the sight of fishing gear on the docks and the smell of the fishing activities—"they want them 'out of sight, out of scent."

Not surprisingly, the least gentrified fishing ports are in Maine (Regions 9 through 11,Table 8). Port Clyde (rank 31), Searsport (rank 32), Cape Porpoise (rank 33), Beals Island/Jonesport (rank 34), Cutler (rank 35) and Northport (rank 36) share common characteristics of isolation, small population size (under 2,000), a reliance on lobster fishing, and a stable resident population. It is not uncommon to find folks who have lived in these communities their

entire lives, and, as in Beals Island, rarely venture far from their home.

Although fishing culture dominates in these communities, size and simplicity (the predominance of lobster as the target fishery) result in little fishing infrastructure differentiation for Northport (factor score –1.628, rank 34, Cutler (factor score –1.184, rank 32), Searsport (factor score -.253, rank 23), and Cape Porpoise (factor score -.240, rank 22). The fishing community with the highest fishing infrastructure differentiation rank (factor score .789. rank of 7, 8th overall) compared to its gentrification differentiation rank (factor score of –808, rank of 28, 29th overall) is Stonington, Maine. Stonington is one of the peninsular fishing ports, and has the most differentiated fishing infrastructure for its size along with the low-level gentrification. Key respondents in Stonington emphasized their self-reliance and a strong sense of connection to their space and place, particularly the nearby coastal areas and offshore islands.

5. Preface to the Sub-region and Port Profiles

As explained in Chapter 1, the introduction to this report, the sub-regions designated herein are partially an artifact of the way statistics are collected by the government (country-based). In addition, the researchers have tried to make this report dovetail with economics modeling research led by Di Jin of Woods Hole Oceanographic Institution. Furthermore, the analysis of the social and economic networks of the fishing communities demonstrate that these often extend beyond the named "fishing communities" that are readily identified by residents and observers of coastal New England.

The sub-regions thus described are not necessarily recognized by their own residents as appropriate or real designations. However, the boundaries of the more commonly named regions, such as Midcoast Maine and Downeast Maine, are also permeable and used vaguely by residents, the tourist industry, Chambers of Commerce, various web sites, etc. Sometimes they are used interchangeably to refer to a small-town life-style with a greater degree of independence or isolation imputed to Downeast Maine. For this research, an effort has been made to identify subregions with similar fishing-related attributes while maintaining a structure that is also amenable to the use of the U.S. Census and other available systematic data.

In each section, we describe a sub-region in general terms, focusing particularly on the relative dependency on fishing as indicated by the dependency indices described in Chapter 3 of this report. A brief sketch of each of the counties in the subregion follows, usually including Census-based data and a list of the towns in the county with those known to have fishing activity noted. Finally, one or two prominent fishing communities in the counties are profiled in some detail, including a section based on interviews with key respondents.

Some redundancy is built into the report to allow readers to read selectively rather than cover-to-cover. In some cases, the redundancy is evident even within a single community profile since some readers may want to read comparatively—selecting only one or two categories, but reading about these for each community.