Integrating Human Wellbeing Assessment Into Marine Resource Management

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Abstract

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Prioritizing social indicators of wellbeing and linking them to specific marine resource management contexts requires ongoing consideration of local community values, social change drivers and dynamic governance goals and objectives. As coastal communities undertake new initiatives to develop marine spatial plans, anticipate renewable energy development projects or examine ecosystem service trade-offs in the context of fishery declines or climate change, this study provides timely insight into the full complexity, political nature, and institutionalized constraints of social assessment integration. Using a qualitative case study of Pacific Fishery Management Council briefing books to assess the Council's current use of socioeconomic data as well as a quantitative survey of other integrated human wellbeing assessment projects from around the world, this study 1) compares the priority domains of wellbeing being promoted in different socio-ecological system governance contexts, 2) outlines a preferred methodology for selecting human and social wellbeing metrics that are reflective of community needs, and 3) makes suggestions for improving the integration of human wellbeing research in U.S. Fishery Management Council processes.

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"To desire and strive to be of some service to the world, to aim at doing something which shall really increase the happiness and welfare and virtue of mankind – this is a choice which is possible for all of us; and surely it is a good haven to sail for." ~ Henry Van Dyke

"Human well-being is not a random phenomenon. It depends on many factors - ranging from genetics and neurobiology to sociology and economics. But, clearly, there are scientific truths to be known about how we can flourish in this world." ~ Sam Harris

1 Introduction

Many interdisciplinary teams of scientists are currently working to better align marine resource management technologies with the promotion of human wellbeing in coastal communities. Resource management practitioners are delving into the best theories and methods of social science research for compatibility with established decision support frameworks, exploring novel econometrics and other quantitative measurements to track human wellbeing over time, and debating the merits and challenges in using social indicators in the governance of highly complex socio-ecological systems.

The Social Wellbeing Indicators for Marine Management (SWIMM) project is one such effort currently underway in Washington State. Initiated by NOAA's Northwest Fisheries Science Center (NWFSC) and Washington Sea Grant (WSG) in 2013, SWIMM research has supported NWFSC's and WSG's combined efforts to develop human wellbeing indicators for the California Current System Integrated Ecosystem Assessment (CCIEA).

Although specifically charged with the development of human wellbeing indicators for the California Current Large Marine Ecosystem, the outputs and insights of SWIMM project research are intentionally designed to inform a wide variety of other resource management contexts. During the first SWIMM working group meeting, NOAA's Ecosystem Science Program Manager, Phil Levin, outlined a number of key members within the NMFS marine governance network which are particularly likely to use the Northwest Fisheries Science Center's human wellbeing data: the Pacific Fishery Management Council (PFMC), NOAA's National Marine Sanctuaries, federal agencies involved in Natural Resource Damage Assessment (NRDA) processes and the California Department of Fish and Wildlife administering the fishery management plans prepared under the state Marine Life Management Act (MLMA).

Funded in part by the SWIMM initiative, this thesis provides information and analyses to 1) support SWIMM's effort to broadly inform the integration of social science research into marine resource management and 2) to identify specific opportunities for improving the value and use of human well-being indicators for one of the CCS IEA's key institutional audiences: the Pacific Fishery Management Council.

1.1 Study Objectives & Outline

The specific objectives of this study have been:

- To undertake a critical examination of the historic use of indicators in socio-ecological system governance.
- To identify lessons learned from existing wellbeing assessment projects toward recommending a preferred indicator selection methodology.
- To recognize and understand the contextual importance of human wellbeing assessment by 1) identifying the laws and mandates promoting the use of these studies within the Pacific Fishery Management Council process and 2) comparing them with the measurement priorities, methods and social contexts which have inspired other integrated assessments around the world.
- To outline the specific human well-being indicators and socioeconomic data currently in use by Pacific Fishery Management Council.
- To suggest opportunities for improving the relevance and value of human wellbeing indicator use within the Pacific Fishery Management Council decision-making context.

Chapter 2 of this thesis draws from interdisciplinary academic literature to explore various conceptualizations of human and social wellbeing and discusses the current marine resource governance context promoting the use of integrated assessments in the United States. Chapter 3 discusses the project survey and case study methodology used to identify best practices in current human wellbeing research as well as to identify the socioeconomic data currently in use by the Pacific Fishery Management Council and the motivations for their particular use. Chapter 4 provides the results of these analyses and discusses their implications. In conclusion, Chapter 5 uses the insights gained in earlier chapters to 1) present a preferred method for human wellbeing indicator selection and 2) recommends specific ways to improve the use of human wellbeing indicators and other social science research in U.S. fishery management council processes.

1.2 Problem Statement

The primary thesis of this study is that "good" indicators of social and human wellbeing are, fundamentally, those that have the most meaning, relevance and value to the specific individuals operating within and impacted by a particular decision-making context. In complex social systems—where many individual definitions of wellbeing exist—monitoring and promoting only certain aspects of wellbeing (or the wellbeing of certain social groups) may have negative impacts on or consequences for others. The great challenge of using indicators of human wellbeing in the management of public resources, therefore, is that, as the number of people impacted by governance decisions increases, so, too, does the number of social measures relevant to governance concern. Prioritizing these social measures and identifying the appropriate governance response to their values is, therefore, a highly political process. It will inherently engage diverse people—each with their own level of access to power and influence—in various forms of social negotiation and persuasion.

While particular indicators of human wellbeing may be supported and justified by strong theoretical foundations, historic use, the availability of data or specific legal or administrative mandates, those seeking to systematically apply these measures within resource management contexts must also be cognizant of and responsive to the dynamic values and goals which co-exist and evolve within a society over time. Policymakers and the public they serve do not always share consistent or invariable long-term social priorities and goals. As a result, social assessment and the selection of measures to track progress toward new and emerging social priorities will necessarily remain an ongoing state function. Shaping useful decision-analysis tools that integrate social and natural systems data must go hand in hand with the institutionalization of iterative and participatory planning norms. In some cases, human wellbeing assessment may be as much a question of whether or not to integrate public participation into once-routine management processes as it is a question of identifying suitable social data for algorithms and predictive modeling. For state agents hoping to use indicators in an attempt to make issues of social concern more legible and efficient to manage, this may be the unexpected, exasperating, and seemingly antithetical outcome of integrated management's promise.

In Washington State, efforts to produce widely accepted social indicators for the integrated management of the Puget Sound ecosystem have been underway since the WA State Legislature established the Puget Sound Partnership (PSP) in 2007. The official effort to cooperatively develop indicators for the Salish Sea, which began in 2000, has also been a long-term project of the U.S. Environmental Protection Agency (EPA) and Environment Canada (EC). As the longevity of both initiatives show, indicators that persist unchanged through cycles of planning or adaptive management are not always easy to develop or institutionalize. As

environmental conditions, and the leaders being held responsible for those conditions, change, new sets of measures may also be required to track progress toward similarly dynamic and evolving social-ecological goals. Guidance is therefore needed to ensure that the many social science integration projects now underway result in positive long-term impacts on both the environment and the many different social groups whose wellbeing depends on positive environmental conditions.

While a considerable volume of literature is currently occupied by human wellbeing research within distinct academic disciplines, much less consideration has been given to the practical linkage of these diverse concepts to the established practices and North American institutions of marine resource management. The SWIMM research initiative has provided an important forum to explore why resource management organizations such as NOAA's NWFSC should incorporate social science data and theory into the management of West Coast fishery resources. This thesis supports and expands upon the SWIMM effort by highlighting opportunities to implement these insights within the Pacific Fishery Management Council.

2 Literature Review

2.1 Definitions and measures of human and social wellbeing

Numerous definitions of "human wellbeing" and "quality of life" have been advanced by theorists, applied researchers, and policymakers (Appendix A). However, no one definition is universally supported in the social sciences. All too often, the complex, multi-dimensional nature of human wellbeing is ignored in policy documents through the simple omission of a human wellbeing definition or by the use of vague language—inoffensive to all—but, ultimately, incapable of supporting the normative pursuit of human wellbeing in a concrete or meaningful way. As Rapley (2003) has discussed, "it is routinely observed that not only do particular studies frequently lack a formal definition of [quality of life (QOL)], but also that widely used measures of QOL fail to relate to an explicit theory of QOL and fail to show how QOL 'outputs' are related to 'inputs' in the shape of either public policy (Hagerty et al. 2001) or more local circumstances" (p.29).

For those who choose to define human wellbeing, however, care must also be given to ensure that working definitions are actually able to guide and support resource management needs. The Australian Bureau of Statistics' (ABS) (2001) definition, for example, demonstrates just how expansive and multidimensional some definitions of human wellbeing can be:

> "From birth to death, life enmeshes individuals within a dynamic culture consisting of the natural environment (light, heat, air, land, water, minerals, flora, fauna), the human made environment (material objects, buildings, roads, machinery, appliances, technology), social arrangements (families, social networks, associations, institutions, economies) and human consciousness (knowledge, beliefs, understanding, skills, traditions). Wellbeing depends on all the factors that interact within this culture and can be seen as a state of health or sufficiency in all aspects of life. Measuring wellbeing therefore involves mapping the whole of life, and considering each life event or social context that has the potential to affect the quality of individual lives, or the cohesion of society. At the individual level, this can include the physical,

> emotional, psychological and spiritual aspects of life. At a broader level, the social, material and natural environments surrounding each individual, through interdependency, become a part of the wellbeing equation" (pg. 6).

The literature further complicates the ABS definition by suggesting that "sufficiency" is, in fact, self-defined and that measures of human wellbeing would be incomplete without accounting for an individual's subjective well-being and the relative values they place on each factor contributing to their personal quality of life (Rapley 2003; World Health Organization 1995; Boling et al. 2003; Brady et al. 1999; Frick et al. 2004; Kemmler et al. 1997; Starace et al. 2002; Thumboo et al. 2003). Thus, while no single resource management plan or agency has the capacity to support "sufficiency in all aspects of life" or to continuously monitor each individual's perception of wellbeing "from birth to death", it is important for those involved in wellbeing assessment to recognize and understand the differences between the subjective vs. objective characteristics of wellbeing. It is also essential to keep in mind the many distinctions that exist between the welfare of individuals and that of an entire community or social group. These nuances of human wellbeing must be part of any robust theoretical foundation used to inform indicator selection or design.

Human Wellbeing Definitions & Theories Recognize:

- Human wellbeing is multidimensional and dynamic
- Human wellbeing is a process as well as a state (ex: health behavior vs. health status)
- Social wellbeing has its own character and is not just the aggregate sum of individual wellbeing measures (ex: social capital, racial conflict).
- People are highly adaptable and some research suggests we maintain fairly stable happiness levels regardless of our circumstances. These "hedonic treadmill" concerns can be addressed by triangulating subjective assessments with objective measures.
- Human wellbeing is unique to specific temporal and/or geographic scales and the societies that inhabit them (but influenced across these scales).
- A functional definition of human wellbeing may sometimes be more useful for resource managers than a complete theoretical definition.
- An appropriate human wellbeing definition for resource management might or ***might not*** require human wellbeing to be:
    - Equitably distributed within a society
    - Normative in its promotion of human regard for the environment

At their first meeting in January of 2014, the SWIMM working group adopted a working definition of human wellbeing based on McGregor (2008):

> "Wellbeing is a relational state of being with others and the environment which arises where human needs are met and where

> individuals and communities can act meaningfully to pursue their goals and enjoy a satisfactory quality of life" (SWIMM 2014).

This definition emphasizes the material, relational and subjective attributes of wellbeing and is grounded in theory originally developed by the University of Bath's Wellbeing in Developing Countries Research (WeD) study (McGregor 2008). In recent years, this definition and theory has been applied in Sri Lanka and India by the WellFish project to support the resource management of subsistence fishing communities (Coulthard et al. 2011). The WellFish project has used the WeD concept of human wellbeing to develop indicator survey instruments that excel in their ability to capture the unique character of local community social networks and to quantify subjective assessments about "what matters most" to an individual. The few alterations that the SWIMM working group have made to this definition reflect an attempt to emphasize that human well-being is not only a "state of being" but is also informed by relational processes that take place within human communities and that also exist between humans and the environment.

Another framework of human wellbeing with a strong emphasis on human connections to the environment is that of the Millennium Ecosystem Assessment (MEA). Many integrated resource management projects undertaken in the past decade have adopted the MEA's conceptual model linking human wellbeing to flows of ecosystem goods and services as well as to the supply and quality of social capital, technology and institutions. Coordinated by the United Nations Environment Programme secretariat, the objective of the MEA was "to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being" (MEA 2005, p. ii). The MEA specifically defines human wellbeing as being comprised of the following five constituents (p. v):

- "basic material for a good life, such as secure and adequate livelihoods, enough food at all times, shelter, clothing, and access to goods";
- "health, including feeling well and having a healthy physical environment, such as clean air and access to clean water";
- "good social relations, including social cohesion, mutual respect, and the ability to help others and provide for children";
- "security, including secure access to natural and other resources, personal safety, and security from natural and human-made disasters"; and
- "freedom of choice and action, including the opportunity to achieve what an individual values doing and being. Freedom of choice and action is influenced by other constituents of well-being (as well as by other factors, notably education) and is also a precondition for achieving other components of well-being, particularly with respect to equity and fairness."

The MEA's emphasis on "freedom of choice and action" stems from the penetrating influence social choice theorists such as Amartya Sen have had on welfare economics literature of the past three decades as well as on the formulation of the United Nations' current perspectives and approach to human development (Sen 1981, UNDP 1990). Here, the MEA characterizes human choice and action through the use of a state variable: "freedom". However, the process of choosing and acting in ways that will support states of wellbeing over time is also an important attribute of wellbeing. Process variables are particularly common in the health literature where health behaviors (i.e. smoking, driving under the influence of alcohol, exercising regularly) are recognized for the role they play in altering one's state of wellbeing over time.

While the MEA definition recognizes that the state of human wellbeing is intrinsically linked to flows of ecosystem services in nonlinear and often unpredictable ways, the MEA provides no normative assertion that sustainable or pro-environment choices and actions are a logical prerequisite of human wellbeing. Indeed, it is in fact the freedom to choose otherwise that is given special emphasis. While the project's stated purpose is to "enhance the conservation and sustainable use of ecosystems," human regard for the environment is not specifically required by the MEA for someone to be "well." As this study's project survey results will also demonstrate, it is not uncommon for environmental assessment projects to refrain from explicitly linking human wellbeing to an human ethic of environmental conservation or sustainability—even if these outcomes have been identified as a desired project goal or objective.

This decoupling of resource conservation from its human motivations may illustrate the reticence of many resource managers to make normative—and, therefore, potentially controversial—claims about the public interest. For future researchers, however, it is worth considering the extent to which institutional norms of this kind may promote "blind spots" in wellbeing evaluation and research. Attempts to alter, regulate and promote the private cultural values of individual citizens based on the idea that a certain belief system may contribute to or detract from a society's wellbeing can, indeed, be highly controversial. As the U.S. military or Department of State may attest, however, it is often both an explicit an implicit function of government. Human beings may not need to share the same cultural values to be well as individuals. However, societies that lack a conservation ethic may face negative impacts to societal wellbeing over the long-term. The point being made here is not that a conservation ethic must be included in any definition of social wellbeing. It is, rather, that contesting social values can and do underpin many drivers of social and environmental change and they will, inevitably, influence the ability of a community to achieve its resource management and human wellbeing goals.

2.1.1 Economic Perspectives

In a competitive world of scarce resources, economists regard economic valuation as the most tangible and immediate reflection of human need, desire and happiness. Measures of economic growth have served as dominant proxies for national well-being and welfare since the 1940s with the most frequently cited metric being: per capita gross domestic product (GDP). GDP measures the combined market value of all officially recognized goods and services produced by a country. Because GDP measures include incomes paid to non-residents of a country, however, economists often adjust this value for "net income from abroad" to derive the gross national income (GNI) of residents (Boarini, Johansson & d'Ercole 2006). According to the U.S. Census Bureau (2013) "personal or household income is generally regarded as the single best measure of the degree to which people are 'well off'". However, because the distributive equity of income is not disclosed by either GDP or GNI measures, household consumption—including goods and services received from social support institutions—has also been promoted by economists as a more suitable metric of household and per capita well-being (Stiglitz, Sen & Fitoussi 2009).

As Simon Kuznets cautioned in 1962, "distinctions must be kept in mind between quantity and quality of growth, between costs and returns, and between the short and long run. Goals for more growth should specify more growth of what and for what" (OECD 2001, p.9). Over the past fifty years, many economists have attempted to make these distinctions through the development and promotion of alternative measures of national welfare and progress. Adjusted net savings (ANS), for example, has been utilized by institutions such as the World Bank to

gauge the extent to which a nation approximates "weak" sustainability (Bolt, Matete & Clemens 2002). Based on the work of Nobel laureates Robert Solow and John Hartwick, weak sustainability is achieved through a balancing of non-renewable resource exploitation with the formation of human capital. The pursuit of weak sustainability attempts to eliminate the net opportunity costs that the use of these resources would impose on future generations by reinvesting in stocks of human competencies, knowledge and other social attributes likely to generate new forms of economic value.

Within the context of West Coast fisheries resource management, fishing industry growth and the substitutability of human and natural capital are both inherently challenged by the strong social desire to prevent a collapse of national fisheries. NOAA's annual Fisheries of the United States statistical series reports the annual economic value of commercial and recreational fishing activities. Landings, prices, fishing effort, participation rates, payroll, sales and value-added impacts are catalogued in each report covering a ten-year time frame. However, as illustrated by the intentional decapitalization of fishing fleets and many other programs designed to regulate and reduce fishing industry pressure, fisheries economists have had to regard many of these common economic data with nuance and restraint. While the sustained economic viability of fishing communities over time is an essential component of their well-being, promoting sector profitability alone is unlikely to support this goal. Consequently, developing the tools to weigh both the positive benefits and negative externalities of proposed resource use has remained both an economic and governance priority.

Economists and public policy analysts frequently use contingent valuation (CV) techniques to estimate the economic value of potential environmental damages and/or improvements (Gregory, Lichtenstein & Slovic 1993). Contingent valuation asks individuals to indicate the dollar value they would place on proposed changes to the quality, amount of, or access to unpriced goods. In 1986, a U.S. District Court of Appeals decision - *Ohio v. United States Department of the Interior* – reviewed the natural resource damage liability assessment methods associated with oil or other hazardous substance spills. The court ruling affirmed and promoted the legitimacy and use of expressed and revealed preference evaluations within natural resource damage assessments overseen by the U.S. federal government (Gregory, Lichtenstein & Slovic 1993). In the years to follow, studies undertaken to outline and quantify ecosystem contributions to human economic and social wellbeing increased substantially (Pearce 1993; De Groot 1992; Hartwick 1994; Asheim 1997; Costanza et al. 1997; Pimentel & Wilson 1997; Hamilton & Clemens 1999). Now routinely discussed in terms of ecosystem service values, contingent valuation remains a key assessment methodology for resource managers working within the nexus of human wellbeing and the environment.

2.1.2 Ecological Perspectives

McDonnell and Pickett (1990) define human ecology as "the discipline that inquires into the pattern and process of interaction of humans with their environments" (p.1233). Distinct from biological ecology, human ecology seeks to understand the complex and wholly-integrated nature of human beings within their environments (Machlis, Force & Burch 1997). Drawing insight from many different fields—geography, sociology, anthropology, economics, etc.—human ecology transcends the functionalist view of socio-ecological systems still held by many natural scientists and resource managers. No longer just the source of environmental problems, dysfunction or pressure, human beings and the natural world are recognized as being co-constituents of our physical and metaphysical realities (Alberti 2008). Humans do shape the natural world, for better and for worse, just as the environment shapes the behaviors, beliefs and

opportunities of a human future. Since the 1960s, this co-constructive or integrated conceptualization has strongly influenced many of the environmental social sciences and has informed much of the contemporary work being undertaken in the applied fields of urban design (Steiner 2004; Alberti 2008; Palazzo & Steiner 2011), the abundance of current research attempting to balance trade-offs between human development and environmental integrity (McShane et al. 2011) and in efforts to better align biological ecology concepts of vulnerability and resilience and with those of social sciences (Armitage et al. 2012)

Since the 1970s, other branches of ecology have also begun to place greater emphasis on the integrated and dynamic nature of natural systems. In the 1970s, for example, natural resource managers began to move away from traditional engineering resilience models of ecology—notably through C.S. Holling's work on multiple stability domains (Folke 2006). Engineering resilience, which assumes a single equilibrium view of nature and focuses on the rates at which ecological systems return to this state after a disturbance, strongly adhered to the methodological heritage of longitudinal data capture of static indicator sets within environmental management institutions. While these methodologies remain essential and necessary tools in the natural sciences for understanding the world, the conceptual framework for the application of indicator data has shifted significantly as natural resource ecologists also place greater emphasis on the non-linear dynamics of integrated socio-ecological systems across spatial and temporal scales (Folke 2006).

2.1.3 Psychological Perspectives

Another important way in which ecological assessments have coincided with the evaluation of human wellbeing is demonstrated through the growing attention being given to defining and measuring human place-attachment. Formal theoretical explorations of place-attachment emerged from the work of environmental psychology in the 1960s and 70s (Giuliani 2003). Typically viewed as the emotional bonds individuals and communities develop with regard to physical places, place-attachment is often cited in environmental management literature as having a role to play in motivating cooperative efforts to improve one's community, volunteerism, and social cohesion (Giuliani 2003, Manzo and Perkins 2006). As Manzo and Perkins (2006) explain, "our thoughts, feelings, and beliefs about our local community places—what psychologists call "intra-psychic" phenomena—impact our behaviors toward such places, thus influencing whether and how we might participate in local planning efforts" (p. 336). For example, natural disasters and other socio-ecological issues which force a community to vacate their place of residence are known to provoke feelings of loss and alienation similar to that experienced after the loss of a loved one (Fried 1963, Brown and Perkins 1992). These bonds may develop as a result of the contributions a physical setting makes to the material needs of an individual or social group or in developing definitions of self and community (Manzo and Perkins 2006).

Positive psychology, according to the Penn University Positive Psychology Center (2014), is "the scientific study of the strengths and virtues that enable individuals and communities to thrive. The field is founded on the belief that people want to lead meaningful and fulfilling lives, to cultivate what is best within themselves, and to enhance their experiences of love, work, and play." Martin Seligman is credited as the "father of positive psychology" while his colleague Ed Diener has been recognized within the field more specifically as "the father of happiness research". Both Seligman and Diener's work have inspired and informed many international leaders now promoting the addition of Gross National Happiness measures to the next iteration of Millennium Development Goals due for release in 2015 (Williamson 2012).

Additionally, their research has helped to identify and quantify both the heritable aspects of individual wellbeing and those—such as morale, positive affect and life satisfaction—with the potential to be increased through various forms of intervention.

The field of positive psychology has also fine-tuned many of the tools commonly used to measure and assess subjective wellbeing. Multi-item measures such as the 5-item Satisfaction With Life Scale (Diener et al. 1985; Pavot et al. 1991) and the 7-item Personal Well-being Index (Cummins et al. 2003; Lau et al. 2005) have been found to have a higher reliability than single-item measures that have appeared in some world surveys (Huppert et al. 2009). Additionally, research has shown that self-reported measures do not always elicit truthful responses from subjects. Momentary emotional states as well as long-term mood tendencies or "affect" have also been shown to color self-assessments of life satisfaction. Affect balance measures such as the PANAS (Positive Affect Negative Affect Schedule) are often used alongside other self-reported life satisfaction measures (Watson, Clark & Tellegan 1988). Other techniques used to increase the accuracy of subjective well-being assessment include the use of informant reports (where close family and friends report on a subject's moods and emotions) or the use of Day Reconstruction Methods (where subjects log their previous day activities and describe the way they remember feeling) alongside Experience Sampling Methods (where subjects respond to a beeper/pager to log current activities and emotional states) (Stone et al. 1999; Sandvik et al. 1993; Seidlitz, Wyer & Diener 1997).

The use of subjective measures help to address the common concern held by economists, behavioral scientists and other social researchers that objective measures—particularly measures of wealth—are often only weakly associated with the way people actually experience their lives (Easterlin 2001; Donavan & Halpern 2002; Helliwell 2003; Helliwell & Putnum 2005). The Easterlin Paradox is a key economic example of this concern. Easterlin's research (1974; Easterlin & Angelescu 2009) has suggested a declining marginal utility of income in relation to its ability to produce happiness. In other words, higher incomes can and do produce higher levels of life satisfaction, but only up to a certain point.

The use of subjective measures alone, however, has also faced criticism for the potential dissonance that can arise between objective quality of life measurements and an individual's own perceptions (Rapley 2003; Hatton 1998). Cummins (2001), for example, has discussed the poor correlation that can exist between an individual's physical and perceived health and has further postulated a theory of homeostatic control. This theory suggests that the World's populations have an average level of life satisfaction that varies by only about 20 percent due to biochemical controls over subjective brain states. While the homeostasis theory is far from being universally supported in the QOL literature, there is more widespread acceptance that people can and do adapt to their objective circumstances and, consequently, objective measurements of wellbeing are also needed to triangulate subjective experience (Brickman and Campbell 1971; Veenhoven 1997; Noll 2000; Berger-Schmitt & Jankowitsch 1999). As a result, in the field of well-being research, subjective and objective measures are commonly tested against one another for correlation (Smith & Clay 2010).

Figure 1, for example, uses a ranked subjective life-evaluation score developed by Gallup-Healthways (2013) as a dependent variable (y-axis) and the median household income data from the U.S. Census (2013) data as an independent variable (x-axis). Rankings in the y-axis range from the lowest score of -434 to the highest score of 0. Here the graph does demonstrate that, to some extent, as medium incomes rise, so too, do the life-evaluation rankings of Washington's congressional districts. However, with a low R^2 value of .4282 the fit between

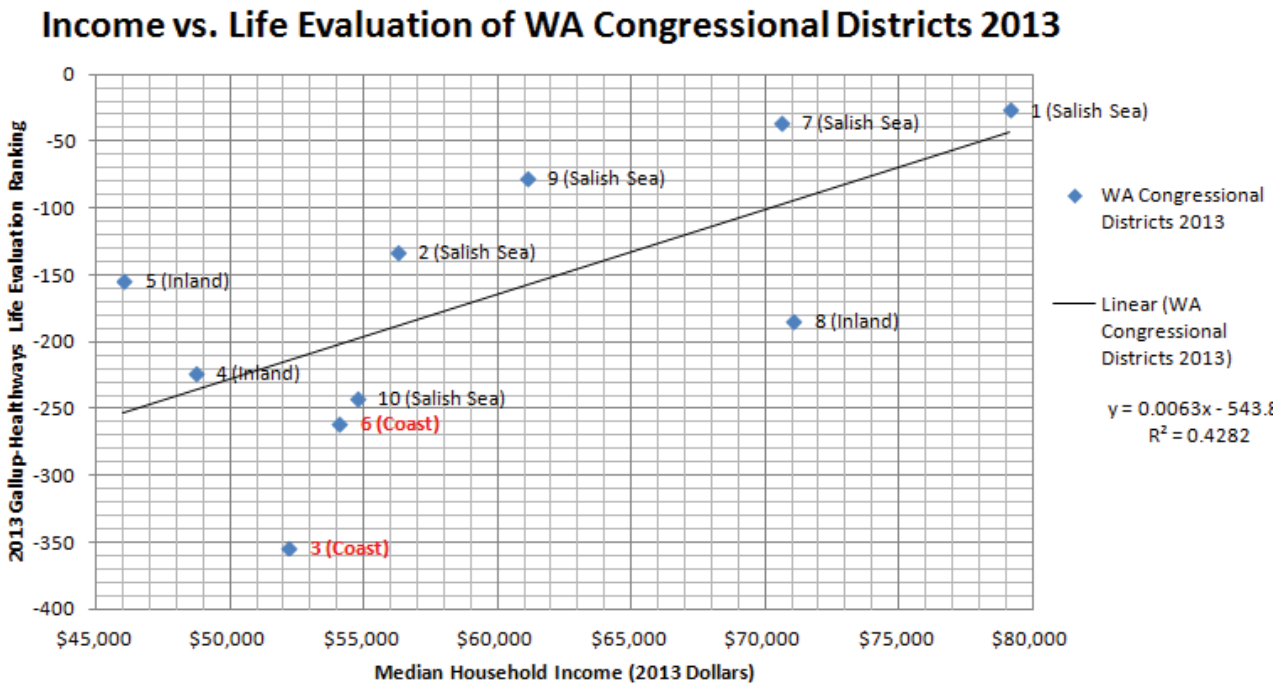


Figure 1: Income vs. Life Evaluation Ranking WA Congressional Districts 2013. Using the Gallup-Healthways (2013) data (pp. 6-7), subjective life-evaluation rankings were given for each of the 434 Congressional Districts of the 113th Congress. A ranking of 0 = highest life evaluation score. A ranking of -434 = lowest life evaluation score. These life-evaluation scores were compared with U.S. Census (2014) median household income data from the 2013 American Community Survey 1-Year Estimates. The low R^2 value of .4282 indicates an imperfect fit between the two variables. Sources: Gallup-Healthways 2013, pp. 6-7; U.S. Census Bureau 2014

these two variables is far from perfect. This is particularly true for the two congressional districts geographically situated on the outer coast of Washington (District #3 & District #6). The subjective well-being scores for these two districts are lower than the correlation model would predict given the medium household income levels. Evidence of this kind can and should encourage analysts to look more closely into the factors—beyond material wealth—that are contributing to the subjective well-being of outer coast residents.

2.1.4 Philosophical Perspectives

Philosophical perspectives on wellbeing were being developed and advanced well before Aristotle first proposed eudaemonia ("happiness" or "human flourishing") as the summum bonum ("the highest good"). Defining what wellbeing consists of and what is, ultimately, good for human beings remain fundamental questions of moral philosophy. Three categories of theory have traditionally dominated the contemporary ethics discourse surrounding wellbeing: hedonism, desire satisfaction and objective list theories. Hedonist theories equate "good" with the pursuit of pleasures/happiness. Desire satisfaction theories, however, acknowledge that not all the things we desire in life are intrinsically pleasure-producing. Objective list theories advance the idea that there is intrinsic value to be had in some things apart from either their desirability or the enjoyment they produce.

Utilitarianism is one of the major hedonic theories within normative ethics which has strongly influenced both economic and political approaches to the maximization of human

welfare. Advanced by John Stuart Mill and Jeremy Bentham, utilitarianism promotes the ethical principle of maximizing the greatest amount of happiness for the greatest number of people in society. "Happiness" in this context is generally defined in terms of "utility", the ability of something to satisfy needs and wants. Utilitarianism and its critiques place the tension that exists between the wellbeing of individuals vs. the wellbeing of larger society in high relief. Upholding the values, norms or laws of a dominant social order, for example, may come at great expense to the wellbeing in minority groups or specific individuals. Thus, recognizing and reducing the negative impacts of governance decisions requires a nuanced understanding of the complex cultural characteristics of society and deliberate definition of intended normative direction of their plans and actions. These and other philosophical perspectives on wellbeing raise important questions such as:

- Is wellbeing something people experience as being good themselves or something that society/the State believes is good for them? (Hobbes 2010; Locke 1988; Rousseau 1913)
- Does wellbeing refer only to personal self-interest or to the maximization of social benefit? (Smith 2001)
- Whose wellbeing is important? Present, past or future generations? (Mill 1969)
- Do we desire what is good, or is something good because we desire it? (Spinoza 2005)
- Does wellbeing take virtue to be the most important constituent in happiness? If so, who determines what is virtuous and why? (Aristotle & Sachs 2002)
- Does wellbeing include the exercise of compassion or other social or personal values? (Kant & Gregor 1998)

2.2 Historic use and current trends in wellbeing research for integrated resource management

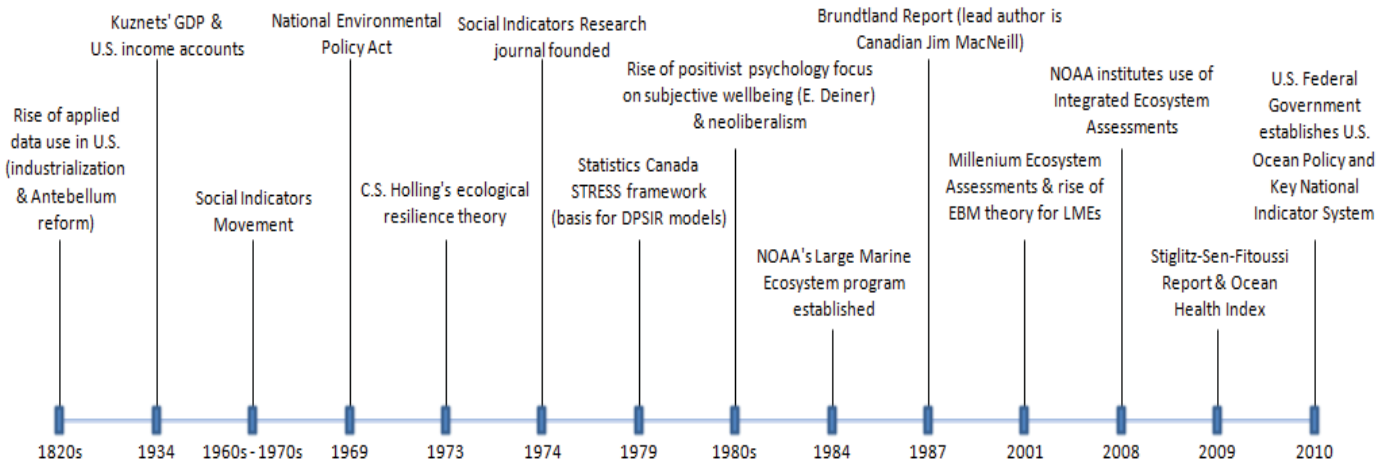


Figure 2: Timeline of Social-ecological Assessment Frameworks.
Source: Author data.

2.2.1 Origins and use of statistics to promote social welfare

As the timeline in Figure 2 illustrates, statistics have been used to promote social change in the United States since the early 19th century (Cohen 1982). In the context of antebellum reform and the industrial revolution, many of the earliest official efforts emphasized the collection of labor statistics to describe wage earnings, unemployment rates and working conditions in an effort to win or detract support for highly politicized labor policies (Leiby 1960). Emerging from these controversial origins, the desire to promote statistical data as a neutrally objective guide to complex and controversial decision-making—as well as the numerous critiques to this claim—have made the pseudo-objective nature of indicator data a persistent narrative over the past two centuries (Cobb & Rixford 1998). Amid this debate, surveys to describe a wide variety of social phenomena—such as education, crime, or public health—have nevertheless been a staple methodological tool used by community civic groups since the early 20th century in their attempts to increase issue awareness, prevent disease and mobilize community action (Smith 1991).

2.2.2 The rise & response to economic indicator dominance

The inability of descriptive indicator data alone to end social crisis was felt deeply during the U.S. economic depression and war era of the 1930s and 40s. The early positivist approach to characterizing the business cycle provided policymakers with a wealth of data but offered too little guidance on how to meaningfully apply these observations. As a result, the positivist approach soon gave way to more normative, prescriptive and predictive use of economic indicator as efforts to predict, preempt and deter economic downturns increased. With the perceived success of these prescriptive efforts by policymakers, the increasingly sophisticated use of economic indicators to inform decision-making gained prominence within governance institutions.

The most influential of these applied indicators—Gross Domestic Product (GDP)—was derived from Simon Kuznet's gross national product accounts introduced as a measure of the nation's wartime production capacity during WWII (Talberth et al. 2007; Cobb et al. 1995) Never intended by its creator to serve as the fundamental barometer of the country's economic health and wellbeing (Talberth et al. 2007; Kuznets, 1934), GDP has nevertheless become a touchstone for the persuasive power of econometrics in contemporary decision analysis and the dominate proxy used to describe human wellbeing around the globe. Why economic indicators, and GDP specifically, continue to displace other forms of data and social analysis—wisely or not—remains a topic of lengthy consideration by scholars (Scott 2012; Sen 1999; Stiglitz, Sen & Fitoussi 2009; Rapley 2003). However, amidst these discussions, it remains difficult to ignore the political expediency and attractiveness of market-based economic theory; a perspective that suggests social welfare maximization will be increased by those doing less to regulate economic enterprise and which, in addition, places the burden of both defining and maximizing what is "good" on the individual.

Indeed, the political rhetoric of market-based economics, the promotion of subjective indicators at the level of the individual, and the displacement of the broader social indicator movement are all historically synchronous with the rise of applied neoliberalism during the era of Margaret Thatcher and Ronald Reagan (Scott 2012; Rapley 2003; Noll 2000). President Reagan's Executive Order 12291—which explicitly requires federal decision-makers to consider the economic benefits and costs of all major regulatory acts—also served to institutionalize the

federal use of economic data, theory and tools within federal decision-making bodies (Callan & Thomas 2000).

However, the widespread adoption and use of economic indicators in decision-making practice has not resolved the many perceived limitations of these devices—or their theoretical foundations—to address numerous socioeconomic and environmental concerns. Indeed, the persistence and, in some instances, the aggravation of these concerns were what initially provoked the momentous new wave of data capture and assessment during the social indicator movement of the 1960s and 70s. During this time, quality of life research became increasingly professionalized as demonstrated, here, by the founding of one the field's leading journals, *Social Indicators Research* in 1974. It was also during this era that some of the United State's most eminent environmental laws—such as the National Environmental Policy Act of 1969—were originally created and implemented by Congress. All of these efforts, in turn, helped to galvanize new groundswells in both national and international environmental sustainability concepts and provided the context necessary to establish the U.S. Environmental Protection Agency (EPA) and the Council on Environmental Quality (CEQ) in the early 1980s (Cobb & Rixford 1998; Wilcox et al. 1972; Gilmartin et al. 1979). As evidenced by the publication of the CEQ's first Environmental Trends report in 1970, these institutions assumed responsibility for the collection and applied use of environmental indicator data that had, until that time, remained largely external to the focus and consideration of existing government agencies.

With the publication of the Brundtland Report in 1987, the international stage was also set for the succession of global sustainability conferences that were to unfold in the 1990s (WCED 1987). It was at this time and in these international forums where the use of predictive frameworks—such as the Drivers-Pressures-State Changes-Impacts-Responses (DPSIR) model—were elevated as a means for the international community to better understand the future outcomes of current social and environmental trends (Cobb & Rixford 1998; WCED 1987; Bowen & Riley 2003). With Jim MacNeill serving as the lead author for the Brundtland Report and Director of Environment for the Organization for Economic Cooperation and Development (OECD) from 1978-1984, it is perhaps to be expected that the indicator framework which has since become such an institution in worldwide environmental assessment also has Canadian origins. Inspired by the Stress Response Environmental Statistical (STRESS) framework created by Anthony Friend and David Rapport from Statistics Canada, the OECD's adaptation and use of the framework has significantly impacted how environmental statisticians around the world continue to think about and use environmental indicator data (Hák, Moldan and Dahl 2007, p. 129).

2.2.3 The MEA & recent calls for new econometric models

Internationally, ecological resilience concepts have been strongly promoted throughout the past decade by the United Nations Environment Programme's (UNEP) Millennium Ecosystem Assessment (MEA) initiative, launched in 2001 (Folke et al. 2002). The MEA's approach—emphasizing dynamic ecosystem service linkages between humans and the environment—has catalyzed more than a decade of regional analyses and engaged hundreds of scientists worldwide in attempts to better understand the relationships between ecosystem services, human wellbeing and the health of the environment (MEA 2005).

However, it is notable--particularly considering the MEA's own emphasis on the need for indicators—that no global long-term monitoring program or specific suite of socio-ecological evaluation metrics was officially adopted to guide future research. This omission was highlighted by the United Kingdom Environmental Audit Committee (UKEAC) report which further

expressed the point of view that "the logical conclusion of research to value ecosystem services and to identify those factors that actually improve human wellbeing, will be the development of an econometric that measures growth in a way that recognizes environmental limits and more accurately describes human wellbeing" (UKEAC 2007, p. 5). Indeed, the UKEAC desire for more holistic measures of growth has been shared and taken up by a number of European Union policy-makers and economists in recent years through notable efforts to better align EU econometric analyses with sustainability concepts.

As traditional economic indicators have proven unreliable in their ability to offer sufficient policy guidance for sustainable human development within the context of increasingly complex, volatile and globalized markets, the full complexity of human wellbeing concepts has once again received high-level attention by prominent leaders and researchers. Two notable efforts to redefine the scope of EU econometrics were launched in 2007 and 2008 respectively. The Beyond GDP initiative of the European Commission and the work of the Commission on the Measurement of Economic Performance and Social Progress (CMEPSP) convened by the French government have both elevated the moral, theoretical and political discourse surrounding the institutionalized use of indicators and measurements of wellbeing to the highest levels of government.

The Commission—chaired by Nobel laureate Professor Joseph E. Stiglitz of Columbia University and advised by Nobel laureate Professor Amartya Sen of Harvard University—published the Report by the Commission on the Measurement of Economic Performance and Social Progress in 2009. Commonly referred to as the "Stiglitz-Sen-Fitoussi Report", this document refines concepts (particularly those developed by its Nobel prize-winning authors) which have occupied the forefront of welfare economics and the human development fields over the past fifty years. Sen's development as freedom concept and capabilities framework, in particular, have shaped the normative direction of development outcomes for many of the current practitioners within the contemporary fields of welfare economics and international development. For example, they were a significant inspiration for Mahbub ul Haq's 1990 efforts to devise the United Nations Human Development Index (HDI) in an effort "to shift the focus of development economics from national income accounting to people-centered policies" (ul Haq 1995; Sen 1999; Robeyns 2011). These ideas—emphasizing the freedom individuals possess to become and do the things that they, personally, have reason to value—now serve as the foundation for a highly interdisciplinary social science literature linking the human development and wellbeing discourses to public policy.

2.3 The evolving management framework for Large Marine Ecosystems

In 1992 the United Nations Conference on Environment and Development (Earth Summit) established 64 geographically specific areas labeled Large Marine Ecosystems (LMEs) in an attempt to "delineate specific areas in which to apply ecosystem-based management approaches to environmental issues" which are often "multi-national in scale" (Hennessey & Sutinen, 2005 p. 19). Since this time, NOAA's Integrated Ecosystem Assessment team for the California Current System has become one of many natural resource management groups worldwide attempting to integrate human dimensions research within each LME's unique cross-scale, cross-temporal and trans-boundary environmental management context.

The integrated ecosystem assessment (IEA) approach is defined by Levin et al. (2009) as "a formal synthesis and quantitative analysis of information on relevant natural and social-ecological factors, in relation to specified ecosystem management objectives" (p. ix). NOAA's IEA framework—which uses the DPSIR indicator framework for the classification of indicator

sets—has become an eminent analysis methodology used by U.S. marine resource managers in complex multi-scale and multi-sector decision-making (Foley et al. 2013). The IEA framework's five-step process consists of: (1) scoping or describing the socio-ecological system to be managed and identification of management goals (2) identification of indicators or reference levels for ecosystem attributes of management interest, (3) linkage of indicators and threats through risk analysis, (4) evaluation of management strategy options through the use of modeling, and (5) tracking indicators to assess and evaluate change. These five steps rationally operationalize the need for leaders to audit progress toward national policy goals and bolster high-level political decisions with what have now become customary metric outputs vetted through reputable knowledge systems.

According to Malone (2009), however, much of the current research on ecosystem vulnerability, resilience and adaptive capacity use frameworks that emphasize the highly dynamic linkages that exist between biophysical states and the socioeconomic factors that mitigate or amplify environmental change. This is an analytical approach that is substantially different from those of static impact assessments models—such as DPSIR, as originally conceived—that seek to project the future outcome of environmental trends using current socio-economic conditions (Malone 2009). These differences have given rise to criticism of the widely used DPSIR model in recent years which many view as incapable of accounting for the full complexity of non-linear socio-ecological systems and for promoting a hegemonic discourse that inherently limits the range of social issues which can be debated and the form management interventions which can take place within an environmental resource management context (Tscherning et al. 2012; Svarstad et al. 2008; Atkins et al. 2011; Berger & Hodge 1998; Rapport et al. 1998; Rekolainen et al. 2003; Niemeijer & de Groot 2008; Carr et al. 2007). However, many recent attempts to rework the DPSIR to account for these criticisms have been undertaken or are now currently underway (Curtin & Prellezo 2010; Ness et al. 2010; Atkins et al. 2011; Kelble et al. 2013).

Particularly relevant to the discussion of the DPSIR framework in the context of marine ecosystem management are the changes made in 2010-2011 to the United Nations Environmental Programme's (UNEPs) methodology for the assessment of large marine ecosystems (LMEs). Both the Global Environmental Fund's (GEFs) LME initiative and UNEP's Regional Seas Programme have been instrumental in initiating large trans-boundary ecosystem governance efforts worldwide for the past two decades. Much of the methodology that has been promoted through these UN programs over the years—including the DPSIR model, and Sutinen et al.'s (2000) modular framework for LME socioeconomic and governance assessment—trace their origins to work initially produced for NOAA's LME Program established in 1984. However, following the Open Oceans and Large Marine Ecosystems working group discussions held at UNESCO in February 2010, the UNEP published a new conceptual framework described as an attempt to "to merge several existing conceptual frameworks: the Driver-Pressure-State-Impact-Response (DPSIR) framework, indicator science, an emerging focus on ecosystem services, and cumulative impact modeling, all with a strong focus on governance and socioeconomics—on how to manage the human-natural system" (IOC-UNESCO 2011).

While UNEP's new model begins to acknowledge human beings as more than just a driver of the changes in ecosystem health, integrated management requires more sophisticated assessments of the ways ecosystems are linked to human society and how human societies, in turn, shape the wellbeing of individuals. Tracing, for example, the food web dynamics of a fishery all the way back to the personal motivations which inspire an individual to harvest fish,

may seem off-topic for fishery population biologists. However, to promote effective and sustainable human interactions with natural resources, decision-makers must engage directly with the personal motivations and needs that compel human behavior. Current DPSIR models do not ignore the human system. However, the current social and human characteristics of these models are rarely as well-defined as their natural counterparts.

New models must begin recognizing the degree to which performance metrics address the wellbeing of aggregated social groups vs. the wellbeing of specific individuals within focal communities (Figure 3). The wellbeing of an entire community may not always be sufficiently described by the constituent elements of individual wellbeing. Community characteristics—such as the distributional equity of resources between individuals or groups, levels of social conflict, or the pressures placed on community institutions due to long-term demographic change—also have drivers, pressures, states, impacts and social responses that influence both the individual and environmental components of a system. Theoretical disaggregation of social, individual and environmental DPSIR components of a system and a more nuanced understanding of how the three components overlap will help provide a clearer picture of the tools needed to achieve policy objectives over time.

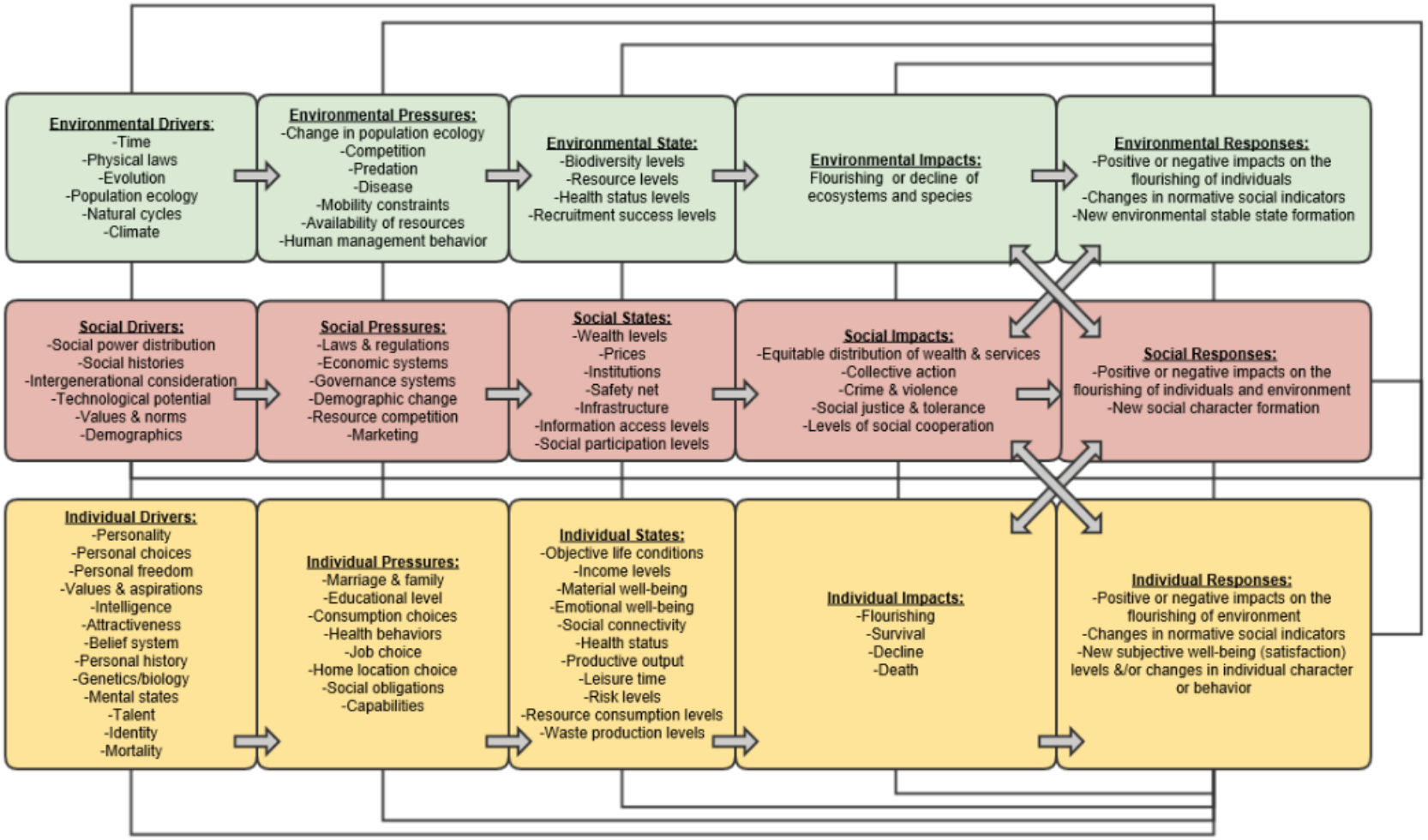


Figure 3: A Social-ecological System Indicator Framework. This new DPSIR-adapted framework is an attempt to focus greater attention on the social components of a social-ecological system and distinguishes between the factors that contribute to the health and wellbeing of an individual person vs. those that contribute to the health and wellbeing of larger social groups.
Source: Author data.

3 Methodology

The recommendations made in the final chapters of this thesis are based on the literature reviewed in Chapter 2 as well as the best practices and specific management context revealed by the following two analyses:

- A survey of recent human wellbeing assessment projects to identify best practices, focal domains of human wellbeing and common assessment methods.
- A case study of the Pacific Fishery Management Council's current use of human wellbeing indicators and socioeconomic data.

3.1 Project Survey Method

The project survey was undertaken to compare and contrast the analytical methods, theoretical frameworks and focal areas of wellbeing commonly used by researchers, resource managers and policymakers in socio-ecological system assessment. A large sample of 175 candidate social indicator projects was identified through a human wellbeing literature review, the SWIMM working group expert selection process, and a review of current and historic projects affiliated with both NOAA and other large international ecosystem governance institutions.

3.1.1 Project Selection Criteria

The large project sample was screened using six selection criteria (Table 1). The screening produced 52 projects (Table 2 & Appendix C) which were selected for in-depth review.

Table 1: Human wellbeing project screening criteria

The project assesses human or social conditions of some kind (whether economic, human wellbeing, health, etc.) using indicators or another systematic, specified method.
The project considers environmental conditions and/or environmental or natural resource management conditions as influencing variables.
The project has been applied to a real-world context and is not just theoretical
The project's process and results are well-documented
The project has been evaluated in some way (reviews may take the form of peer-reviewed literature publication, stakeholder involvement and feedback, expert evaluation reports, etc.)
The project has a relatively high profile, with influence on related efforts – e.g. indicated by its presence in the media or literature; geographic scope; funding level; etc.

Each project's peer-reviewed literature, reports and public media were reviewed for insight into project design, methodologies, human wellbeing definitions, human wellbeing domain selection, use of participatory processes, project mandates and other best practices (Appendix C). As common themes emerged, projects were iteratively revisited to document the presence/absence of shared theories, methods, and the attention given to particular human wellbeing focal components (ex: health, security, governance). The indicators used in each project were also identified and coded against a comprehensive list of human wellbeing domains and subdomains originally produced by Dr. Sara Breslow and Raz Barnea of the SWIMM

research team during their initial literature, law and policy review (Table 4). If indicators found in the projects did not correspond well with the initial wellbeing domain categories, the addition of new domains or sub-domains was permitted. However, in practice, all project indicators identified were measures that could fall under one or more of the originally identified categories, with some adjustment to the subdomain definition (for example: augmenting the "education" subdomain to incorporate the concept of "access to information").

To ensure consistent understanding and use of the wellbeing categories, the research team discussed each of the domains at length and collaborated to produce a written codebook of domain and subdomain definitions (Appendix D). In addition, the inter-coder consistency of the team was tested using Cronbach's Alpha to help ensure the internal validity of the data. Using the common coding for three policy documents, $\alpha =$ 0.62769 for the coding of wellbeing domains and $\alpha =$ 0.75769434 for the coding of human wellbeing sub-domains.

No weighting of any kind was used to quantify the emphasis a project placed on any one human wellbeing domain focal area. A project that weighted one human wellbeing domain area highly or used multiple indicators to describe a particular focal component received the same presence/absence notation as a project that used only one unweighted measure. This decision was intended to reduce the complexity of comparing projects with highly variable and inconsistent methodologies.

Project indicators were, however, frequently coded to more than one human wellbeing category in an attempt to address the lack of consistent human wellbeing domain definitions that exist between projects. For example, if no specific domain was assigned to a measure of crime incidence or incarceration broken down by age and ethnic categories, this indicator may have been coded to the subdomains of "security", "equity", "social justice" and "community integrity" based on the way these indicators had been used in other projects or based on expert opinion taken from the literature or SWIMM working group discussions. Because indicators may have been assigned to more than one category—particularly more than one subdomain category—this method is inherently subject to double-counting and overstated evidence concerns. The higher-order domain analysis contains fewer instances of code co-occurence than the subdomain analysis. However, code co-occurrences are not entirely absent at this level of analysis.

Projects were placed in categories (Table 2) based on the project's geography (North America, United States, other), the scale of the assessment (international, national, sub-national), the type of management or governance body completing the assessment (federal government, NOAA, indigenous groups, other), and the type of management framework which produced the project (environmental resource management, production of national wellbeing account statistics, sustainable development). Categorical count and percent calculations of the coded data were then produced and graphed using Excel to compare and contrast assessment methods and the use of wellbeing domains/subdomains.

3.1.2 Project category assignments

Table 2: Project Survey Categories. The project category assignments below were used in the project survey assessment figures that appear throughout this document.

NA = North American
IN = Indigenous
NT = National Project
FR = U.S. Federal Resource Mgmt
NOAA = NOAA Project
EM = Enviro. Mgmt Project
NS = National Scale
IS = International Scale

Project	Administrative Organization(s)	NA	IN	NT	FR	NOAA	EM	SD	NS	IS
Swinomish Indigenous Health Indicators	Swinomish Indian Tribal Community	x	x							
First Nations Health Indicators Toolkit	Canadian Institutes of Health Research (CIHR), Saskatchewan Health Research Foundation (SHRF) and Northern Medical Services at the University of Saskatchewan	x	x							
Canadian Index of Wellbeing	University of Waterloo, Faculty of Applied Health Sciences	x		x						x
The State of the USA	The State of the USA (Nonprofit)	x		x						x
Community Profiles for West Coast Fishing Community	NOAA NMFS-NWFSC	x			x	x	x		x	x
Improving Community Profiles for the North Pacific Fisheries	NOAA Alaska Fisheries Sciences Center	x			x	x	x			
Large Marine Ecosystems (NOAA; UNEP/RS; GEF)	NOAA, GEF, UNEP, UNDP, World Bank, NEMFS, University of Rhode Island	x			x	x			x	x
Evaluating Changes in Health and Well-being in Communities Affected by the Deepwater Horizon Disaster	NOAA	x			x	x				
Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. Southeast and Northeast Regions	NOAA	x			x	x				
Fisheries Social Impact Assessment Model (Pollnac et al.)	NOAA Office of Science & Technology; NOAA NEFSC; University of Rhode Island; Oregon State University; University of Washington	x			x	x				
Measuring the social and economic performance of catch share programs: definition of metrics and application to the U.S. Northeast Region groundfish fishery	NOAA NEFSC	x			x	x				
Marine and Estuarine Goal Setting for South Florida (MARES) - Noneconomic Indicators	MARES	x			x	x				
Socioeconomic Profiles of Fishers, their Communities and their Responses to Marine Protective Measures in Puerto Rico	NOAA SEFSC	x			x	x				
Nova Scotia GPI Fisheries & Marine Environment Accounts	GPI Atlantic	x					x	x		
Community Foundations of Canada Vital Signs/Toronto Vital Signs	Community Foundations of Canada	x						x	x	x
Sustainable Neighborhoods for Happiness	University of Georgia, Cornell University	x						x		

Te Kupenga Maori Wellbeing Survey	Statistics New Zealand		x	x						x
SARD Cultural Indicators of Indigenous Peoples' food and agro-ecological systems	FAO, International Indian Treaty Council (IITC), Government of Norway and, indirectly, Christensen Fund		x				x	x	x	x
UN Permanent Forum on Indigenous Issues	The International Indigenous Forum on Biodiversity (IIFB) established a Working Group on Indicators to contribute to the efforts to develop indicators relevant to indigenous peoples and the CBD. The United Nations Permanent Forum on Indigenous Issues (UNPFII) also began working on this issue due to lack of indigenous representation related to the Millennium Development Goals.		x						x	x
Arctic Social Indicators Project	Initiated by the Stefansson Arctic Institute, Akureyri, Iceland, the ASI project in its first phase (2006-2009) was an international Polar Year project and was endorsed by the Arctic Council. It grew organically from the Arctic Human Development Report.	x	x						x	
Voices From The Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion	Undertaken by two non-governmental organizations and the community government of Sanikiluaq. The tiny Inuit community of Sanikiluaq on Belcher Islands took the lead to organize a project involving 28 Inuit and Cree communities around Hudson Bay. Carried out in 1992-95, the project aimed to build an integrated regional-scale picture of environmental change from the point of view of aboriginal people, drawing upon the day-to-day and year-to-year observations of hunters and fishers.	x	x							
Social Indicators Study of Alaskan Coastal Villages	U.S. Minerals Management Service	x	x							
West Coast Vancouver Island Coastal Strategy & Integrated Ocean Management Plan	West Coast Aquatic	x	x							
Indigenous Relational Wellbeing Index	Washington State University, University of Hawaii, Norwegian Centre for Violence and Traumatic Stress Studies		x							
Sustainability Monitor of the Netherlands	Statistics Netherlands			x				x		x
European Social Survey Round 3 Wellbeing Module	European Social Survey			x					x	x
Gallup Healthways Well-Being Index	Healthways			x					x	x
Measures of Australian Progress (MAP)	Australian Bureau of Statistics			x						x
UK Measuring National Well-being Programme	UK Office for National Statistics			x						x
Commission on the Measurement of Economic Performance and Social Progress	Commission on the Measurement of Economic Performance and Social Progress (Govt. of France)			x						x
Bhutan's Gross National Happiness Project	The Centre for Bhutan Studies			x						x
Hong Kong Quality of Life Index	The Chinese University of Hong Kong			x						x
Thailand Green & Happiness Index	National Economic and Social Development Committee			x						x

EPA Human Wellbeing Index	U.S. Environmental Protection Agency (EPA), Office of Research and Development (ORD), National Health and Environmental Effects Research Laboratory (NHEERL), Gulf Ecology Division (GED).				x		x			x
Integrating Watershed & Coastal Areas Management in Caribbean Small Island Developing States	Integrating Watershed and Coastal Areas Management in Caribbean Small Island Developing States (IWCAM)/Global Environmental Facility (GEF)						x	x	x	x
Millennium Ecosystem Assessment	United Nations Environmental Programme						x	x	x	x
Vital Signs (African Monitoring System)	Launched by grant from Bill & Melinda Gates Foundation to Conservation International. Led in partnership with Earth Institute at Columbia University and the Council for Scientific and Industrial Research in South Africa						x	x	x	x
Socio-economic drivers and indicators for artisan coastal fisheries in PICTs in Pacific island countries and territories	Secretariat of the Pacific Community, University of Auckland						x	x	x	x
FAO Intl Guidelines on Securing Small-Scale Fisheries/Guidelines on collection of demographic and socio-economic information on fishing communities for use in coastal and aquatic resources management	FAO						x	x	x	x
Nature Conservation and Human Well-Being in Bhutan	Royal Institute of Management, Thimphu, Bhutan; Utrecht University, Netherlands						x	x		
Transboundary Waters Assessment Programme	Global Environmental Facility; Intergovernmental Oceanographic Commission of UNESCO						x		x	x
Ocean Health Index	UC Santa Barbara's National Center for Ecological Analysis and Synthesis (NCEAS) and Conservation International						x		x	x
Wellfish/Wellbeing in Developing Countries (WeD)/Governing Small-scale Fisheries for Wellbeing and Resilience	Northumbria University; Ruhuna University, Sri Lanka; Anna University, India; Canadian International Development Agency						x			
Developing Human Wellbeing Indicators for the Hood Canal Watershed	Puget Sound Institute; Stanford University; Puget Sound Coordinating Council						x			
Evaluating Social and Ecological Vulnerability of Coral Reef Fisheries to Climate Change	Australian Research Council Centre of Excellence for Coral Reef Studies Kenyan Reef						x			
Selecting Indicators to Protect and Sustain Experiences in the Eastern Arctic of Nunavut	Aldo Leopold Wilderness Research Institute, USDA Forest Service;						x			
Sustainable Consumption & Production Indicators for Developing Countries	United Nations Environmental Programme							x	x	x
SUSTAIN Partnership	European Regional Development Fund: http://www.sustain-eu.net/what_are_we_doing/sustain_indicator_set.pdf							x	x	x
UNDESA Indicators of Sustainable Development	Department of Economic and Social Affairs of the United Nations Secretariat							x	x	x
Social and Cultural Sustainability: Criteria, Indicators, Verifier Variables for Measurement and Maps for Visualization to Support Planning	Sustainable Bergslagen Model Forest Network							x		x

3.2 Pacific Fishery Management Council Case Study Method

A case study method was selected to analyze the Pacific Fishery Management Council's use of socio-economic indicators. This research endeavored to answer the questions "what socio-economic indicators are being used by members of the PFMC to make fishery management decisions?" and "why have these indicators been used?".

According to Robert Yin (2003) a case study method is appropriate when 1) you are unable to manipulate the behavior of those involved in the study, 2) contextual conditions are believed to be important and 3) the boundaries between a phenomenon and its context are unclear. In a descriptive case study information is collected without any experimentation or manipulation of the environment. Often called an "observational study", these assessments aid researchers in identifying specific relationships, behaviors, attitudes or other characteristics unique to a group, institution or situation. Descriptive case studies are often undertaken to assist in the identification of the critical variables for future experimental research. Descriptive analyses do not allow researchers to make predictions or to identify causal relationships. However, because the purpose of this analysis was only to identify what and why something has happened in the past – not to predict future behavior - a case study was selected as a valid and appropriate analytical method.

3.2.1 Unit of Analysis & Case Boundaries

The study began with an investigation of references to and use of socio-economic indicators in Pacific Fishery Management Council Briefing Books between March 2012 and September 2014. To manage the scope of case study analyses, Stake (1995) has recommended the specific use of time and activity boundaries. While it is impossible to identify and review all the sources of socio-economic information likely to influence the decision-making of PFMC members, the briefing books do represent the official data of record for council deliberation and decision-making. Briefing books contain the agenda item synopses, reports and written public comments used to facilitate PFMC meetings. This places an activity boundary around the consumption and current use of fishery-related information used by Council members. In addition to an activity boundary, this study has also identified a specific timeframe for the briefing book analysis: March 2012 – September 2014. This time frame allows the briefing books to be reviewed through the theoretical lens of integrated ecosystem-based resource management which has gained traction in both the PFMC and NOAA-NMFS over the past five years (Levin et al. 2008; Fluharty 2012). The PFMC appointed their first Ecosystem-Based Fishery Management Plan Development Team and an Ecosystem Advisory Subpanel in September of 2009. However, the first briefing book to report on the work and recommendations of these groups was in September 2010. Based on these factors, it was decided to concentrate on the most recent briefing books (2014) and work backward toward this September 2010 starting line as time permitted. As the scope of work and challenges of data acquisition for earlier dates became clearer, a decision was quickly made to limit this review to the three most recent years: March 2012 - September 2014.

3.2.2 Document Coding with Atlas.ti

Unlike earlier years, the 2012-2014 briefing books are all readily accessible as PDF Portfolios on the PFMC website: (http://www.pcouncil.org/resources/archives/briefing-books). These thirteen portfolios were downloaded and converted to single file PDFs . All together, this document sample comprised 40,954 pages of text, not including the password protected documents which required separate review. In order to assist in the evaluation of such large

files, Atlas.ti 7 qualitative data analysis software was employed. Auto coding was used to identify sentences relevant to the topic of human wellbeing assessment. Auto coding was based on the following keyword queries:

Table 3: Keyword codes used for PFMC briefing book analysis

# of Quotes	Codes & Query Keywords
12	"Human wellbeing" = human wellbeing | human well-being (exact phrase)
13	"Human Dimensions" = human dimensions (exact phrase)
5,514	"Wellbeing" = well-being |wellbeing | welfare | wellness | quality of life | health*| happiness |satisfaction |life-satisfaction
1,562	"Human" = human*|man*| people
4,047	"Community" = communit* | societ*
9,661	"Socioeconomic" = soci* |*econom* |revenue|utility
1,443	"IEA" = integrated ecosystem assessment | IEA | integrated management |integrated assessment* |ecosystem-based management | EBM
3,908	"Indicator" = indicat*

To further target the areas of text most relevant to the case study questions, Atlas.ti 7 was also used to identify instances of code co-occurrence. These were places in the text where multiple codes can be found within the same sentence. This identified 280 document pages which then became the concentrated focus of the briefing book analysis.

3.2.3 Document Triangulation

In addition to the briefing books, two other primary document sources were consulted for the purposes of triangulation and to gain additional perspective on the PFMC's use of social data. The PFMC's (2005) report "*Social science in the Pacific Fishery Management Council process*" clearly outlines the socio-economic indicators the Council believed to be relevant and meaningful for fisheries management decision-making at that time (prior to the adoption of the EBM/IEA Framework). A review of the briefing books released after this report's publication can, therefore, be used to identify PFMC social science research priorities that may 1) remain unmet or which 2) may have changed since the publication of the 2005 guidance document. Finally, current fishery management plans were consulted to compare the socioeconomic data in use with the Council's stated goals and objectives.

3.2.4 Case Study Propositions

The use of specific case study propositions has been suggested by Baxter and Jack (2008) as another way to appropriately limit the scope of case study investigation and analysis. In this case, the use of propositions was used primarily to identify the possible motivations for Council socio-economic data use. These propositions frame the case study's approach to answering the question "why have these indicators been used?".

- Proposition 1: The Council reviews socioeconomic data they are required by law or policy to consider.
- Proposition 2: The Council reviews socioeconomic data presented by the public and expert advisors.
- Proposition 3: The Council reviews socioeconomic data that will support them in achieving the goals and objectives of fishery management plans.

3.2.5 Research Design Validity

Like all social science research, case study designs must pass tests for construct validity, internal validity, external validity and reliability. To pass the test of construct validity, the study must correctly measure what it claims to measure. In this instance, briefing book code co-occurrences are being used to identify what socio-economic indicators are used in Council meeting documents and why these specific data are being consulted. There is, of course, an assumption being made that the information contained in the briefing books is read by council-members and that it does inform council decision-making in some way.

The ability of the study to correctly link specific indicators to a particular reason or rational for their use would, for example, be a test of the case study's internal validity. In this instance, however, no attempt is being made to establish a definite causal relationship between conditions. A general description of the overall context contributing to the inclusion (or avoidance) of certain kinds of socio-economic data in council documents is sufficient for the purpose of this analysis. The contextual issues identified and discussed in this study have emerged from both an iterative and inductive evaluation of the briefing documents quotes selected for analysis as well as from insights gleaned from a wider review of pertinent literature and policy.

Correctly identifying the extent to which a study can be generalized establishes the external validity of the design. The intent of this case study is only to provide information specific to PFMC so that researchers hoping to improve Council integration of additional social science research data will be informed of current practices. This is not to say that the socio-economic data prioritized by the Council may not be compared with other resource management organizations or human wellbeing assessment projects—indeed that is the whole point of including the project survey as part of this thesis. Comparing the PFMC's current metrics with indicators used in other human wellbeing assessment projects can and does, within the context of this study, serve as a useful gap analysis.

4 Results

4.1 Wellbeing Assessment Project Survey

The project survey identified assessment methods and wellbeing domains prioritized by different project categories. The diversity of approaches taken reinforces the need for and utility of identifying important governance priorities and social groups within a community as an early part of the indicator development process. This step is useful, not only in assessing different priorities placed on various aspects of human wellbeing, but can also offer guidance on the best methods and tools for communicating with and engaging diverse audiences.

4.1.1 Common assessment methods

A participatory process was used by 88% of the projects reviewed. Predictably, experts

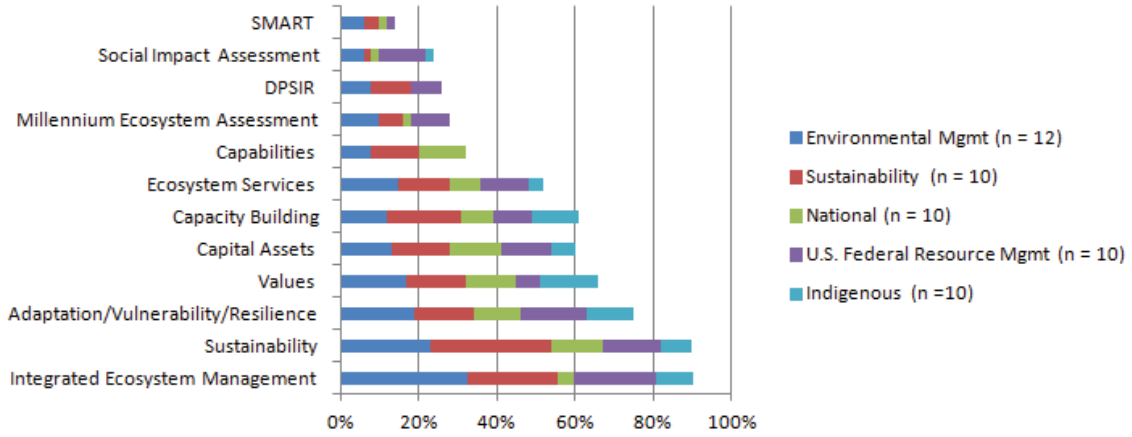


Figure 4: Theoretical frameworks referenced by projects, by project type
Source: Author data

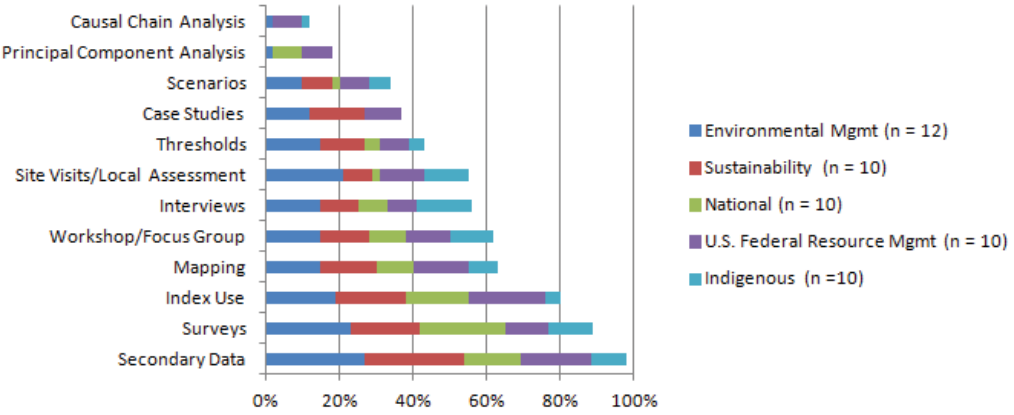


Figure 5: Methodological tools used by projects, by project type
Source: Author data

were most often (71% of projects) involved in indicator framework development and selection methodologies, often through a working group format (63% of projects). Workshops involving the general public were used by 50% of the projects. The need for indigenous participation was emphasized by 42% of the projects reviewed. 71% of reviewed projects used both objective and subjective measures of human wellbeing. Measures of both community and individual wellbeing were observed in 69% projects. However, projects varied considerably in their articulation of the underlying theory which informed and differentiated these measures and their strengths and limitations.

U.S. Federal Resource Management Projects utilized subjective measures of wellbeing in only 55% of the projects reviewed. This was less than the 79% mean use of subjective indicators observed across all project categories. The US federal projects also tended to focus more on community assessments (91%) and less on wellbeing at the level of the individual (64%) and

were more likely than average to rely on secondary data sources (91% vs. 74%). In contrast, national projects—all but one of which represents a country besides the U.S.—tended to place greater emphasis on subjective measures (100%) and the collection of primary wellbeing data via surveys at the level of the individual (100%). Projects were linked to policy goals in 60% of the projects assessed. Perhaps an indication of the international governance nature of the total project sample, the Millennium Development Goals (MDGs) were cited in 27% of all projects.

The U.S. Federal Resource Management projects surveyed here were strongly informed by ecosystem management frameworks and were more likely to employ quantitative, modeling or mapping approaches. Alternatively, the national projects have placed greater emphasis on concepts promoting citizen capabilities and sustainable development. Indigenous projects were the most likely to be framed in terms of traditional community values solicited through research using surveys, interviews or focus group discussions. These findings promote the idea that different assessment methods and analytical frames may be more meaningful to or better suited to the needs of different audiences. Unfortunately, the tools that work well within communities to assess well-being may not be the tools that work best for managers or policy-makers and analytical flexibility may be needed to navigate between these audiences.

4.1.2 Comparisons of wellbeing domain priorities

Table 4: Domain Coverage by Project Category

THEME	DOMAIN	Enviro. Mgmt Projects n=12	Sustainability Projects n=9	National Projects n=10	NOAA Projects n=10	Indigenous Projects n=10
Conditions	**Environment**	**60%**	**61%**	**33%**	**40%**	**45%**
	Enviro. Quality/Habitat Health	58%	56%	30%	20%	40%
	Infrastructure/Built Enviro./Ports/Housing/Transit	58%	56%	50%	70%	50%
	Resource Availability & Ecosystem Distributions	58%	67%	10%	50%	40%
	Pollution/Waste	67%	67%	40%	20%	50%
	Economy	**48%**	**56%**	**20%**	**58%**	**23%**
	Commerce/Industry/Trade/Revenue	67%	56%	10%	60%	10%
	Jobs/Employment	25%	56%	30%	60%	20%
	Local Economies	17%	44%	0%	40%	30%
	Material WB/Wealth/Prosperity/Mat. Security	83%	67%	40%	70%	30%
	Safety	**40%**	**34%**	**29%**	**36%**	**31%**
	Hazards Preparedness	33%	22%	10%	30%	30%
	Safety	25%	22%	10%	30%	10%
	Health	**50%**	**47%**	**35%**	**45%**	**43%**
	Emotion/Attitude/Mental Health	50%	44%	60%	40%	40%
	Food/Nutrition/Food Security	67%	44%	20%	30%	60%
	Physical Health/Mortality	50%	56%	60%	40%	50%
	Demographics	33%	44%	0%	70%	20%
Connections	**Culture**	**25%**	**26%**	**10%**	**33%**	**43%**
	Archaeological/Historic Heritage	17%	22%	0%	30%	40%
	Cultural Values/Traditions/Valued Practices	50%	44%	20%	40%	70%
	Identity	8%	11%	10%	30%	20%
	Community	**38%**	**22%**	**35%**	**30%**	**30%**
	Social Relationships	33%	44%	40%	30%	40%
	Social Capital	42%	0%	30%	30%	20%
	Tangible Connections to Nature	**38%**	**25%**	**15%**	**38%**	**43%**
	Resource Access & Utility	58%	22%	20%	70%	50%
	Access to Nature	33%	44%	10%	30%	30%

	Conservation/Stewardship/Environmentalism	8%	33%	20%	20%	50%
	Non-Consumptive Uses	50%	0%	10%	30%	40%
	Intangible Connections to Nature	**31%**	**4%**	**13%**	**13%**	**27%**
	Beauty/Aesthetics	17%	0%	0%	0%	0%
	Place Attachment/Sense of Place	33%	11%	20%	30%	40%
	Wonder/Spirituality	42%	0%	20%	10%	40%
Capabilities	**Knowledge & Technology**	**42%**	**44%**	**25%**	**25%**	**45%**
	Education/Outreach/Building Awareness/Access to Information	83%	67%	50%	40%	60%
	Science/Research/Production of Knowledge/Technology	0%	22%	0%	10%	30%
	Sense of Control	**25%**	**33%**	**33%**	**37%**	**47%**
	Agency/Self-Governance/Sovereignty	17%	11%	30%	30%	60%
	Public/Political Participation	33%	67%	40%	50%	40%
	Transparency in Government	25%	22%	30%	30%	40%
	Livelihood & Activities	**42%**	**22%**	**22%**	**36%**	**32%**
	Livelihoods	50%	11%	10%	40%	30%
	Job Quality	25%	11%	50%	30%	10%
	Personal Activities/Time Allocation	25%	44%	30%	20%	50%
	Recreation and Tourism	50%	33%	10%	60%	20%
	Subsistence	58%	11%	10%	30%	50%
	Governance & Civil Society	**25%**	**39%**	**28%**	**28%**	**33%**
	Civil Society	33%	56%	40%	40%	60%
	Conflict Reduction/Resolution	8%	0%	30%	20%	10%
	Diversity/Multiple Users	17%	33%	10%	0%	20%
	Governance/Management/Public Services	42%	67%	30%	50%	40%
Cross-Cutting	**Equity & Justice**	**33%**	**67%**	**40%**	**30%**	**30%**
	Social Justice/Equity	33%	67%	40%	30%	30%
	Certainty & Resilience	**10%**	**17%**	**18%**	**23%**	**25%**
	Community Vibrancy/Integrity/Stability/Adaptability	0%	22%	0%	20%	30%
	Certainty/Predictability/Ability to Plan Future	0%	11%	10%	10%	30%
	Resilience	17%	0%	10%	20%	20%
	Security/Peace (Safety)	25%	33%	50%	40%	20%
	Future Generations	**33%**	**61%**	**25%**	**15%**	**30%**
	Future Generations' Wellbeing/Sustainability	42%	67%	30%	10%	50%
	Energy Production & Consumption Patterns	25%	56%	20%	20%	10%
	Total average cover of all domains:	**36%**	**37%**	**25%**	**32%**	**35%**

4.1.2.1 Most frequently used wellbeing domains and subdomains of all projects

Figure 6, below identifies the domains of human wellbeing most commonly assessed by all projects in the sample (n = 51). Figure 7 ranks the subdomains in order of observation frequency. The most frequently observed aspects of human wellbeing likely to have well-validated indicators and data sets with established and financially-supported assessment programs. The aspects of human wellbeing at the lower end of the ranking, however, reveal aspects of human wellbeing likely to have received less analytical attention by resource managers, which may be more challenging to define or measure or which may simply not be priorities of the type of projects assessed. The lower-ranked areas of human wellbeing may, nonetheless, be significant contributors to the wellbeing of particular individuals or groups within a society and it is worth considering the extent to which these lower-ranking attributes might represent a gap in current management evaluations.

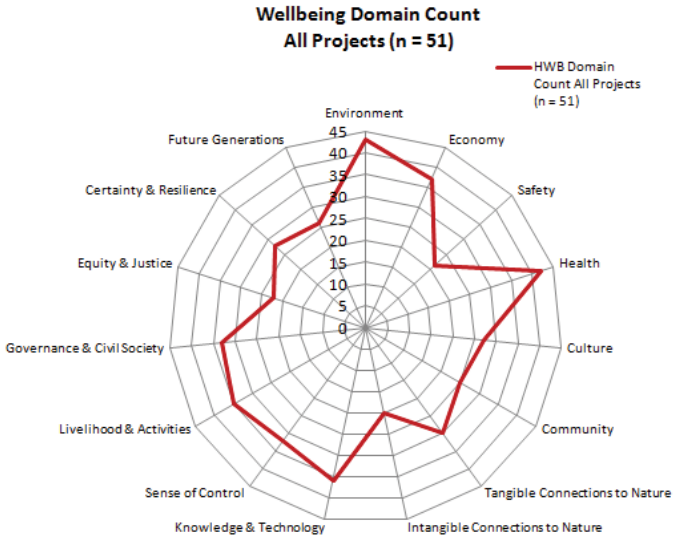
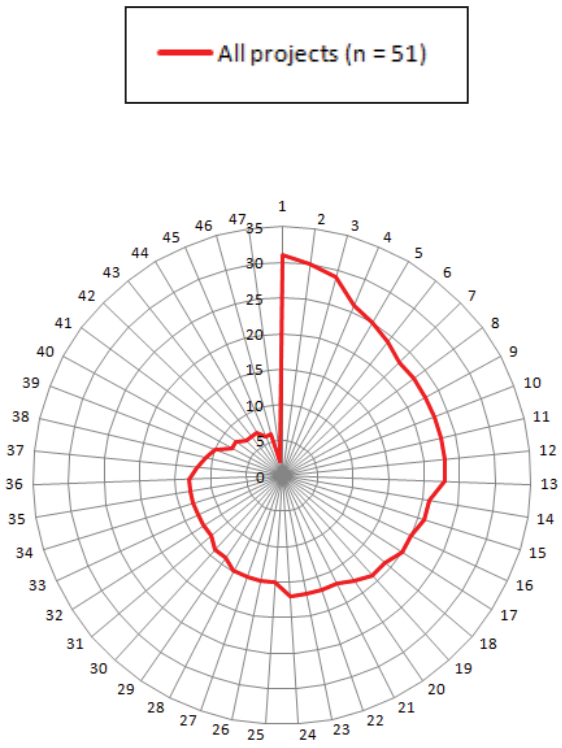


Figure 6: Count of wellbeing domains identified in project survey (n=51) .
Source: Author data



1	Education/Outreach/Building Awareness/Access to Info.
2	Material Wellbeing/Wealth/Prosperity/Material Security
3	Infrastructure/Built Environment/Ports/Housing/Transit
4	Physical Health/Mortality
5	Pollution/Waste
6	Emotion/Attitude/Mental Health
7	Food/Nutrition/Food Security
8	Public/Political Participation
9	Governance/Management/Public Services
10	Resource Availability & Ecosystem Distributions
11	Civil Society
12	Cultural Values/Traditions/Valued Practices
13	Resource Access & Utility
14	Environmental Quality/Habitat Health
15	Commerce/Industry/Trade/Revenue
16	Future Generations' Wellbeing/Sustainability
17	Social Justice/Equity
18	Social Relationships
19	Jobs/Employment
20	Recreation and Tourism
21	Security/Peace
22	Personal Activities/Time Allocation
23	Subsistence
24	Demographics
25	Access to Nature
26	Transparency in Government
27	Livelihoods
28	Agency/Self-Governance/Sovereignty
29	Place Attachment/Sense of Place/Place-Based
30	Non-Consumptive Uses
31	Energy Production & Consumption Patterns
32	Job Quality
33	Social Capital
34	Hazards Preparedness
35	Conservation/Stewardship/Environmentalism
36	Local Economies/Corp.Consolidation/Econ.Freedom
37	Wonder/Spirituality
38	Archaeological/Historic Heritage
39	Safety
40	Diversity/Multiple Users
41	Identity
42	Conflict Reduction/Resolution
43	Resilience
44	Community Vibrancy/Integrity/Stability/Adaptability
45	Science/Research/Knowledge Production/Technology
46	Certainty/Predictability/Ability to Plan Future
47	Beauty/Aesthetics

Figure 7: Count of wellbeing subdomains identified in project survey
Source: Author data

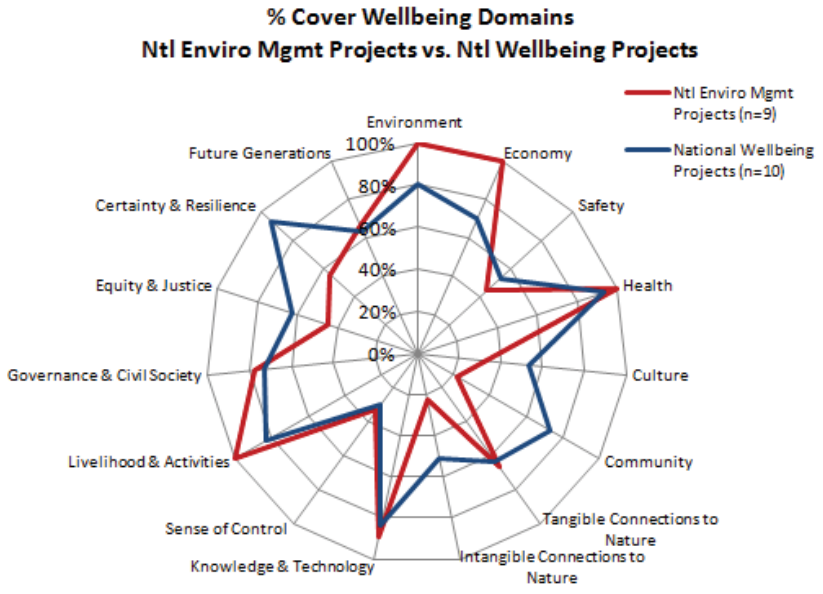


Figure 8: % cover wellbeing domains of national environmental management and national wellbeing projects Source: Author data

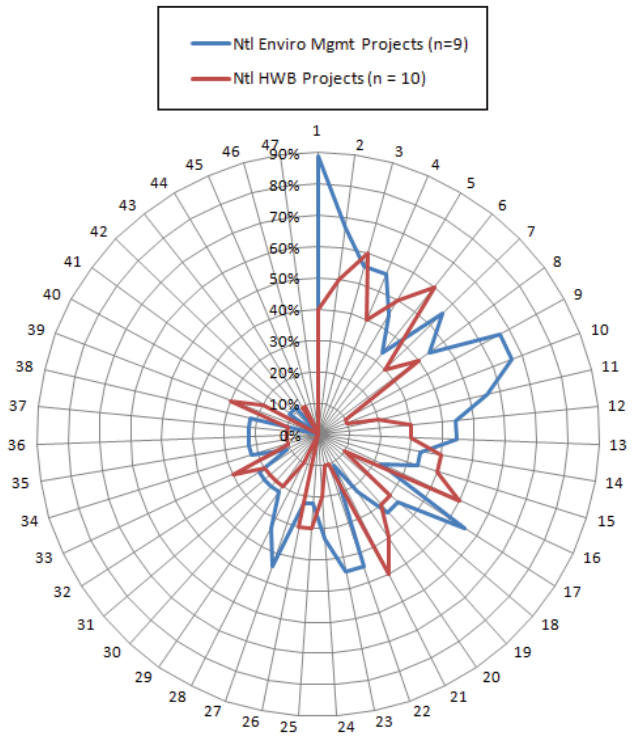


Figure 9: % cover wellbeing subdomains of national environmental management and national wellbeing projects Source: Author data

1	Material Wellbeing/Wealth/Prosperity/Material Security
2	Education/Outreach/Building Awareness/Access to Info.
3	Physical Health/Mortality
4	Pollution/Waste
5	Infrastructure/Built Environment/Ports/Housing/Transit
6	Emotion/Attitude/Mental Health
7	Environmental Quality/Habitat Health
8	Social Justice/Equity
9	Commerce/Industry/Trade/Revenue
10	Recreation and Tourism
11	Food/Nutrition/Food Security
12	Governance/Management/Public Services
13	Future Generations' Wellbeing/Sustainability
14	Social Relationships
15	Public/Political Participation
16	Security/Peace
17	Resource Availability & Ecosystem Distributions
18	Jobs/Employment
19	Social Capital
20	Civil Society
21	Job Quality
22	Hazards Preparedness
23	Non-Consumptive Uses
24	Resource Access & Utility
25	Transparency in Government
26	Personal Activities/Time Allocation
27	Demographics
28	Access to Nature
29	Cultural Values/Traditions/Valued Practices
30	Place Attachment/Sense of Place/Place-Based
31	Wonder/Spirituality
32	Energy Production & Consumption Patterns
33	Agency/Self-Governance/Sovereignty
34	Safety
35	Livelihoods
36	Subsistence
37	Diversity/Multiple Users
38	Resilience
39	Conflict Reduction/Resolution
40	Conservation/Stewardship/Environmentalism
41	Local Economies/Corp. Consolidation/Econ. Feedom
42	Archaeological/Historic Heritage
43	Beauty/Aesthetics
44	Identity
45	Certainty/Predictability/Ability to Plan Future
46	Science/Research/Knowledge Production/Technology
47	Community Vibrancy/Integrity/Stability/Adaptability

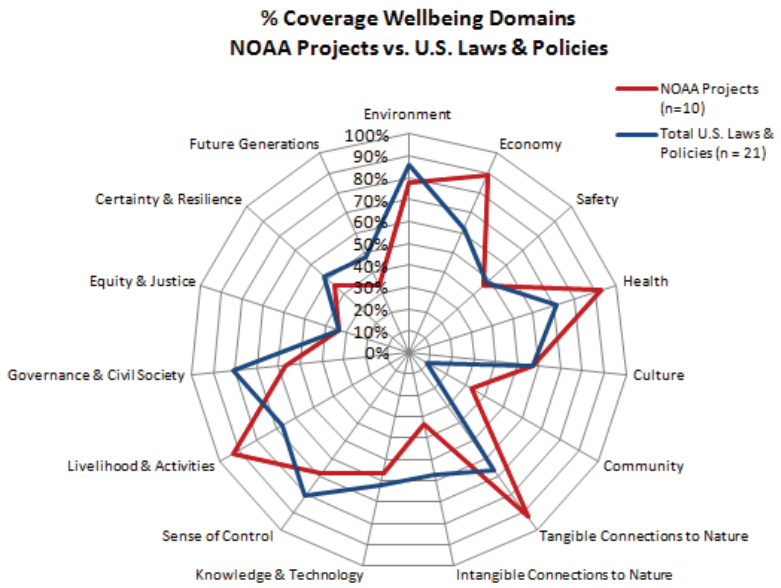


Figure 10: % cover wellbeing domains of NOAA projects vs. U.S. laws & policies
Source: Author data

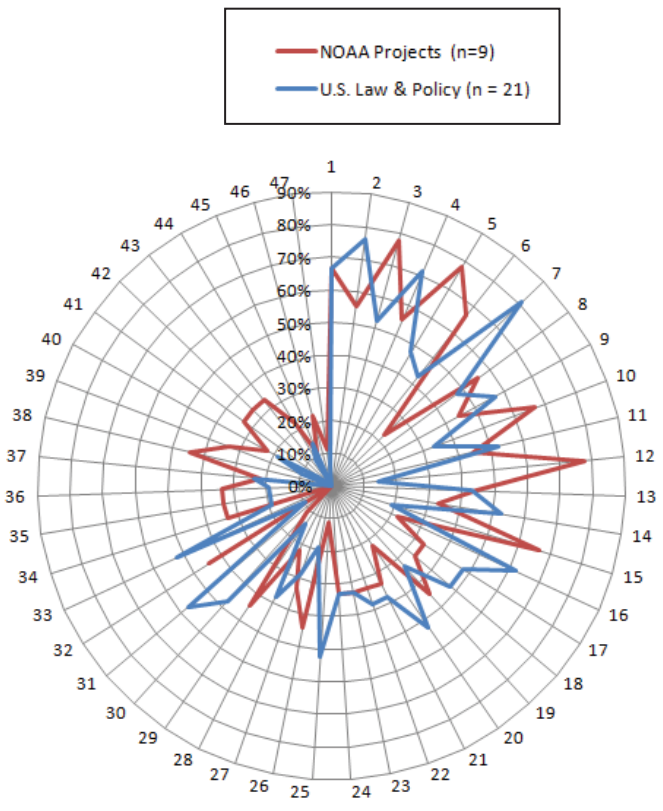


Figure 11: % cover wellbeing subdomains of NOAA projects vs. U.S. laws & policies
Source: Author data

1	Infrastructure/Built Environment/Ports/Housing/Transit
2	Public/Political Participation
3	Material Wellbeing/Wealth/Prosperity/Material Security
4	Governance/Management/Public Services
5	Resource Access & Utility
6	Recreation and Tourism
7	Environmental Quality/Habitat Health
8	Resource Availability & Ecosystem Distributions
9	Physical Health/Mortality
10	Commerce/Industry/Trade/Revenue
11	Education/Outreach/Building Awareness/Access to Info.
12	Demographics
13	Cultural Values/Traditions/Valued Practices
14	Transparency in Government
15	Jobs/Employment
16	Conservation/Stewardship/Environmentalism
17	Safety
18	Archaeological/Historic Heritage
19	Civil Society
20	Pollution/Waste
21	Food/Nutrition/Food Security
22	Access to Nature
23	Hazards Preparedness
24	Social Justice/Equity
25	Science/Research/Knowledge Production/Technology
26	Security/Peace
27	Agency/Self-Governance/Sovereignty
28	Conflict Reduction/Resolution
29	Local Economies/Corp. Consolidation/Econ.Freedom
30	Future Generations' Wellbeing/Sustainability
31	Diversity/Multiple Users
32	Livelihoods
33	Beauty/Aesthetics
34	Non-Consumptive Uses
35	Place Attachment/Sense of Place/Place-Based
36	Subsistence
37	Community Vibrancy/Integrity/Stability/Adaptability
38	Emotion/Attitude/Mental Health
39	Social Capital
40	Resilience
41	Identity
42	Social Relationships
43	Job Quality
44	Personal Activities/Time Allocation
45	Certainty/Predictability/Ability to Plan Future
46	Energy Production & Consumption Patterns
47	Wonder/Spirituality

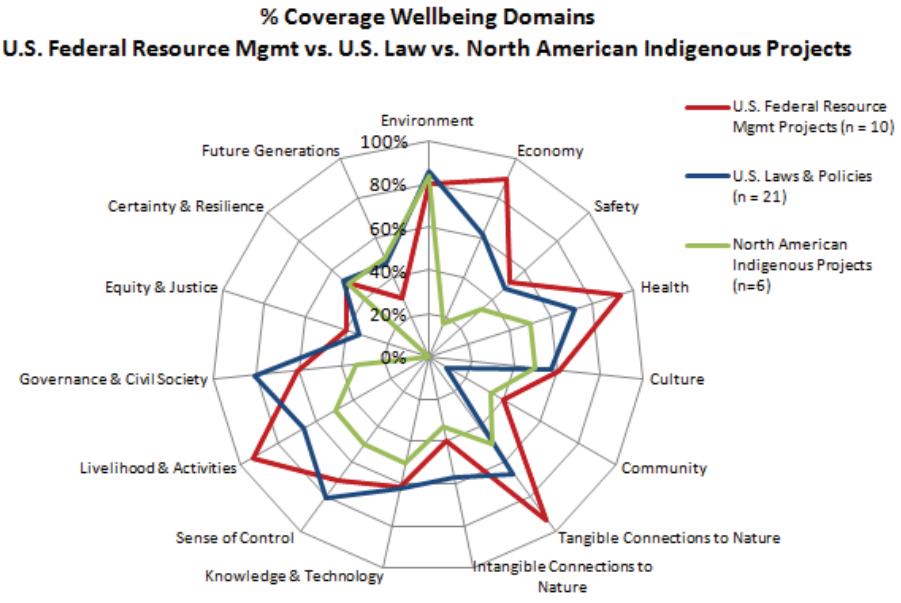


Figure 12: % cover wellbeing domains of U.S. federal resource mgmt projects, U.S. laws & policies & North American indigenous projects Source: Author data

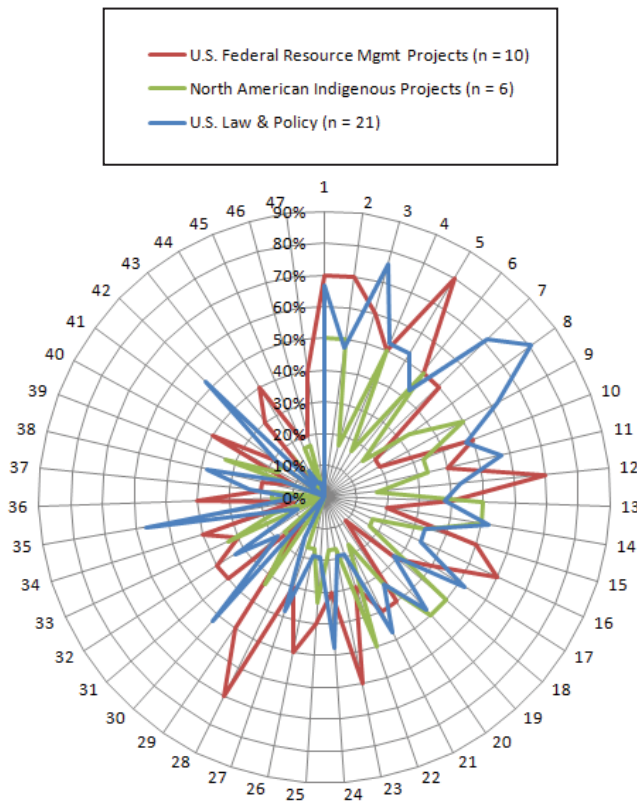


Figure 13: % cover wellbeing subdomains of U.S. federal resource mgmt projects, U.S. laws & policies & North American indigenous projects Source: Author data

1	Infrastructure/Built Environment/Ports/Housing/Transit
2	Resource Access & Utility
3	Public/Political Participation
4	Education/Outreach/Building Awareness/Access to Info.
5	Material Wellbeing/Wealth/Prosperity/Material Security
6	Cultural Values/Traditions/Valued Practices
7	Governance/Management/Public Services
8	Environmental Quality/Habitat Health
9	Conservation/Stewardship/Environmentalism
10	Resource Availability & Ecosystem Distributions
11	Physical Health/Mortality
12	Recreation and Tourism
13	Food/Nutrition/Food Security
14	Pollution/Waste
15	Civil Society
16	Commerce/Industry/Trade/Revenue
17	Transparency in Government
18	Agency/Self-Governance/Sovereignty
19	Future Generations' Wellbeing/Sustainability
20	Hazards Preparedness
21	Safety
22	Subsistence
23	Jobs/Employment
24	Archaeological/Historic Heritage
25	Non-Consumptive Uses
26	Security/Peace (Safety)
27	Access to Nature
28	Demographics
29	Emotion/Attitude/Mental Health
30	Science/Research/Knowledge Production/Technology
31	Place Attachment/Sense of Place/Place-Based
32	Social Justice/Equity
33	Personal Activities/Time Allocation
34	Local Economies/Corp. Consolidation/Econ. Freedom
35	Diversity/Multiple Users
36	Social Capital
37	Community Vibrancy/Integrity/Stability/Adaptability
38	Conflict Reduction/Resolution
39	Certainty/Predictability/Ability to Plan Future
40	Social Relationships
41	Resilience
42	Beauty/Aesthetics
43	Identity
44	Livelihoods
45	Wonder/Spirituality
46	Energy Production & Consumption Patterns
47	Job Quality

4.1.2.2 Wellbeing attributes of national wellbeing vs. environmental management projects

Figure 8 and Figure 9 compare projects which have recently attempted to integrate measures of human wellbeing into the country's statistical accounting—such as the United Kingdom's Measuring National Well-being Programme—with federal projects specifically undertaken to support environmental resource management. As one might expect, national wellbeing projects tended to take a less expansive view of wellbeing's linkages to environmental resources. As shown in both figures, the national wellbeing projects also tended to place slightly less emphasis on the economic domain and subdomains of wellbeing than those in the environmental management category. As the motivation for many of these national wellbeing projects has in recent years been to expand on the usual accounts (such as GDP) states use to assess national wellbeing, this is not altogether surprising. Significantly, however, these projects do not ignore the economic domain entirely. Instead, the economic scale of focus is shifted downward toward the level of the individual, giving greater attention to the presence of quality jobs (subdomain #21 in Figure 9) and to subjective measures of human happiness (ex. #6 "Emotion/Attitude/Mental Health" in Figure 9).

Indeed, all 12 of the national human wellbeing projects reviewed in this analysis included subjective wellbeing assessments of individual citizens. Of the national environmental assessment projects surveyed (n = 9) only 33% of the projects incorporated subjective data. Thus, for environmental researchers attempting to meet federal human wellbeing assessment mandates, these national human wellbeing projects make a strong case for engaging individuals in the subjective evaluation of their own wellbeing. Projects that fail to cross-reference objective social data with the personal feelings, beliefs and experiences of the individuals being evaluated, are missing what these new national account measures have already recognized to be a relevant and highly important wellbeing characteristic.

4.1.2.3 Wellbeing attributes of NOAA projects vs. U.S. law and policy

Figure 10 and Figure 11 compare the human wellbeing domain and subdomain priorities of NOAA social assessment projects with that of a number of U.S. Environmental Laws and Policies. It is essential to note that the law and policy review and document coding that allowed for this comparison was undertaken by Raz Barnea of the SWIMM research team. For this assessment I have paired my NOAA project data with his wellbeing domain and subdomain coding for the following 21 U.S. environmental law and policy documents:

US Federal Legislation

1. Magnuson Stevens Act 2007 – Amended
2. Clean Air Act
3. Federal Water Pollution Control Act (Clean Water Act)
4. National Environmental Policy Act (NEPA)
5. Marine Mammal Protection Act
6. Endangered Species Act
7. Coastal Zone Management Act

US Federal Policy

8. National Ocean Policy 2013
9. Ocean Policy Task Force Final Recommendations 2010
10. Obama 2013 Ocean Research Priorities Plan Update
11. Executive Order on Environmental Justice
12. Executive Order on Government to Government Relations

US Federal Management

13. PFMC 2013a - Pacific Coast Ecosystem Fishery Plan
14. PFMC 2013a - Ecosystem Initiatives Appendix
15. CCIEA Report Summary 2012
16. CCIEA Scenarios 2012
17. CCIEA 2013 Engagement Chapter

US State Legislation & Policy

18. California Ocean Protection Act
19. California Coastal Act
20. Washington Shoreline Management Act
21. Oregon Coastal Management Program

Each of the laws above was selected for evaluation based on their relevance to ocean and coastal management. Of the seven federal statutes coded, four were substantive laws for which the National Oceanic and Atmospheric Administration is either the action agency or one of the action agencies responsible for implementation. The Clean Air Act and Clean Water Act were chosen for their focus on the relationship between environmental quality and human health. The National Environmental Policy Act was selected due to its unique status as the United States' "umbrella" environmental statute (Kubasek and Silverman 2011). The statutes selected from Washington, Oregon and California were all pursuant to state implementation of the Coastal Zone Management Act. The Executive Order on Environmental Justice was included based on the common reference to and emphasis placed on the order in many fisheries-related EIS documents. The Executive Order on Government to Government Relations guides the fisheries co-management activities between NOAA and Pacific Northwest Tribes. The federal management documents selected were those with the strongest programmatic connection to the California Current Integrated Ecosystem Assessment and the management activities of the Pacific Fisheries Management Council.

As shown in Figure 10, the wellbeing domain profile of NOAA projects and U.S. Laws & Policies are, in fact, very similar. At the subdomain level (Figure 11), however, it appears that NOAA projects might not be paying as close attention to the subdomains of #7 "Environmental quality/habitat health" and #20 "Pollution/Waste" as one might expect from an agency legally tasked with the sustainable management of U.S. ocean resources. This would be a hasty conclusion to draw, however. Rather than suggest that NOAA is failing to meet its obligation to monitor the environmental quality or the habitat health of marine resources, it is more likely an indication of the ongoing tendency within the agency to conduct separate social and natural science research. It is also important to keep in mind that different agencies—such as the U.S. Coast Guard—are also engaged in providing insight into particular issues contributing to the wellbeing of ocean-dependent communities—such as safety (e.g. loss of life at sea) and security (e.g. fishery regulation enforcement). Thus, any gaps in wellbeing domain/subdomain coverage identified by this analysis must also be considered within the context of the larger governance network in which ongoing integrated assessments are likely to be conducted. The ongoing question for decision-makers and analysts who fully support an integrated management framework must then become: how well are all the research activities of various ocean governance agencies integrated and how centralized are their data?

4.1.2.4 Wellbeing attributes of U.S. law and policy vs. federal resource management and indigenous wellbeing assessment projects.

The comparative analyses undertaken in this study are informed by a recognition that definitions of human wellbeing are highly context specific. Culture, history, governance practices and other social factors all have a role to play in shaping the opportunities for and obstacles to a community's welfare. Different social groups will prioritize the myriad potential dimensions of human and social wellbeing according to their unique set of values, goals and worldviews. In the Pacific Northwest, where treaties protect and preserve Native American and First Nation rights to harvest traditional resources, indigenous communities are important co-managers of U.S. and Canadian fisheries. These tribal communities and federal state agencies do not always share the same social priorities or values, however, and it is important that they—as well as any other community whose wellbeing is being assessed—have the capabilities necessary to participate fully in both defining and acting to promote their own wellbeing.

Figure 12 and Figure 13 compare wellbeing attributes emphasized by the U.S. federal laws and policies, U.S. federal resource management projects and the North American indigenous projects assessed in this study. What may be most surprising in this comparison is not what is given the greatest emphasis by the indigenous projects (#9: Conservation/ Stewardship/Environmentalism and #19: Future Generations' Wellbeing/Sustainability) but the domain which is given the least—Equity & Justice. It is only by looking more closely at the subdomain coding that it becomes evident just how important Equity & Justice is likely to be for these projects and that a greater cultural awareness may be needed to understand the nuanced values the projects embody. For example, here the indigenous projects place greater emphasis on subdomains #13: Food/Nutrition/Food Security, #18: Agency/Self-Governance/Sovereignty and #22: Subsistence—all of which may also be perceived and understood through a lens of social justice and equity. Greater attention is also given to #39: Certainty/Predictability/Ability to Plan for the Future. However, further reinforcing the need for direct consultation and community engagement, it is important to note that this human wellbeing domain attribute is likely to be viewed as a highly controversial and contentious one for some indigenous communities—particularly in Canada where an emphasis on legal "certainty" is often viewed through the lens of federal government efforts to extinguish First Nations sovereignty via modern land claims treaty-making (Bird et al. 2002). This controversial and persistent tension between First Nations and Canadian federal policymakers illustrates the fundamental and ongoing need for direct community participation in the ground-truthing of assumed socio-cultural values and priorities.

4.1.3 Indicators commonly observed in project survey assessments

Table 5 provides examples of common indicators used by projects to measure and assess the wellbeing domain and sub-domain areas identified by the SWIMM research team. This list was produced by placing all project survey indicators into an Excel spreadsheet and working through the comprehensive list to consolidate similar metrics and to assign each metric to one or more relevant wellbeing domain categories. The indicators listed below do not identify the exact measure used by projects the greatest number of times. Instead the listed indicators represent what might be called a robust example of a "type" of indicator used by multiple projects. For example, employment rate was one of the most common measures of economic wellbeing observed in the project survey. However, within the projects, there were many slight variations on how this measure was operationalized. Some of these variations have been included in parentheses below: (annual) (seasonal) (part-time) (by literacy skill type and level) (of people

who have work disabilities) (of working age population) (by age group) (by gender). As these variations suggest, indicators can be highly context specific and there is no guarantee that a certain type of measure will remain relevant and meaningful across multiple geographies, jurisdictions or scales of governance.

Table 5: Example indicators for human wellbeing domains		**Indicator Example**
Conditions	**Environment**	
	Environmental Quality/Habitat Health	% of all beaches open for all swimming days
	Infrastructure: Ports/Transit	change over time in modal split of marine & terrestrial transit
	Infrastructure: Built Environment/Housing	% housing affordable to buyers at 30% median income, 30-49% median income, and 50-79% of median income by tenure, income, race/ethnicity and geography
	Resource Availability & Ecosystem Distributions	land use (% cover by type and intensity)
	Pollution/Waste	# days exceeding NAAQS air quality standards
	Economy	
	Commerce/Industry/Trade/Revenue	GDP (over time; per annum/per capita; per person employed)
	Jobs/Employment	employment rate (annual) (seasonal) (part-time) (by literacy skill type and level) (of people who have work disabilities) (of working age population) (by age group) (by gender)
	Local Economies/Corporate Consolidation/Economic Freedom	economic diversity (as measured by employment or earnings.)
	Material Wellbeing/Wealth/Prosperity/Material Security	household consumption
	Safety	
	Hazards Preparedness	% of population living in hazard prone areas
	Safety	incidence rate for work related injuries/fatalities
	Health	
	Emotion/Attitude/Mental Health	suicide mortality (per 100,000 population)
	Food/Nutrition/Food Security	key species harvest levels or activity intensity (including avidity/guaranteed levels)
	Physical Health/Mortality	life expectancy at birth
	Demographics	Categorical breakdowns (gender/race/ethnicity/etc) by age cohort
Connections	Culture	

	Archaeological/Historic Heritage	% of indigenous traditional territory covered by traditional use studies
	Cultural Values/Traditions/Valued Practices	% of all young adults that participate in community events and organizations
	Identity	% of people who say they feel part of the community
	Community	
	Social Relationships	% of population participating in community building activities
	Social Capital	% living below the Federal Poverty Level
	Tangible Connections to Nature	
	Resource Access & Utility	% users satisfied with access to shorelines and marine resources
	Access to Nature	miles of accessible shoreline
	Conservation/Stewardship/Environmentalism	environmental regulation infractions
	Non-Consumptive Uses	parkland visitations
	Intangible Connections to Nature	
	Beauty/Aesthetics	community satisfaction with the visual quality of the landscape
	Place Attachment/Sense of Place/Place-Based	level of agreement with statement about willingness to stay in community even if good job comes up elsewhere
	Wonder/Spirituality	% of residents who describe experiencing positive feelings/emotions from being in nature
Capabilities	Knowledge & Technology	
	Education/Outreach/Building Awareness/Access to Information	community profile of educational attainment levels
	Science/Research/Production of Knowledge/Technology	funding levels for research
	Sense of Control	
	Agency/Self-Governance/Sovereignty	# of natural resource tenures, by sector, held locally and non-locally
	Public/Political Participation	political participation by gender, age, minority status, and access to political leadership such as shares of parliamentary seats and other governing bodies
	Transparency in Government	community perceptions of management complexity
	Livelihood & Activities	
	Livelihoods	mobility/alternatives or substitutes for activities of interest (jobs, recreation, and subsistence; occupational mobility indicated as whether the respondent changed jobs in the past five years and preferred their current occupation)
	Job Quality	average job satisfaction levels
	Personal Activities/Time Allocation	% of labour force participants working more than 50 hours per week

	Recreation and Tourism	# of visitor-oriented business licenses
	Subsistence	proportion of activity-related product in diet
	Governance & Civil Society	
	Civil Society	# of eligible residents not registered to vote
	Conflict Reduction/Resolution	% adults reporting discrimination in the past year
	Diversity/Multiple Users	equity in professional and leadership positions (gender/race/ethnicity/etc)
	Governance/Management/Public Services	% of people satisfied with the amount and quality of government services
Cross-Cutting	Equity & Justice	
	Social Justice/Equity	gini coefficient of income inequality
	Certainty & Resilience	
	Community Vibrancy/Integrity/Stability/Adaptability	ratio of business start-ups to business closures
	Certainty/Predictability/Ability to Plan Future	#/frequency of regulatory amendments/frameworks per year
	Resilience	confidence in the effectiveness of community safety net programs
	Security/Peace (Safety)	crime rates (per 100,000 population)
	Future Generations	
	Future Generations' Wellbeing/Sustainability	depletion rate of non-renewable resources
	Energy Production & Consumption Patterns	energy consumption per capita/GDP

4.1.4 Other lessons learned from project literature

Lesson 1: Coordinated assessment programs can be designed to reflect local issues and values while simultaneously monitoring core domains of wellbeing that are comparable at larger scales.

While indices such as the Ocean Health Index have been developed to inform top-level national governance in recent years, there have also been persistent calls within the field to localize both indicator development and environmental management planning (WCED 1987; Scott 2012). These two different approaches to wellbeing assessment have challenged social scientists to simultaneously meet the needs of decision-makers looking for data which is comparable across regions, populations and scales while simultaneously addressing the unique and highly diverse values and concerns of local communities.

Wellbeing projects have taken on this challenge in a number of ways. For example, the Community Foundations of Canada (CFC) Vital Signs initiative combines the use of a core data set with annual community engagement efforts by its membership organizations. Modeled after the initial wellbeing assessment work of the Toronto Community Foundation, the CFC indicators initiative has been promoted throughout Canada as a tool for local grantmaking foundations to direct resources to the areas of greatest need within their communities and, additionally, track general trends in community quality of life. Supported by a core data set of common indicators

captured and analyzed on CFC's behalf by The Centre for the Study of Living Standards, the 35 Canadian community foundations that now participate in the initiative supplement these core indicators with local quantitative and qualitative research tailored to meet the specific local needs and emerging issues faced by each foundation and the people these institutions serve (Community Foundations of Canada 2013). Ostensibly similar to the early 20th century social statistics projects described earlier in this document, the CFC initiative nonetheless provides a concrete example of tracking what Martha Nussbaum might term "a minimum account of social justice" while also making room for local participatory processes (Nussbaum 2000, p. 72). With a shared set of core indicators, communities acknowledge the moral obligation they share to ensure a minimum level of wellbeing for all Canadian citizens.

Another example of this core indicator model supplemented by local analysis—this time scaled to the national and international level and tailored specifically to environmental monitoring and assessment—is yet another project with the Vital Signs moniker. Initially known as the Africa Monitoring System, the project was re-branded and re-launched in 2012 with the help of a three-year $10 million grant from the Bill & Melinda Gates Foundation. Both of these foundation-funded Vital Signs projects help to illustrate two important reciprocal points relevant to ongoing efforts to link social wellbeing concepts to environmental management: (1) **institutions operating outside the constraints of well-established legal mandates and governance process obligations may have greater capacity to design and implement innovative large-scale environmental and social monitoring technologies** and (2) both **corporate and third sector institutions with the capacity to develop innovative monitoring techniques and governance technologies establish new 'regimes of truth'—with no formal mandate to operate democratically—in the process** (Foucault 1975, p.30). These two reciprocal factors likely play a role in both the proliferation of new NGO-produced governance technologies in recent years as well as philanthrocapitalism's many ongoing criticisms (The Economist 2006; LaMarche 2014; Jenkins 2011; Richard 2009).

Lesson 2: Care must be taken to ensure that local communities are meaningfully involved in the ongoing use and application of data as it pertains to their own wellbeing and governance.

Technological innovation and new prospects for commercial enterprise have prompted many communities concerned about the trade-offs involved in new and existing resource use strategies to initiate, engage in and provide funding for new environmental planning and assessment activities in recent years. Increasingly, environmental consulting firms are being engaged to fill knowledge gaps and temporarily augment the capacity of groups working to reduce the social-ecological impacts of development activities (Beamish & Paulsen 2000; Burke & Gaughran 2006). Many consultants have, in the process, been tasked by their public sector clients with the independent development of indicators to describe community wellbeing. Often, the indicator reports produced by these consulting or special planning efforts follow similar formats comprised of: (1) a literature review to identify widely used indicators, (2) a review of available community data and (3) a final suite of suggested indicators based on focus group contact with community members and/or other key informants (Sheltair Group 2009; Biedenweg 2013; USEPA 2013). However, the treatment of these processes as technical exercises rather than substantive theoretical or social debates may not be sufficient to establish the necessary relevance or significance within a community—or the specialized disciplines of resource

management—to ensure meaningful changes in long-term governance. While expedient for the short 2-6 year time frames that set the rhythm of business for political performance cycles, the data produced by these products can be inherently limited and limiting.

Consulting firms are not the only agencies attempting to make the complex process of defining social and human wellbeing much more systematic and contained. In 2013, the Gulf Ecosystem Division (GED) of the U.S. Environmental Protection Agency (USEPA) released a report on the "Indicators and Methods for Constructing a U.S. Human Well-Being Index (human wellbeing) for Ecosystem Services" (USEPA 2013). The report outlined an ecosystem services approach to human well-being assessment, inspired by the Millennium Ecosystem Assessment, that attempts to link the flows of values between three broad human wellbeing categories: environmental, economic and social.

Summers et al. (2012) discuss the conceptual framework of human wellbeing that has informed the USEPA-GED's index development. Based on their interpretation of the human wellbeing literature, they broadly categorize human wellbeing as being comprised of "four primary components—basic human needs, economic needs, environmental needs, and subjective happiness" (p. 328). Like many other indicator development projects, the USEPA-GED then surveyed the domains used by other national human wellbeing indices to compile the list of human well-being domains. According to Smith et al. (2013), the project identified 157 domains and 799 indicators that they regrouped to form the eight human wellbeing domains of the USEPA-GED: connection to nature, cultural fulfillment, education, health, leisure time, living standards, safety and security and social cohesion.

What criteria informed the selection of the indices surveyed is not made explicit. However, both the Canadian Index of Well-being (CIW) and the Organization for Economic Co-operation and Development's (OECD) Better Life Index (www.oecdbetterlifeindex.org)—another project that allows individuals to independently weight human wellbeing domains using an online interactive real-time data visualization tool—were cited as being key references for domain re-categorization because they "contained the most complete set of measurements identified in the review of all potential indices" (USEPA 2013, p. 5). Upon domain selection, the initial desire to link human wellbeing domains to ecosystem services appears to have been achieved by reviewing the literature for each of the selected domain's cited ecosystem service linkages.

Indicator data for each of the 8 domains is pulled from 14 different data sources. Availability and access to data are the primary criteria for indicator selection. These data are not consistent in their scale of analysis and reporting nor are the data themselves vetted for relevance within the communities where the index is applied. Instead community members are invited to rank the relative importance that each individual places on the 8 human well-being domain categories. Based on the aggregate rankings within a defined geographic area, domains are weighted differently in the final index score. Little commentary has been offered to justify why the data selected are the best for use, why they are believed to be scalable, or what policy guidance can be derived from changes to data over time. For example, statewide performing arts attendance is intended to serve as a meaningful data set for the description of cultural fulfillment. At the state level, however, this metric is likely to be skewed toward the attendance of live performing arts events in urban centers. Additionally, it captures only the attendance of a limited set of "high art" art forms most likely to be attended by community elites: jazz/classical music; opera & theatre; dance performance; art museum/gallery/festival visitations. As such, this metric has little directly to do with the cultural fulfillment that might come with being part of a fishing

or tribal community—or other expressions of culture more directly connected to ecosystem services.

As the USEPA-GED project demonstrates, participatory indicator development approaches can fall short—whether unintentionally or by design—of connecting selected measures of human wellbeing to specific policies and goals. Community members may be asked

Lesson 3: Both public engagement processes and data aggregation methods can distract resource managers and the public from engaging in the challenging work of linking indicators to explicit normative social goals and debating the persistent trade-off concerns that exist within dynamic societies.

to rank indicators traditionally used in local governance based on their own experiences, expertise or values without having to agree upon or explicitly acknowledged the social circumstances that inform their preferences. Under these conditions, public participation may promote greater community acceptance of a selected dashboard of wellbeing domains. However, how these measures will be embedded as benchmarks in specific plans, who will benefit and who will be held accountable for them are questions that often remain conspicuously unanswered. Policymakers or state agents may take on the task of embedding these public preferences in law or management practice, or not, as they see fit—their obligation to check "public participation" off the planning task list having now been met.

While public participation is believed to promote stewardship of more locally relevant resource management projects, reduce conflict, and to build trust in government and democratic institutions, public participation in the development of management indicators is often treated as a technical rather than political exercise (Terry 2008; Cooke & Kothari 2001; Scott 2012). "Our opinions," as Scott describes of her experience, "were meticulously gathered up on flip charts each covered with a rash of post-it stickers so that 'what matters' can inform measurements and indicators for national policy"(p. 3). However, the wellbeing indices that are developed based on the content of these flip charts and sticky notes are often fraught with implicit and explicit social, cultural and economic meaning, value and policy implications which deserve to be unpacked and debated in civil society over time. Particularly under conditions of risk and uncertainty, complex matrices and aggregated technologies of "hard science" have often run the risk of becoming what Foucault described as "regimes of truth", used by decision-makers in attempts to shield themselves from the fundamental political discourse each of those technologies abstractly represents (Foucault, in Rabinow 1991).

One prominent marine assessment metric—the Ocean Health Index (OHI)—illustrates just how complex these aggregated measures can be (Halpern et al. 2012). Initiated when William Wrigley Jr.—the business and economics-trained Executive Chairman of a worldwide confectionary corporation known for chewing gum and candy bars—chose to fund and promote the project as part of his philanthropic expenditures in 2009, OHI's complex calculation is the product of more than 65 experts in marine science, economics and sociology. It is worth noting that a number of the OHI's contributors have also been long-term participants in U.S. National Ocean Policy formation as well as ongoing efforts to promote Ecosystem-Based Management of national marine ecosystems. As Karen Scott has discussed (2012), "in a policy world dominated by discourses of 'hard' evidence, policy actors have to back up their decisions with statistical evidence that represents the interests of all concerned as fully as possible" (p.8). The OHI's

attempt to refine the vast complex of national ocean governance and sustainability concepts into a single number will no doubt help meet these ongoing national policy demands for "hard evidence".

Yet, ironically, the increasing wealth of hard evidence available to today's decision-makers has not been shown to have an empirical linkage to substantive changes in policy or societal outcomes (Flyvbjerg 1998; Boulanger 2007; Rydin 2007; Rydin et al. 2003; Levett 1998; Cobb 2000; Innes 1990; Scott 2012). UNEP's independent evaluation of the MEA as well as a separate evaluation undertaken by the United Kingdom's Environmental Audit Committee (UKEAC) published in 2007 have also both acknowledged a dearth of policy formation and other evidence of direct impact as a result of the widespread MEA initiative. However, whether or not this challenge of linking indicators directly to policy outcomes should be regarded as an inherently negative thing remains an important debate in the field of human wellbeing research where the process of participatory governance is often viewed to be as important—if not more important than—the data technologies employed to aid decision-making (Scott 2012).

As these and many more critical social justice issues demonstrate, understanding and minimizing the shortcomings of social indicator use must go hand in hand with current efforts to shape useful tools for resource managers and decision-makers. Indicator selection methodologies must be built out of strong theoretical foundations, responsive to the legal and management contexts in which they will operate, and support our ability to understand constituent communities through appropriate scale, boundary and data selections.

4.2 Pacific Fishery Management Council Case Study

In the United States, eight regional fishery management councils have been authorized by the Magnuson-Stevens Act to govern the sustainable use of our nation's fishery resources. These councils are responsible for developing the fishery management plans implemented by the National Marine Fisheries Service, setting total allowable catch levels, establishing regional catch share allocations, monitoring potential non-fishing impacts to essential fish habitat and engaging stakeholders in the fisheries governance process. The Pacific Fishery Management Council is specifically responsible for the oversight of 100+ species of fish found throughout the U.S. West Coast EEZ (3-200 nm off the coasts of WA, OR & CA), inshore salmon rivers extending inland as far as Idaho, and the offshore migratory waters of highly migratory species (PFMC 2013b). Many council functions raise obvious wellbeing issues related to access and the equitable distribution of marine resources. However, councils also make many other important decisions that directly and indirectly impact wellbeing such as: approving the use of scientific methodologies and fishing technologies, establishing the rules of engagement within public deliberative processes, and endorsing the policy positions of other government agencies.

4.2.1 Current use of socioeconomic indicators & data

The PFMC Briefing Book assessment quickly identified the two human wellbeing indicators which were last presented in NOAA's 2014 California Current Ecosystem report for review and use by the PFMC:

- **Fleet Diversity:** The average diversification of US West Coast and Alaskan fishing vessels with over $5K in revenues, broken out by revenue class and fleet length class (1981-2012). Fleet Diversity is measured using the Herfindahl-Hirschman Index (HHI) "which ranges from a high of 10,000 for a vessel that derives all its income from a single

fishery and declines toward zero as revenues are spread more evenly across more fisheries" (p. 17)

- **Personal Use:** Volume of fish and shellfish (in tons) kept for personal use from tribal vs. non-tribal commercial fishery landings in WA & CA (1990-2010).

The indicator data and further description of each measure can be found in NOAA's 2014 State of the California Current report (pp. 17-19). This document is included, in its entirety, in the PFMC's March 2014 Briefing Book. Both indicators reviewed short-term data trends relative to the long-term mean and followed a highly-specific presentation format which was used for all report indicators (Figure 14).

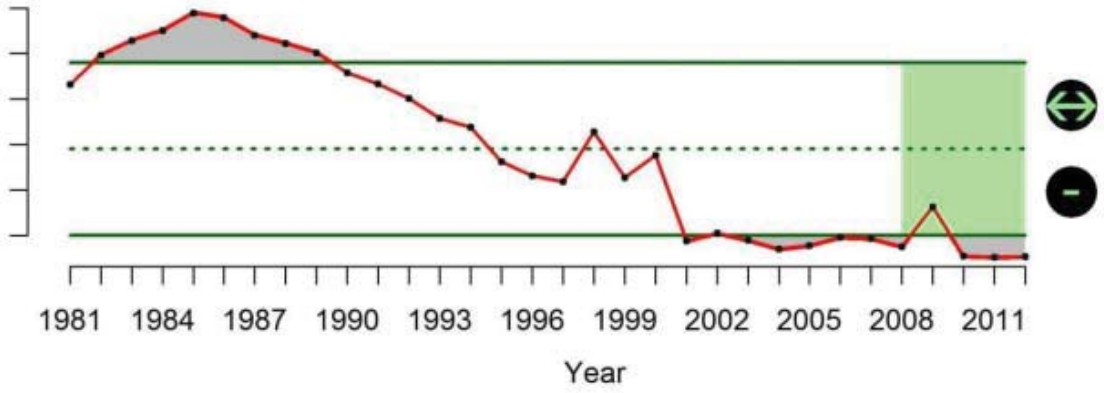


Figure 14: Indicator format used in the Annual State of the California Current report. The dashed line shows the data mean. Solid lines show ± 1.0 standard deviations. The shaded green area represents the last five years of time-series data. The upper symbol at right indicates the direction of trend. The lower symbol at right indicates whether the mean of the past five years was more or less than the 1 s.d. of the full time series. Source: NMFS 2014, pg. 2

The 2014 report also briefly discusses the guidance which was used to select these two wellbeing measures:

> "These indicators can be empirical or model based, and should either directly or indirectly relate to the productivity or condition of managed or protected species or assemblages. Ideally, they should offer some perspective on the relative condition of species, species assemblages or communities that might not necessarily be reflected by species-specific metrics" (p. 17)

This exact guidance, indicator format and the Fleet Diversity metric was also found in the first (2013) annual California Current Assessment report (p. 14). In contrast, Fleet Diversity was grouped under a more general assessment heading of "Human Activities" and the Personal Use indicator was not included as part of the report.

The briefing book analysis also identified recommendations made by the PFMC's Scientific and Statistical Committee to improve the human dimensions sections of the California Current report:

> "The SSC suggests that Chapter 4 (human activities) and 5 (human wellbeing) be reorganized to characterize all of the mentioned activities as sources of wellbeing, with the level of each activity suggestive of both the extent of wellbeing and adverse effects on the ecosystem. Activity levels should in turn be distinguished from indicators that are more directly relevant to ecosystem effects (e.g., nutrient input, ship strikes)." Agenda Item C.1.b, Supplemental SSC Report, March 2014 Briefing Book

> "The IEA team members expressed interest in presenting habitat information as well as more economic analyses. To make room for this information, forage fish abundance, information on vessels fishing in Alaska, and human well-being data from Puget Sound could be dropped." Agenda Item C.1.b, Supplemental SSC Report, March 2014 Briefing Book

Other recommendations to improve the use of indicators and social assessment in the PFMC decision-making process were also found in many documents unrelated to the California Current assessment. For example, the PFMC Staff's (2012) white paper "*An FMP Amendment to Change the Groundfish Specifications and Management Measures Process*" addressed the difficult challenges involved in developing and implementing timely harvest specifications while meeting the many legal mandates of rigorous data-driven decision-making. This document strongly argues for assessments which:

- Standardize formats
- Standardize metrics to evaluate decision-impacts
- Reduce the range of direct and indirect impacts evaluated
- Document more general cumulative impacts
- Establish thresholds that help decision-makers link their choices to impact analysis levels (EIS vs. EA) and which identify the governance process implications of proposed decisions.

PFMC Briefing Books also routinely include draft Environmental Impact Statements associated with fishery management plans. These documents contain socioeconomic profiles of communities that may be impacted by policy decisions. These profiles are used to establish community dependence on fishery plan resources and to evaluate proposed management alternatives. According to the June 2014 draft of the EIS related to a proposal to expand the boundaries of Gulf of the Farallones (GFNMS) and Cordell Bank (CBNMS) national marine sanctuaries, a standard socioeconomic profile " includes information on: **population, demographics (e.g. sex, race/ethnicity, and age), population density, poverty rate, labor force, unemployment rate, income by place of work/industry, employment by industry, income by place of residence, and per capita income**. The

combined information describes the region's socioeconomic health" (p. 4.6-1). Other NEPA documents identified in the Briefing Book analysis also considered the potential for management decisions to impact: **fleet safety, ex-vessel revenues, change in personal income over time, agency monitoring/management/enforcement costs, willingness to pay for recreational activities,** and **changes in angler satisfaction**.

The GFNMS & CBNMS expansion impact statement also clearly outlines the type of socioeconomic impact that would be classified as "significant" according to NEPA legislation.

- Substantial changes in **unemployment rate**;
- Substantial changes in **total income**;
- Substantial changes in **business volume**;
- **Changes in the local housing market** and **vacancy rates**, particularly with respect to the availability of **affordable housing**;
- **Conflicts with the objectives, policies, or guidance of federal, state, and local plans**;
- A conflict or **inconsistency with established land or water use plans** (e.g., county plans);
- A substantial **change in existing land or water uses**;
- An **interference with the public's right of access to the sea;**
- A **long-term preemption of a recreational use or substantial temporary preemption during a peak use season**; or
- Disproportionately **high and adverse human health or environmental effects on minority or low-income populations**

Groundfish Harvest NEPA documentation—such as the "Measures for the 2013-2014 Pacific Coast Groundfish Fishery" document (April 2012 Briefing Book)—further emphasized the obligation Federal agencies have according to Executive Order 12898 to identify the potential for disproportionately high impacts to minority and low-income populations. To meet this EO mandate, U.S. Census data at the County and Census Place level are used to assess environmental justice "vulnerability" based on metrics such as: **% nonwhite, % Native American, %Hispanic, median family income and poverty rate**. The **Social Vulnerability Index (SoVI®)** is also cited as being part of this analysis. The SoVI® is an index of 30 socioeconomic variables compiled and processed by the Hazards and Vulnerability Research Institute at the University of South Carolina. Using a principal components analysis, the SoVI® 2006-10 suggests seven components of the 2006-10 index explained 72% of the U.S. data's variance: race and class; wealth; elderly residents; Hispanic ethnicity; special needs individuals; Native American ethnicity; and service industry employment (HVRI 2014).

In addition to NEPA impact assessments, regularly produced Stock Assessment and Fishery Evaluation (SAFE) reports associated with each FMP provide the Council with additional socioeconomic status updates. This Briefing Book quote—originally from PFMC's (2013) Research and Data Needs report—lists some of the models and survey instruments that are used to update the socioeconomics of SAFE reports:

> "Quantitative descriptions of economic status are generally limited to basic information such as landings, ex-vessel revenues and fishing effort. **Cost-earnings surveys, the Groundfish EDC**

> **Program, recreational angler surveys, charter boat (CPFV) surveys, the IOPAC model, and recreational valuation models provide the means to enhance the utility of SAFE documents.** Information on profitability of commercial operations, economic value of recreational fisheries, employment and income impacts, and other community effects should be included in SAFE documents as such information becomes available". (emphasis added)

The Briefing Book analysis also identified areas in both the PFMC's 2013 Research and Data Needs report and the 2013 Ecosystem Initiatives Appendix to the Pacific Coast Fishery Ecosystem Plan for the US Portion of the California Current Large Marine Ecosystem where specific socioeconomic data has been requested to support current and future PFMC decision-making activities. The PFMC's (2005) *Social Science in the Pacific Fishery Management Council Process* report is also cited in the 2013 data needs report as a still relevant source of additional information for ways to increase social science considerations in the Council process (PFMC 2013, p. 14). For any researcher hoping to understand the types of social analyses and indicators that will be most useful and germane to the decision-making concerns of the PFMC, these three documents should all be thoroughly consulted. For reference, some socioeconomic data requested in 2013 is listed below and the full matrix of social research needs originally identified in the 2005 report is also included as an appendix (Appendix E). Reviewing these lists, however, will not substitute for a full and careful reading of each document.

<u>PFMC 2013 Research and Data Needs</u>

- Socioeconomic information on CCE climate conditions, climate change, habitat conditions, and ecosystem interactions (p. 3)
- Socioeconomic effects of marine reserves (p. 10)
- Periodic recreational angler and charter boat (commercial passenger fishing vessels, or CPFV4 surveys (p. 13)
- Expansion of the regional input-output model (IO-PAC) developed by the NWFSC to include all FMP fisheries and fishery sectors (p. 14)
- Community indicators of fishery dependence, well-being and resilience linked to specific regulations or economic conditions (p. 14).
- Socioeconomic data for integration into bycatch models used by the Groundfish Management Team to support the Council in identifying regulatory alternatives that keep the bycatch of weak stocks at acceptable levels (p. 14).
- Socioeconomic trade-offs of alternative groundfish rebuilding strategies and alternative sardine harvest control rules (p. 14).
- Retrospective analysis of the actual socioeconomic effects of Rockfish Conservation Areas (RCAs), the groundfish trawl vessel buyback (2003), salmon fishery closures (2000s), and the groundfish catch share program (2011) on fisheries and fishing communities (p. 17).
- The socioeconomic effects of alternative capacity management programs (limited entry and catch shares) on fishery participants and fishing communities. (The open access groundfish and coastal pelagic non-trawl fisheries are of particular interest) (p. 18).

- Transition models describing the regional economic impacts, cost effects, fleet earning effects, harvest capacity effects and community effects of transitioning from an open access to limited entry or limited entry to catch shares management model (p. 18).
- Infrastructure availability/ finance/development/maintenance needs for commercial fisheries, recreational fisheries, other marine resource-related uses (p. 17).
- Data for understanding economic behavior and estimating the economic value and impact of fisheries using community analysis methods and collaborative stakeholder research (p. 15)

PFMC 2013 Ecosystem Initiatives Appendix to the Pacific Coast Fishery Ecosystem Plan

- Data on human recruitment to the fisheries to assess "whether the immobility between and entrance into West Coast fisheries is of significant enough concern to merit a new Council effort under National Standard 8" (p. A-20). Relevant measures proposed for this assessment include:
    - A cross FMP look at age-distribution of fishery participants relative to coastal counties
    - fishery participation costs
    - mobility within and between Council-managed, and state/tribe-managed fisheries,
    - barriers to entry in Council-managed fisheries
    - public/private efforts to facilitate the upward mobility of skilled crewmen to positions as skippers, vessel owners, and other leadership positions within the fishing fleet.
- Cross-FMP socioeconomic effects of fisheries management (p. A-21). Relevant measures proposed for this assessment include:
    - seasonality of fishing operations,
    - temporal-spatial landings compositions,
    - vessel displacement and mobility,
    - operational tradeoffs when management decisions made under different FMPs affect the same communities
    - Rankings of fishing ports in terms of their annual landings and ex-vessel revenues, by species management group and gear type
    - amount of economic activity generated by fish harvesters and processors operating within an inter-connected system of businesses comprising a particular West Coast port.
    - which fishing communities are most closely tied to which fisheries, and
    - which communities undergo cyclical within-year effects from shifts in fishery management programs

4.2.2 Motivations for use

The propositions originally developed in Chapter 3 were supported by the Briefing Book analysis. NEPA impact assessment requirements, the Magnuson-Stevens Act National Standards and Fishery Management Plan objectives were all frequently cited to explain why socioeconomic data was or should be assessed. Fishery Management Plan SAFE documents included analyst-driven socioeconomic studies which derived content from NOAA's IOPAC regional modeling efforts, economic data capture programs, and special community profiling projects. The Briefing Book analysis also identified one data-heavy public comment letter suggesting that informed

members of the public and the representatives of stakeholder institutions also bring socioeconomic analyses and insights to the Council's attention.

In addition to the motivations originally proposed, the need for and use of socioeconomic data also appeared to be prompted by 1) the Council's desire to evaluate the impact of past decisions and policy actions, 2) the desire to uphold adaptive and ecosystem-based management perspectives and norms, 3) a desire to understand the impact of fisheries management decisions across all fishery management plan areas and on "communities" (as opposed to assessing just the commercial/recreational fishing industry impacts within a single fishery) and 4) a desire to discuss additional opportunities for stakeholder involvement in fisheries governance. Meeting these many research needs at a time when the capacity for non-economic social science research at NOAA-NWFSC remains so limited (only 2 FTEs at NOAA-NWFSC are dedicated to non-economic social science research) may require further consideration, prioritization and guidance on the part of PFMC council members and staff.

4.2.2.1 Fishery Management Plan Goals & Objectives

The PFMC's (2005) social science assessment discusses the "lack of understanding on the part of both managers and social scientists about how social science information can and should be used" in the Council process (p. ES-6). This report also emphasizes the need for social researchers to develop a "clear understanding of the Council's goals and objectives regarding fisheries management and community impacts" (p. ES-6). Researchers not directly involved in Council proceedings may have limited knowledge of these planning guideposts as well as the breadth and depth of the socio-economic data which is currently leveraged by the Council and its staff. Table 5 identifies a number of goals and objectives stated within the PFMC's current FMP documents (PFMC 2011a, 2011b, 2012, 2013, 2014) and Figure 15 compares the human wellbeing domains identified in these goals/objectives with some of the socioeconomic metrics which have previously been included in NOAA reports, fishing community profiles and Environmental Impact Assessments presented to the Council for evaluation and review (Table 7).

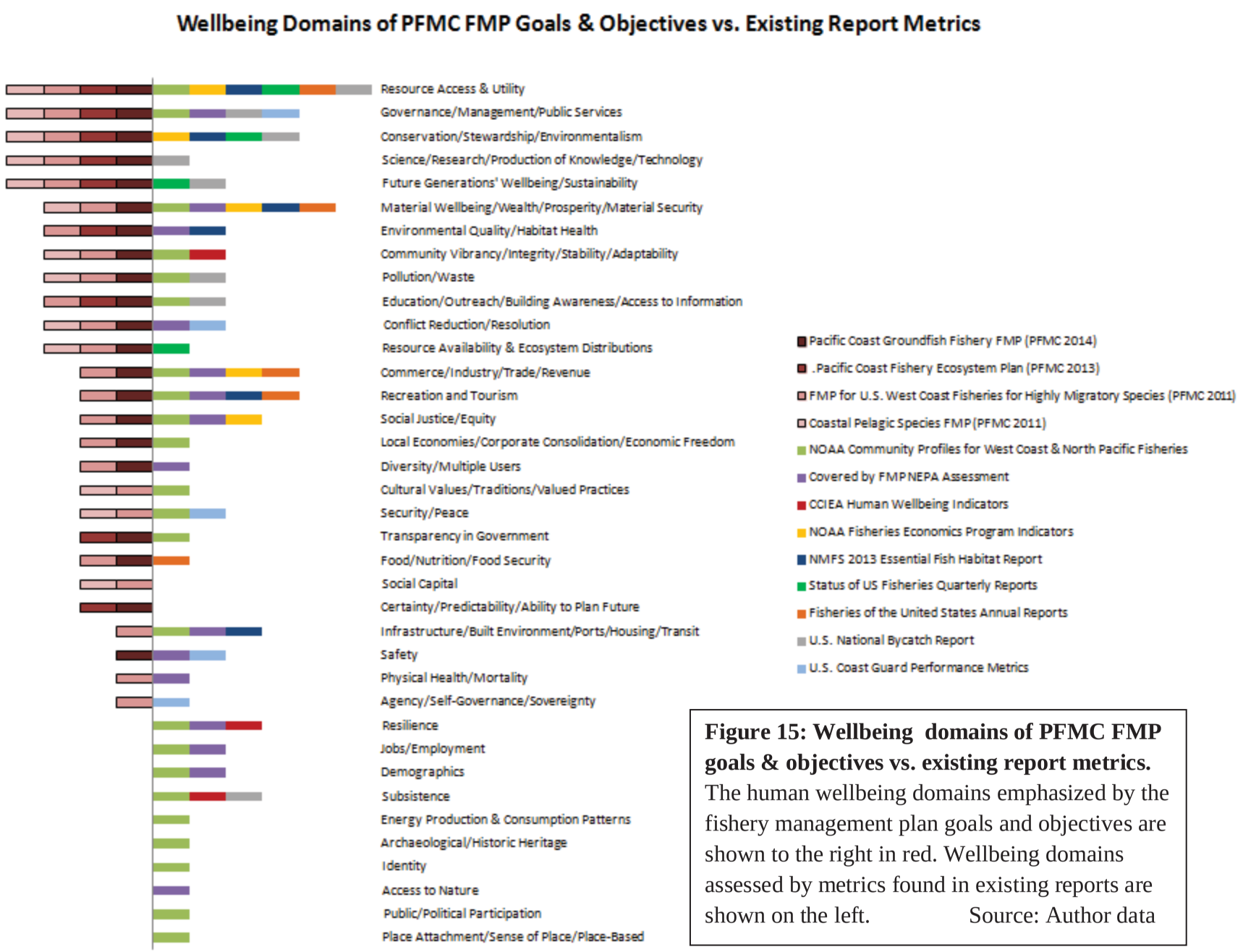


Figure 15: Wellbeing domains of PFMC FMP goals & objectives vs. existing report metrics. The human wellbeing domains emphasized by the fishery management plan goals and objectives are shown to the right in red. Wellbeing domains assessed by metrics found in existing reports are shown on the left. Source: Author data

Table 6: Wellbeing domains of PFMC fishery management plan goals & objectives

Goals & Objectives	FMP Source	Human Wellbeing Domain of Goal/Objective
Goal 1 - Conservation. Prevent overfishing and rebuild overfished stocks by managing for appropriate harvest levels and prevent, to the extent practicable, any net loss of the habitat of living marine resources.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Conservation; Habitat Health; Management; Resource Access & Utility
Goal 2 - Economics. Maximize the value of the groundfish resource as a whole	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Material wellbeing; Revenue
Goal 3 - Utilization. Within the constraints of overfished species rebuilding requirements, achieve the maximum biological yield of the overall groundfish fishery, promote year-round availability of quality seafood to the consumer, and promote recreational fishing opportunities.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Resource Access & Utility; Food security; Recreation
Objective 1. Maintain an information flow on the status of the fishery and the fishery resource which allows for informed management decisions as the fishery occurs.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Access to information; Management; Transparency in Government
Objective 2. Adopt harvest specifications and management measures consistent with resource stewardship responsibilities for each groundfish species or species group. Achieve a level of harvest capacity in the fishery that is appropriate for a sustainable harvest and low discard rates, and which results in a fishery that is diverse, stable, and profitable. This reduced capacity should lead to more effective management for many other fishery problems.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Sustainability; Resource Access & Utility; Stability; Material wellbeing; Management; Waste; Diversity
Objective 3. For species or species groups that are overfished, develop a plan to rebuild the stock as soon as possible, taking into account the status and biology of the stock, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock within the marine ecosystem.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Ability to Plan Future, Resource Availability
Objective 4. Where conservation problems have been identified for non-groundfish species and the best scientific information shows that the groundfish fishery has a direct impact on the ability of that species to maintain its long-term reproductive health, the Council may consider establishing management measures to control the impacts of groundfish fishing on those species. Management measures may be imposed on the groundfish fishery to reduce fishing mortality of a non-groundfish species for documented conservation reasons. The action will be designed to minimize disruption of the groundfish fishery, in so far as consistent with the goal to minimize the bycatch of non-groundfish species, and will not preclude achievement of a quota, harvest guideline, or allocation of groundfish, if any, unless such action is required by other applicable law.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Stability; Sustainability; Conservation
Objective 5. Describe and identify EFH, adverse impacts on EFH, and other actions to conserve and enhance EFH, and adopt management measures that minimize, to the extent practicable, adverse impacts from fishing on EFH.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Conservation; Habitat Health; Ecosystem Distributions
Objective 6. Within the constraints of the conservation goals and objectives of the FMP, attempt to achieve the greatest possible net economic benefit to the nation from the managed fisheries.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Revenue; Wealth

Objective 7. Identify those sectors of the groundfish fishery for which it is beneficial to promote year-round marketing opportunities and establish management policies that. extend those sectors fishing and marketing opportunities as long as practicable during the fishing year.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Commerce
Objective 8. Gear restrictions to minimize the necessity for other management measures will be used whenever practicable. Encourage development of practicable gear restrictions intended to reduce regulatory and/or economic discards through gear research regulated by EFP.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Management; Technology; Revenue
Objective 9. Develop management measures and policies that foster and encourage full utilization (harvesting and processing), in accordance with conservation goals, of the Pacific Coast groundfish resources by domestic fisheries.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Resource Access & Utility; Conservation
Objective 10. Recognize the multispecies nature of the fishery and establish a concept of managing by species and gear or by groups of interrelated species.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Management; Diversity
Objective 11. Develop management programs that reduce regulations-induced discard and/or which reduce economic incentives to discard fish. Develop management measures that minimize bycatch to the extent practicable and, to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. Promote and support monitoring programs to improve estimates of total fishing-related mortality and bycatch, as well as those to improve other information necessary to determine the extent to which it is practicable to reduce bycatch and bycatch mortality.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Waste; Management; Research
Objective 12. When conservation actions are necessary to protect a stock or stock assemblage, attempt to develop management measures that will affect users equitably.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Equity; Conservation; Management
Objective 13. Minimize gear conflicts among resource users.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Conflict Reduction
Objective 14. When considering alternative management measures to resolve an issue, choose the measure that best accomplishes the change with the least disruption of current domestic fishing practices, marketing procedures, and the environment.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Stability; Management
Objective 15. Avoid unnecessary adverse impacts on small entities.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Local economies; Management
Objective 16. Consider the importance of groundfish resources to fishing communities, provide for the sustained participation of fishing communities, and minimize adverse economic impacts on fishing communities to the extent practicable.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Community integrity/stability; Sustainability; Material wellbeing
Objective 17. Promote the safety of human life at sea.	Pacific Coast Groundfish Fishery FMP (PFMC 2014) (Note: This FMP Lists Goals/Objectives in order of priority)	Safety
Objective 1. Improve and integrate information used in Council decision-making across the existing FMPs by: a. Describing the key oceanographic, physical, biological, and socioeconomic features of the CCE and dependent fishing communities; b. Identifying measures and indicators, and informing reference points to monitor and understand trends and drivers in key ecosystem features; c. Identifying and addressing gaps in ecosystem knowledge, particularly with respect to the cumulative and longer-term	Pacific Coast Fishery Ecosystem Plan (PFMC 2013)	Management; knowledge production; access to information

effects of fishing on marine ecosystems; d. Examining the potential for a science and management framework that allows for managing fish stocks at spatial scales relevant to the structure of those stocks.		
Objective 2: Build toward fuller assessment of the greatest long-term benefits from the conservation and management of marine fisheries, of optimum yield, and of the tradeoffs needed to achieve those benefits while maintaining the integrity of the CCE through: a. Assessing trophic energy flows and other ecological interactions within the CCE; b. Assessing the full range of cultural, social, and economic benefits that fish and other living marine organisms generate through their interactions in the ecosystem; c. Improving assessment of how fisheries affect and are affected by the present and potential future states of the marine ecosystem.	Pacific Coast Fishery Ecosystem Plan (PFMC 2013)	Conservation; Research; Management; Resource Access & Utility; Future Generations; Ability to Plan for the Future
Objective 3. Provide administrative structure and procedures for coordinating conservation and management measures for the living marine resources of the U.S. West Coast EEZ: a. Guiding annual and regular reporting of status and trends to the Council; b. Providing a nexus to regional, national, and international ecosystem-based management endeavors, particularly to address the consequences of non-fishing activities on fisheries and fish habitat; c. Identifying ecological relationships within the CCE to provide support for cross-FMP work to conserve non-target species essential to the flow of trophic energy within the CCE.	Pacific Coast Fishery Ecosystem Plan (PFMC 2013)	Management; Conservation; Access to Information; Transparency in Government; Habitat Health
Promote and actively contribute to international efforts for the long-term conservation and sustainable use of highly migratory species fisheries that are utilized by West Coast-based fishers, while recognizing these fishery resources contribute to the food supply, economy, and health of the nation	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Governance; Conservation; Sustainability; Resource Access & Utility; Food; Material Wellbeing; Commerce; Health
Provide a long-term, stable supply of high-quality, locally caught fish to the public	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Local economies; stability; resource access & utility
Minimize economic waste and adverse impacts on fishing communities to the extent practicable when adopting conservation and management measures.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Conservation; Management; Material wellbeing; stability
Provide viable and diverse commercial fisheries and recreational fishing opportunity for highly migratory species based in ports in the area of the Pacific Council's jurisdiction, and give due consideration for traditional participants in the fisheries.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Diversity; Commerce; Recreation; Ports; Traditions
Implement harvest strategies which achieve optimum yield for long-term sustainable harvest levels.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Resource Access & Utility; Sustainability
Provide foundation to support the State Department in cooperative international management of highly migratory species fisheries.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Governance; Sovereignty

Promote inter-regional collaboration in management of fisheries for species which occur in the Pacific Council's managed area and other Councils' areas.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Management; Social Capital
Minimize inconsistencies among federal and state regulations for highly migratory species fisheries	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Governance; Management
Minimize bycatch and avoid discard and implement measures to adequately account for total bycatch and discard mortalities.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Waste; Management; Production of Knowledge
Prevent overfishing and rebuild overfished stocks, working with international organizations as necessary	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Resource availability; Conservation; Governance; Sovereignty; Social Capital
Acquire biological information and develop a long-term research program.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Production of knowledge; Research
Promote effective monitoring and enforcement.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Governance; production of knowledge; security
Minimize gear conflicts.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Conflict Reduction
Maintain, restore, or enhance the current quantity and productive capacity of habitats to increase fishery productivity for the benefit of the resource and commercial and recreational fisheries for highly migratory species.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Habitat Health; Ecosystem Distributions; Resource Access & Utility; Commerce; Recreation
Establish procedures to facilitate rapid implementation of future management actions, as necessary.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Governance
Promote outreach and education efforts to inform the general public about how West Coast HMS fisheries are managed and the importance of these fisheries to fishers, local fishing communities, and consumers.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Education; Outreach; Building Awareness
Manage the fisheries to prevent adverse effects on any protected species covered by MMPA and MBTA and promote the recovery of any species listed under the ESA to the extent practicable.	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Conservation
Allocate harvest fairly and equitably among commercial, recreational and charter fisheries for HMS, if allocation becomes necessary	FMP for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011)	Equity; Commerce; Recreation
Promote efficiency and profitability in the fishery, including stability of catch.	Coastal Pelagic Species FMP (PFMC 2011)	Material wellbeing; Stability
Achieve Optimal Yield (OY)	Coastal Pelagic Species FMP (PFMC 2011)	Resource Access & Utility; Sustainability
Encourage cooperative international and interstate management of CPS.	Coastal Pelagic Species FMP (PFMC 2011)	Social capital; Management
Accommodate existing fishery segments.	Coastal Pelagic Species FMP (PFMC 2011)	Traditions; Stability
Avoid discard.	Coastal Pelagic Species FMP (PFMC 2011)	Waste
Provide adequate forage for dependent species.	Coastal Pelagic Species FMP (PFMC 2011)	Resource availability
Prevent overfishing.	Coastal Pelagic Species FMP (PFMC 2011)	Sustainability; Conservation; Resource Access & Utility

Acquire biological information and develop long-term research program.	Coastal Pelagic Species FMP (PFMC 2011)	Production of knowledge; Research
Foster effective monitoring and enforcement.	Coastal Pelagic Species FMP (PFMC 2011)	Production of knowledge; Management; Security
Use resources spent on management of CPS efficiently.	Coastal Pelagic Species FMP (PFMC 2011)	Management; Material wellbeing
Minimize gear conflicts.	Coastal Pelagic Species FMP (PFMC 2011)	Conflict Reduction

Table 7: Socioeconomic information previously used in NOAA/PFMC reports

Human Wellbeing Domain	Example Metrics/Information Previously Used by NOAA/PFMC	Information Source
Adaptability; Resilience	Fleet Diversity: Herfindahl-Hirschman Index (HHI) : ranges from a high of 10,000 for a vessel that derives all its income from a single fishery and declines toward zero as revenues are spread more evenly across more fisheries	Current CCIEA Human Wellbeing Indicator
Subsistence	Personal Use: Volume of fish and shellfish (in tons) kept for personal use from tribal vs. non-tribal commercial fishery landings in WA & CA (1990-2010)	Current CCIEA Human Wellbeing Indicator
Pollution	Deposition of sulfates derived from the National Atmospheric Deposition Program	NMFS 2013 - Essential Fish Habitat Report
Pollution	Point source pollution from factories and mines and non-point source pollution that scales with the amount of impervious surface area.	NMFS 2013 - Essential Fish Habitat Report
Pollution	Input of pesticides.	NMFS 2013 - Essential Fish Habitat Report
Habitat Health	Combined pressure of “Commercial shipping activity” and “Invasive species”.	NMFS 2013 - Essential Fish Habitat Report
Pollution	Nitrogen input from farming and atmospheric deposition.	NMFS 2013 - Essential Fish Habitat Report
Pollution	Sediment input from watersheds with dams.	NMFS 2013 - Essential Fish Habitat Report
Pollution	Sediment input from watersheds without dams.	NMFS 2013 - Essential Fish Habitat Report
Habitat Health	Combined pressures score	NMFS 2013 - Essential Fish Habitat Report
Pollution; Stewardship	Amount of trash collected from beach clean-up efforts	NMFS 2013 - Essential Fish Habitat Report
Recreation	Beach attendance	NMFS 2013 - Essential Fish Habitat Report
Energy; Infrastructure	Locations of coastal power plants	NMFS 2013 - Essential Fish Habitat Report
Pollution; Infrastructure	Stable lights at night database (National Geophysical Data Ctr).	NMFS 2013 - Essential Fish Habitat Report
Infrastructure; Habitat Health	Location of hardened shorelines.	NMFS 2013 - Essential Fish Habitat Report
Transit	Vessel track lines from the World Meteorological Organization Voluntary Observing Ships Scheme and ferries	NMFS 2013 - Essential Fish Habitat Report
Infrastructure; Energy; Resource Access & Utility	Locations of offshore oil rigs	NMFS 2013 - Essential Fish Habitat Report
Habitat Health; Resource Access & Utility	Locations of fish net-pens.	NMFS 2013 - Essential Fish Habitat Report
Pollution	Species invasions based on annual tonnage of goods passing through each port	NMFS 2013 - Essential Fish Habitat Report
Material wellbeing	Net Revenue: gross revenue-operating costs	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries

Material wellbeing	Vessel productivity: Malmquist index	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries
Material wellbeing	Profit	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries
Material wellbeing	Rents: Economic profit	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries
Resource Access & Utility; Material Wellbeing	Rents: Catch share share price	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries
Safety	Vessel safety: # of search and rescue events	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries
Safety	Vessel safety: vessel accident rates	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries
Safety	vessel safety: personal injury/fatality rates	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries
Employment	crew information: labor days	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries
Employment	crew information: crew earnings	NOAA Fisheries Economics Program's Tier 2 Indicators for Catch Share Fisheries
Resource Access & Utility	Effort: Entities holding share	NOAA Fisheries Economics Program's Tier 1 Indicators for Catch Share Fisheries
Resource Access & Utility	Effort: Active vessels	NOAA Fisheries Economics Program's Tier 1 Indicators for Catch Share Fisheries
Equity	Revenues: Gini Coefficient	NOAA Fisheries Economics Program's Tier 1 Indicators for Catch Share Fisheries
Resource Access & Utility	Share Accumulation: Share cap in place? (Y/N)	NOAA Fisheries Economics Program's Tier 1 Indicators for Catch Share Fisheries
Material wellbeing	Cost recovery: cost recovery fee	NOAA Fisheries Economics Program's Tier 1 Indicators for Catch Share Fisheries
Conservation; Resource Access & Utility	Catch & Landings: ACL or Quota/TAC; quota allocated to catch share program	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Conservation; Resource Access & Utility	Catch & Landings: Aggregate landings	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Conservation; Resource Access & Utility	Catch & Landings: ACL or Quota/TAC exceeded (Y/N)	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Resource Access & Utility	Catch & Landings: % Utilization	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Resource Access & Utility	Effort: Trips	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Resource Access & Utility	Effort: Days at sea	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries

Resource Access & Utility	Effort: Season Length	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Aggregate revenue from species in fishery/catch share species	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Aggregate revenue from species not in fishery/non-catch share species	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Average price	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Total Revenue	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Fishery species revenue per active vessel	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Fishery species/catch share revenue per day at sea	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share & Catch Share Fisheries
Resource Access & Utility	Effort: Number of permits	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share Fisheries
Resource Access & Utility	Effort: Limited Entry (Y/N)	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Combined species/Catch share species revenue per active vessel	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Fishery species revenue per trip	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Combined revenue per trip	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share Fisheries
Revenue; Material wellbeing	Revenues: Combined species revenue per day at sea	NOAA Fisheries Economics Program's Tier 1 Indicators for Non-Catch Share Fisheries
Sustainability	Fish Stock Sustainability Index	NOAA Fisheries' Office of Sustainable Fisheries quarterly updates
Conservation; Resource Access & Utility	Stock status changes	NOAA Fisheries' Office of Sustainable Fisheries quarterly updates
Commerce; Recreation; Material Wellbeing; Food security	The Fisheries of the United States annual report provides data on U.S. recreational catch and commercial fisheries landings and value. In addition, data are reported on the U.S. fishery processing industry, imports and exports of fishery-related products, and domestic supply and per capita consumption of fishery products.	NOAA's Annual Commercial & Recreational Fisheries Statistics Data Reports : Fisheries of the United States Series
Demographics	Age and gender structure of fishing sector employees	Norman et al. 2007
Infrastructure	Building permits	Norman et al. 2007
Infrastructure	city classification	Norman et al. 2007
Access to information; public services; social justice	community proximity to nearest fishery council meeting venue	Norman et al. 2007
Access to information; public services; social justice	community proximity to NOAA fisheries offices	Norman et al. 2007

Access to information; public services; social justice	community proximity to state agency in charge of fisheries management	Norman et al. 2007
Access to information; public services; social justice	community proximity to US Citizenship and Immigration Services	Norman et al. 2007
Adaptability	Dependency scores by city, county	Norman et al. 2007
Education	Education attainment of fishing communities	Norman et al. 2007
Energy; Infrastructure	Electricity	Norman et al. 2007
Employment	Employment estimation	Norman et al. 2007
Resilience; Adaptability	Fishing engagement scores by region, county, city, sector, fishery, port	Norman et al. 2007
Housing	Housing	Norman et al. 2007
Identity; Sense of Place; Traditions	Local history	Norman et al. 2007
Security	Police	Norman et al. 2007
Infrastructure	Proximity to larger cities	Norman et al. 2007
Infrastructure	Public accommodations	Norman et al. 2007
Identity; demographics	Racial & ethnic profiles of fishing communities	Norman et al. 2007
Resilience	Resiliency scores by city, county, fishing community	Norman et al. 2007
Education	Schools	Norman et al. 2007
Housing	Seasonal Housing	Norman et al. 2007
Pollution	Solid waste	Norman et al. 2007
Transit	Transportation connectivity	Norman et al. 2007
Transit	Transportation options	Norman et al. 2007
Pollution	Waste and waste water	Norman et al. 2007
Safety; Security; Stewardship	Incidence & enforcement reports (gear conflict; compliance with regulations; safety)	U.S. Coast Guard; NOAA Fisheries Office of Law Enforcement; Fisheries & Oceans Canada reports to Itl Pacific Halibut Commission

4.2.2.2 Important Laws & Policies

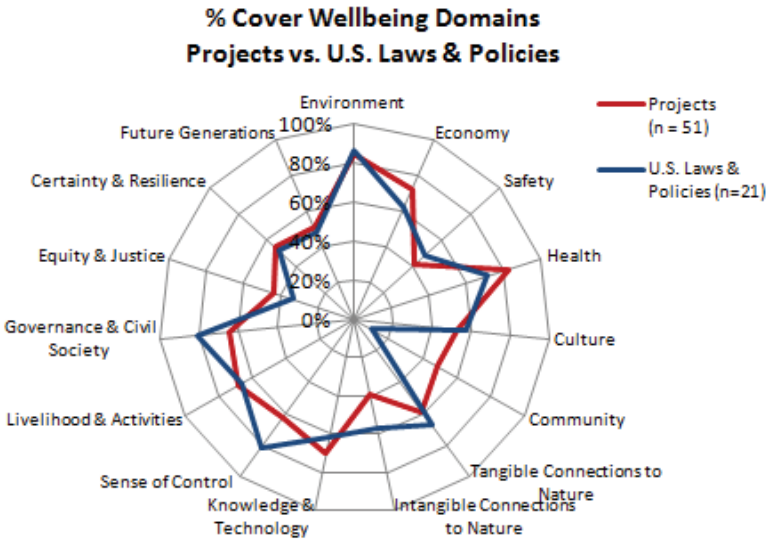


Figure X: % cover wellbeing domains of all projects vs. U.S. laws & policies
Source: Author data

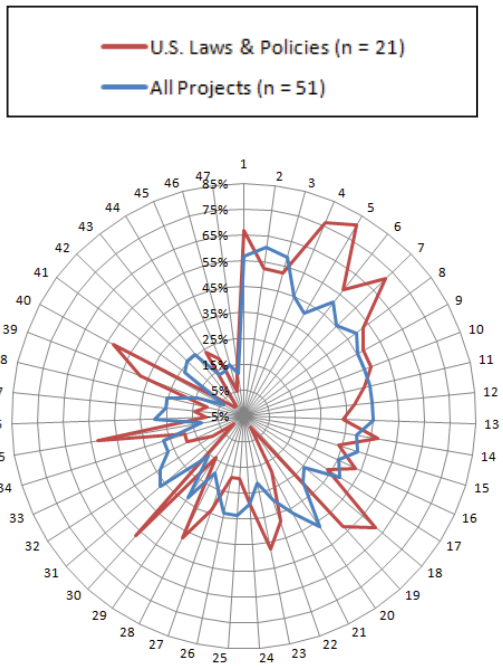


Figure X: % cover wellbeing subdomains of all projects vs. U.S. laws & policies
Source: Author data

1	Material Wellbeing/Wealth/Prosperity/Material Security
2	Education/Outreach/Building Awareness/Access to Info.
3	Physical Health/Mortality
4	Pollution/Waste
5	Infrastructure/Built Environment/Ports/Housing/Transit
6	Emotion/Attitude/Mental Health
7	Environmental Quality/Habitat Health
8	Social Justice/Equity
9	Commerce/Industry/Trade/Revenue
10	Recreation and Tourism
11	Food/Nutrition/Food Security
12	Governance/Management/Public Services
13	Future Generations' Wellbeing/Sustainability
14	Social Relationships
15	Public/Political Participation
16	Security/Peace (Safety)
17	Resource Availability & Ecosystem Distributions
18	Jobs/Employment
19	Social Capital
20	Civil Society
21	Job Quality
22	Hazards Preparedness
23	Non-Consumptive Uses
24	Resource Access & Utility
25	Transparency in Government
26	Personal Activities/Time Allocation
27	Demographics
28	Access to Nature
29	Cultural Values/Traditions/Valued Practices
30	Place Attachment/Sense of Place/Place-Based
31	Wonder/Spirituality
32	Energy Production & Consumption Patterns
33	Agency/Self-Governance/Sovereignty
34	Safety
35	Livelihoods
36	Subsistence
37	Diversity/Multiple Users
38	Resilience
39	Conflict Reduction/Resolution
40	Conservation/Stewardship/Environmentalism
41	Local Economies/Corp. Consolidation/Econ. Freedom
42	Archaeological/Historic Heritage
43	Beauty/Aesthetics
44	Identity
45	Certainty/Predictability/Ability to Plan Future
46	Science/Research/Knowledge Production/Technology
47	Community Vibrancy/Integrity/Stability/Adaptability

At the interstate and international scales of large marine ecosystems, national environmental regulations necessarily serve as important points of reference for federal marine resource managers. Third sector human wellbeing indicator development projects or those focusing primarily on participatory processes may be less inclined to consult and incorporate the mandates found in these major social contracts. However, understanding the differences between neighboring or nested legal regimes may be useful in revealing important gaps in governance, tensions between social groups, and opportunities to strengthen the collective action effectiveness of governance networks. Legislation can also help to identify historic forces (including those which may no longer be emphasized by current public concern) that continue to shape and reinforce important social institutions.

The PFMC case study highlighted a number of laws and policies that motivate socioeconomic data use or identify human wellbeing domain priorities at the federal and West Coast regional scale (Appendix F). Rather than providing a comprehensive list of every law or policy identified here, however, this section focuses on the four governance documents (2 old laws and 2 new policies) that were most often seen in the code co-occurrence analysis of the 2012-2014 Briefing Book study:

- Magnuson-Stevens Act (MSA)

- National Environmental Policy Act (NEPA)
- National Ocean Policy & National Ocean Policy Implementation Plan
- West Coast Governor's Alliance on Ocean Health

In the United States, legislative mandates—such as the National Environmental Policy Act (NEPA) and the Magnuson Fishery Conservation and Management Act (MSA)—have systematized U.S. processes of Social and Environmental Impact Assessment in an effort to better inform planners and decision-makers of the potential outcomes of proposed projects, programs and policies. The Interorganizational Committee on Guidelines and Principles for Social Impact Assessment (ICGPSIA) (2003) has said that the "strength of the comparative SIA model is that with appropriate data sources (those which can be collected frequently, such as land transfer records) it allows for an interpretation of dynamic events and can provide monitoring of short-term impacts. This kind of frequent monitoring provides a continual source of evaluation or check on the direction of forecasts made about social impacts" (p. 240). These monitoring and assessment requirements—including the acquisition of baseline data and trends, scoping of probable outcomes to proposed actions, and projections of estimated effects—fundamentally shape the conduct of Social Impact Assessment, the architecture of resource management decision-making frameworks and identify specific human wellbeing assessment needs. Federal resource managers must meet these legal requirements as part of their oversight mandate of any major endeavor likely to have significant socio-ecological impact—even if the local public is not currently demanding such a review.

In U.S. fisheries-related social impact statements, a number of specific human well-being focal components are outlined in NEPA and MSA legislation as well as the NMFS (2007) guidance document on social impact assessment (PFMC 2005; Feeney 2012). These sources prescribe assessment of:

<u>MSA Section 303(b)(2)</u>
- "the **number of vessels involved** in the fishery"
- "quantity of fishing **gear** used, the species of fish involved and their location"
- "any **recreational interest** in the fishery"
- "the nature and extent of **foreign fishing** and **Indian treaty fishing rights"**
- "actual and potential **revenues** from the fishery"
- "the **cost likely to be incurred in management**"

<u>MSA Section 303(b)(6)</u>
- "the **present participation** in the fishery"
- **"historic fishing practices** in, and **dependence** on, the fishery"
- **"**the **economics** of the fishery"
- "the **capability of fishing vessels used in the fishery to engage in other fisheries**"

<u>NMFS guidelines (PFMC 2005, pp. 24-25)</u>
- "**size and demographic characteristics** of the fishery-related workforce residing in the area"
- "cultural issues of **attitudes, beliefs, and values** of fishermen, fishery-related workers, other stakeholders and their communities"

- "effects of proposed actions on social structure and organization; that is, on the **ability to provide social support and services to families and communities**"
- "non-economic social aspects of the proposed action or policy, including **lifestyle** issues, **health and safety** issues, and the **non-consumptive and recreational uses** of living marine resources and their habitats"
- " **historical dependence** on and participation in the fishery by fishermen and communities, reflected in the **structure of fishing practices, income distribution, and rights**"

Figure 18: Human Wellbeing Priorities for U.S. West Coast Marine Management. Based on stated goals of the U.S. National Ocean Policy Implementation Plan (NOC 2013), NOAA's Next Generation Strategic Plan (NOAA 2010) & the West Coast Governor's Association Ocean Health Action Plan (WCGAOH 2008)
Source: Author data

While established legislation offers insight into the historic goals of a society, recently developed or emerging policies serve as important reference guides to the management priorities and concerns occupying the attention of current administrations. Review of the PFMC's briefing books indicated that both the U.S. National Ocean Policy Implementation Plan (NOC 2013) and the West Coast Governor's Association Ocean Health Action Plan (WCGAOH 2008) were reviewed and referenced multiple times during Council and subcommittee meetings. A review of both these plans—as well as NOAA's (2010) Next Generation Strategic Plan—indicate that all three policy documents emphasize similar wellbeing priorities and concerns within their stated goals and objectives. Together, they offer consistent guidance to support the identification of

federal policy-mandated social science research priorities for the California Current System and U.S. West Coast (Figure 18).

The National Ocean Policy Implementation Plan and the WCGA Ocean Health Action Plan also outline and identify a formal governance network within which the human wellbeing of U.S. West Coast communities is now being promoted, managed and shaped. Social assessments undertaken to support PFMC decision-making, can and should be linked to the work of these and other relevant inter-state agencies and institutions. This will not only promote greater governance capacity but will also help to ensure that financial and political support for CCS IEA social science persists over time and that there are more coordinated and effective long-term policy responses to the systemic issues revealed through research.

5 Recommendations

5.1 A Preferred Method for Wellbeing Indicator Selection

1) Develop a profile of the human wellbeing governance context

a) Identify who the project is for and the initial goals it is intended to serve (Primary Audience)
b) Identify the legal mandates and priorities that influence the project
b) Identify current and emerging policy priorities which will promote/detract from project goal achievement
c) Identify the larger governance network which could promote/detract from project outcomes (Auxiliary Audience)

2) Build support for and develop project partnerships with the larger governance network

a) Agree upon (and revise, if necessarily) project goals among all project partners
b) Identify the social groups which will be the focus of human wellbeing assessment
c) Make sure priority social groups are engaged in all aspects of human wellbeing assessment, evaluation and decision-making
d) Plan for the long-term administration and funding of the project
e) Plan and establish a central, coordinated and easily accessible information management framework

3) Define individual and/or social wellbeing in a scale-specific and meaningful way

a) Be explicit about the differences between the wellbeing of a community and human wellbeing within a community
b) Identify the scale(s) at which wellbeing is being defined and any differences in this definition between scales
c) Recognize the distinctions & possible dissonances between subjective experiences vs. objective states of wellbeing
d) Policy goals, historic laws, social science literature, other human wellbeing projects, experts and the social groups that will be the focus of human wellbeing may all identify and prioritize different domains of wellbeing. Be explicit about how the information from consulted sources will be integrated into project outcomes

4) Be explicit about which aspects of social &/or individual wellbeing will be the focus of

management and why

a) Identify how these aspects of wellbeing are linked to both long-term and short-term policy goals
b) Identify the normative direction intended for each aspect of wellbeing
c) Identify how the governance network directly impacts these aspects of human wellbeing or influences their social drivers.
d) Identify existing and emerging social trends which place these aspects of human wellbeing at risk

5) Identify indicators which can reveal dynamic trends in human wellbeing and progress being made toward policy goals

a) Be explicit about the important information obscured by indicator aggregations
b) Be explicit about which indicators are valued as end goals as opposed to means to an end
c) Be explicit about what cannot be identified by selected indicators and how those blind spots can be addressed
d) Be explicit about the criteria used for indicator selection
e) Identify a core set of indicators that allow for comparisons between social groups
f) Allow social groups to supplement core indicators with measures that reflect their specific priorities, values and concerns
g) Ensure indicators are well understood, meaningful and relevant to the managers and decision-makers

6) Promote the ongoing institutionalization and the adaptive management of human wellbeing assessment

a) Ensure the data, tools and findings which emerge from human wellbeing assessments are widely communicated
b) Periodically evaluate the project to ensure that it remains relevant to the dynamic needs/goals of the governance network

5.2 PFMC Human Wellbeing Assessment Recommendations

- **Directly engage the targeted users of human wellbeing indictors in their development & consult the documents they have prepared to guide social research.**

The suggestion made by the PFMC's SSC to drop the "human well-being data from Puget Sound" in the March 2014 Briefing Book hints at a disconnection that may exist between the Council and recent wellbeing indicator development projects being undertaken by both NOAA and its Puget Sound collaborators. If the California Current Integrated Ecosystem Assessment indicators are being developed for consumption by specific audiences, more can be done to involve those institutions in the indicator development process. At the very least, social researchers should plan to review and respond to the PFMC guidance documents discussed in Section 4.2.1 of this study.

- **Focus on the assessment scales and social groups which have already been prioritized by the PFMC and which are relevant to PFMC fishery management plan goals & objectives.**

Indicators that are meaningful for management offer strong justifications for policies, laws and institutional arrangements (Morgan 2005). Human wellbeing is a widely shared social value that is present within individuals and societies regardless of any policy, law or institution. As such, general measures of wellbeing are inherently weak justifications for decision-makers because their direct link to any one management decision may not be well established or recognized. To strengthen the relevance and utility of indicators, it is essential, therefore, that these measures characterize the values, interests or normative principles which will not otherwise be addressed in the absence of specific natural resource governance arrangements. To be meaningful for the PFMC, human wellbeing indicators must enhance the council's ability to achieve specific fishery management plan (FMP) goals and objectives and directly relate to the types of council decisions actively being made.

A comparison of the PFMC's FMP goals with the socioeconomic assessment measures that appear in Council Briefing Books reveals that much of the data used is not appropriately scaled to evaluate and compare the communities of concern to the PFMC. FMP goals prioritize commercial fishing gear groups, small entities, traditional resource users, commercial/recreational & subsistence fishing communities, public consumers of fish, future generations of coastal resource users, and the regional coastal resource governance network. FMP goals also state a clear desire to undertake assessments at spatial scales which are relevant to cross-FMP stock structures—all of which are not inherently well-aligned to County or Census tract configurations .

In March 2013, the PFMC's Pacific Coast Fishery Ecosystem Plan made an effort to "provide non-Council entities with information on some of the Council's highest priority concerns for non-fishing activities within the West Coast EEZ" (PFMC 2013, p. 178). Linking social research back to these specific management priorities—as well as specific FMP goals and objectives—will help produce social research that will be more meaningful for PFMC management:

<u>PFMC Policy Priorities for Ocean Resource Management (PFMC 2013, pp. 178-187)</u>

Species of Concern:

- Anadromous Species
- Species protected through an overfished species rebuilding program
- Species dependent upon a fixed habitat type
- Species and locations with tribal treaty rights to fishing
- Internationally-managed species

Essential Fish Habitat for Managed Species:
Each of the Council's FMPs, their EFH appendices, and applicable NEPA analyses should be consulted for
assessments of the types of human activities expected to have a potential negative effect on EFH for Council-managed species. Of particular interest are activities that:

- Disturb or kill structure-forming invertebrates or vegetation in a manner that either prevents those species from recovering within the affected area within their mean generation times, or which reduces the known distribution of those species;
- Alter the geological structure of the habitat such that the habitat cannot maintain or recover its
  functionality unaided;
- Alter the chemical composition, turbidity, or temperature of the seawater such that the habitat
  cannot recover to its pre-disturbance state

Fisheries:

- Communities with a Dependency on Fishery Resources
  (Activities of potential concern to the Council include those that)
    - Directly take or otherwise deplete local populations of marine species;
    - Block or significantly revise (whether temporarily or permanently) physical access between a fishing community and the marine fishing grounds its vessels commonly use;
    - Increase pollutant loads in the habitats of managed species such that those pollutants may bioaccumulate in the flesh of targeted species;
    - Increase the hazards to navigation for vessels; or
    - Have not undergone local consultation with the affected communities before implementation.
- Tribal Fishing Communities
    - Changes in the accessibility of fishery resources to treaty tribes, whether due to ecosystem processes or management policy, have the potential to profoundly affect treaty Indian communities because the fisheries of western treaty tribes are geographically constrained to their Usual & Accustomed fishing areas.
    - Activities that may increase pollutant loads within the flesh (bioaccumulation) of species targeted by tribal fisheries (Kann et al. 2010).
        - Data source: Fish consumption survey conducted by the Columbia River Inter-tribal Fish Commission (CRITFC 1994)
- Brief Duration Fisheries (harvest levels are low relative to effort levels or fleet capacity
    - Commercial and recreational fisheries for Pacific halibut and salmon, as well as commercial fisheries for Pacific sardine.
    - Challenges from poorly-timed non-fishing activities could be devastating if they limit or curtail a vessel's participation at a critical time. Non-fishing activities that could adversely affect a fishing vessel's participation in a fishery include, but are not limited to, port facility construction or improvement projects, interruptions to necessary supplies (fuel, ice, etc.), and dredging or jetty operations that impede bar crossings.
- Location-Constrained Fisheries
    - non-fishing activities that would restrict or displace fishing opportunities that are place-based and therefore difficult to relocate.
        - groundfish fisheries are often limited to particular depth zones to avoid interactions with overfished species, which at times can force boats to

concentrate in near-shore waters or require transit to waters of greater depth.
    - Salmon fisheries often target a particular species or run by fishing in areas near river mouths or in specific depths
    - Fisheries for Pacific halibut and groundfish can tend to concentrate on areas with benthic structure, such as banks and reefs
    - Fisheries for Coastal Pelagic Species, particularly market squid and to a lesser extent Pacific sardine, often rely on aggregations of individuals in areas of favorable temperature, food sources, or spawning habitat

Ecosystem Structure and Function:
Non-fishing activities that have the potential to jeopardize the Council's short- or long-term ability to manage West Coast fisheries so as to provide food and recreation to this and future generations of Americans.

- **Do more to embed indicators to PFMC internal and external governance network performance evaluations and learning cycles**

The PFMC's current Fishery Management Plans include many goals and objectives related to effective fisheries governance and the promotion of regional partnerships and collective action capacity. These themes reflect focal components of human wellbeing which were also found in regional policy documents and the project survey. However, few of the social data used by the PFMC—based on the limited review of this study—appear to be measures of the PFMC's own governance effectiveness. While SAFE reports and NEPA social assessments help the PFMC make better policy decisions, they are not specifically designed to assist the Council and its fisheries governance partners learn from institutional self-evaluations or assess institutional performance outcomes. Indicators that measure coastal community perceptions of fisheries governance effectiveness/equity/transparency/etc. can, however, serve as wellbeing indicators in addition to informing cycles of PFMC self-evaluation and adaptive management. A relationship satisfaction indicator such as the one used by McGregor et al. (2008) and Coulthard et al. (2011) could also be useful for alerting decision-makers to problematic fisheries governance network connections. A governance network performance evaluation could also help to advance the PFMC's cross-FMP assessment initiative outlined in the 2013 Pacific Coast Ecosystem Plan.

- **Add additional subjective wellbeing survey questions to already well-established assessment programs.**

Quantitative analyses of stakeholder perceptions and personal experiences were not common in the documents reviewed in the PFMC case study. Although members of the PFMC do engage directly with stakeholders through written and oral public comments, formal stakeholder perception and satisfaction surveys can also help the PFMC track progress toward FMP goals and serve to triangulate objective socioeconomic data drawn from secondary sources. Social scientists such as Patricia Clay (Clay, Kitts & Pinto da Silva 2014) and Richard Pollnac (Pollnac et al. 2009) within NOAA's Northwest Fisheries Management Region have also demonstrated the fisheries utility of direct participant surveys related to:

- opportunities for new entrants to the fishery
- ability to purchase quota

- perception of their degree of influence over governance
- perceptions of legitimacy/complexity/effectiveness/inclusiveness of governance system
- changes in levels of conflict
- regulatory adaptability/flexibility
- perceptions of regulatory compliance
- job/activity satisfaction
- social networks
- voluntary conservation activities
- risk perceptions
- perception of condition/adequacy of activity-related physical resources/infrastructure
- preferred alternative activities
- perceived ability to cope with adversity
- perceptions related to their access to social/physical capital
- perceptions of community solidarity
- perceptions of activity or resource importance/value to self/community
- satisfaction with life/conditions/outlook for the future

The PFMC (2005) has also expressed its own desire for more subjective research related to:

- perceived importance of fishing to community continuity or self-identification.
- attitudes, beliefs and values of fishermen, fishery-related workers, other stakeholders
- confidence in the future of the fishery
- perceived social problems
- perceived non-compliance and illegal behavior
- desire of community members to stay in community or fishery
- level of controversy regarding proposed management actions
- fishery-related job satisfaction
- family and community cultural values related to fishing
- religious and other norms satisfied by fishing activities

Rather than developing new stand-alone subjective wellbeing/social surveys, however, the inclusion and use of additional social data should be promoted within already well-established marine industry evaluation programs and reports (ex. Economic Data Collection (EDC) program, or on-board fishery observation programs, NMFS's Pacific Coast Groundfish Trawl Fishery Social Study, IOPAC modeling, Fisheries Economics & Sociocultural Status & Trends series).

It is also highly recommended that some measures—life-satisfaction, for example— be based on the data capture methods of at least one major national survey, such as the Gallup-Healthways Well-Being survey, to allow managers and decision-makers to compare the subjective wellbeing of specific social groups with the national U.S. mean. As contentious issues—such as the introduction of marine-based renewable energy projects in coastal areas—raise trade-off concerns between the wellbeing of local communities vs. the nation as a whole, having some measures that allow for comparison across scales will become increasingly valuable.

- **Identify indicator thresholds and the process impacts of exceeding those thresholds.**

Social scientists developing human wellbeing indicators for PFMC consumption via CCS-IEA reports should keep in mind the CCS-IEA's current indicator format (Figure 14). They should also respect the tremendous pressure that the NEPA-driven social impact assessment framework places on Council decision-makers. Consistent indicator formats that clearly outline social impact thresholds and the necessary management requirements (ex. EIS vs. EA) that result from exceeding those thresholds will be much more valuable to a Council and staff already overwhelmed by data, reports and legal mandates. Communities which have been identified as priorities by the PFMC should also be engaged in the identification of their own wellbeing thresholds. The project survey undertaken for this study revealed that communities—although often consulted to identify and prioritize the factors that contribute to their wellbeing—are rarely involved directly in establishing the acceptable limits to or consequences of their own changing conditions.

- **Meaningfully involve tribal communities in the identification of their own wellbeing priorities, indicators and risk factors.**

As discussed above, the PFMC has identified tribal fisheries as a priority policy concern. However, as the indigenous vs. federal resource management project survey comparison in Chapter 4 demonstrated, tribal communities and government agencies may not always share the same views about what it takes for a native community to be "well". Tribal members will have their own ideas about what constitutes their own personal and community wellbeing. Indicator development initiatives of U.S. federal agencies should focus, therefore, on aiding the integration of tribally self-defined wellbeing metrics into the PFMC process rather than selecting and promoting the use of indicators believed to be culturally sensitive based on literature reviews or historic use precedents.

Risk assessments are also recommended in lieu of public consultations intended solely to identify or approve human wellbeing domains or indicators. Risk identification requires community members to reflect not only on things they care most about but also how these values are linked to and shaped by a community's social interactions. The World Economic Forum (WEF) has developed a global risk assessment methodology which could provide guidance for the identification of more locally-specific social risk drivers and support comparisons between social groups (WEF 2011, p. 46). By consulting legal documents, academic literature, other human wellbeing assessment projects, etc. an increasingly sophisticated and comprehensive picture of human wellbeing's many facets may be drawn. However, not all of these facets can or should be the focus of fishery resource managers. All aspects of human wellbeing remain important over time, but all aspects of well-being may not be under threat at any given moment. Risk assessments will point a community toward the immediate, near-term and long-term challenges that must be overcome to sustain well-being. Thus, having both a comprehensive view of human wellbeing's contributing factors and the ability to reprioritize them based on changing socio-ecological conditions may be more useful for managers of dynamic socio-ecological systems than simply referencing changes to a single index value over time.

6 Conclusion

This thesis has modeled a methodology for identifying a comprehensive definition and description of human and social wellbeing. It has identified a variety of human wellbeing focal

components which remain relevant across a variety of social contexts and spatial/temporal scales. However, it has also demonstrated that prioritizing and linking human wellbeing indicators to specific management and decision-making purposes—such as the California Current System IEA or the PFMC—requires ongoing consideration of local community values, social change drivers and dynamic governance goals and objectives. Resource managers operating in different geographic regions may use the same indicators to assess and compare human wellbeing but these data will not become truly meaningful for decision-making until they are viewed through the lens of their unique socio-ecological contexts.

Although scientists informing resource managers are increasingly recognizing the value of human dimensions research (Samhouri et al. 2013), many knowledge regimes still go to great lengths and expense to prioritize particular forms of inquiry and management practice. It is common practice to test and tinker with systematic and rational conceptual management frameworks informed by perfectly manageable sets of numeric indicators while the complex issues facing management agencies have yet to become systematic, rational and perfectly manageable problems. The use of both social and ecological indicators remains vital to understanding our world and the changes taking place around us. However, there will never be a perfect set of indicators to track and describe the vast spectrum of human and natural variability in the world. We must remain wary of our own potential for technological hubris and of taking shortcuts—in science, governance, and inter-agency operations—to avoid the persistent challenges of collective action, community engagement and rich social science research.

Adaptive management demands both the use and the continual refocusing of data sets to support both policy formation and knowledge production. But no directional change in indicator data will ever be clear evidence of good resource management and we must not—intentionally or unintentionally—mistake prescriptive formulas of inquiry for the laws of good governance. At their best, indicators are merely proxies for the exchange of information between diverse epistemic communities and world views. Indicators alone can't bridge these divides. Nevertheless, both social science and indicators of human wellbeing can be important and useful tools in marine resource management. To make these tools meaningful, it is essential that both their potential contributions as well as their limitations are thoroughly explored within the context of specific governance institutions and the pursuit of well-defined—and rigorously debated—social goals.

7 References

Alberti, M. 2008. Advances in Urban Ecology : integrating humans and ecological processes in urban ecosystems. New York: Springer.

Aristotle and J. Sachs. 2002. *Nicomachean ethics*. Newbury, MA, Focus Pub./R. Pullins.

Armitage, D., C. Béné, A. T. Charles, D. Johnson, and E. H. Allison. 2012. The interplay of well-being and resilience in applying a social-ecological perspective. Ecology and Society, 17(4):15.

Asheim, G. 1997. Adjusting green NNP to measure sustainability. Journal of Economics, 99(3): 335-70.

Atkins, J.P., Burdon, D., Elliott, M., and A.J. Gregory. 2011. Management of the marine environment: integrating ecosystem services and societal benefits with the DPSIR framework in a systems approach. Marine Pollution Bulletin, 62: 215–226.

Australian Bureau of Statistics [ABS]. 2001. Measuring Wellbeing: Frameworks for Australian Social Statistics. Canberra: Australian Government Printing Service.

Beamish, T.D. and K. Paulson. 2000. Santa Barbara Channel Post-Petroleum Economy: Environmental Consulting Proliferates. California Islands Symposia Compendium, 5: 698-702. Santa Barbara, CA: MBC Environmental Sciences. February 2000.

Beaumont, J. 2011. Measuring National Well-being: A discussion paper on domains and measures. London: Office for National Statistics.

Biedenweg, K. and A. Hanein. 2013. Developing Human Wellbeing Indicators for the Hood Canal Watershed. Tacoma, WA: Puget Sound Institute.

Berger, A.R. and R.A. Hodge. 1998. Natural change in the environment: a challenge to the pressure–state–response concept. Social Indicators Research, 44, 255–265.

Berger, B. 2013. NOAA Cuts Deal with Congress to Avoid Furloughs. Space News. Retrieved online November 12, 2013 from: http://www.spacenews.com/article/civil-space/35579noaa-cuts-deal-with-congress-to-avoid-furloughs?utm_source=feedly#.Uayh0-sZGCi

Berger-Schmitt, R. and B. Jankowitsch. 1999. Systems of Social Indicators and Social Reporting, EuReporting Working Paper No. 1. Mannheim: Centre for Survey Research and Methodology.

Bird, J., Land, L. and M. Macadam (Eds). 2002. Nation to Nation: Aboriginal Sovereignty and the Future of Canada. Vancouver, B.C.: Irwin Publishing.

Boarini,R., Johansson, Å., and M.M. d'Ercole. 2006. Alternative Measures of Well-being. OECD Statistics Brief, 11. Retreived August 14, 2014 from http://www.oecd.org/els/soc/36967254.pdf.

Boling, W., Macrina, D.M., and Clancy, J.P. 2003. The care giver quality of life cystic fibrosis (CQOLCF) scale: Modification and validation of an instrument to measure quality of life in cystic fibrosis family caregivers. Quality of Life Research; 12:1119-1126.

Bolt, K., Matete, M. and Clemens, M. 2002. Manual for Calculating Adjusted Net Savings. Environment Department, World Bank. Retrieved August 14, 2014 from http://siteresources.worldbank.org/INTEEI/1105643-1115814965717/20486606/Savingsmanual2002.pdf

Boulanger, P. 2007. Political uses of social indicators: overview and application to sustainable development indicators. International Journal of Sustainable Development, 10 (1-2):14-32.

Bowen, R.E. and C. Riley. 2003. Socio-economic indicators and integrated coastal management. Ocean & Coastal Management, 46: 299-312.

Brady, M.J., Peterman, A.H., Fitchett, G., Mo, M., and Cella, D. 1999. A case for including spirituality in quality of life measurement in oncology. Psycho-Oncology, 8: 417-428.

Brickman, P. and D.T. Campbell. 1971. Hedonic relativism and planning the good society. In M.H. Appley (Ed.), Adaptation Level Theory: A Symposium. New York: Academic Press.

Brinson, A.A. and E. M. Thunberg 2013. The Economic Performance of U.S. Catch Share Programs. U.S. Dept. of Commerce, NOAA Technical Memorandum NMFSF/SPO-133, 160 p.

Brown B.B. and D.D. Perkins. 1992. Disruptions in Place Attachment. In I. Altman and S.M. Low (Eds.), Place Attachment (pp. 279-304). New York: Plenum Press.

Burke, S. and W.F. Gaughran. 2006. Intelligent environmental management for SMEs in manufacturing. Robotics and Computer-Integrated Manufacturing, 22: 566-575.

Callan, S.J, and J.M. Thomas 2000. *Environmental Economics and Management: Theory, Policy, and Applications*. Fort Worth, TX: Dryden Press.

Canadian Index of Wellbeing. 2014. What is Wellbeing? Retrieved August 16, 2014 from: https://uwaterloo.ca/canadian-index-wellbeing/wellbeing-canada/what-wellbeing

Carr, E.R., Wingard, P.M., Yorty, S.C., Thompson, M.C., Jensen, N.K. and J. Roberson. 2007. Applying DPSIR to Sustainable Development. *International Journal of Sustainable Development & World Ecology* 14: 543–55.

Chan, Y.K., Kwan, C.C.A. and T.L.D. Shek. 2005. Quality of Life in Hong Kong: The CUHK Hong Kong Quality of Life Index. Social Indicators Research, 71: 259-289.

Clay, P.M., Kitts, A. and P. Pinto da Silva. 2014. Measuring the social and economic performance of catch share programs: Definition of metrics and application to the U.S. Northeast Region groundfish fishery. Marine Policy, 44: 27-36.

Cobb, C., T. Halstead, and J. Rowe. 1995. If the GDP is Up, Why is America Down? The Atlantic Monthly, 276 (4): 59.

Cobb, C. and C.Rixford. 1998. Lessons Learned from the History of Social Indicators. San Francisco: Redefining Progress.

Cobb, C. 2000. Measurement Tools and the Quality of Life. San Francisco, CA: Redefining Progress.

Cohen, P. C. 1982. A Calculating People: The Spread of Numeracy in Early America. Chicago: University of Chicago Press.

Community Foundations of Canada. 2013. VitalSigns Data. Retrieved October 5, 2013 from http://www.vitalsignscanada.ca/en/about

Cooke, B. and U. Kothari (Eds.) 2001. Participation: The New Tyranny? New York: Zed Books

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P. and M. van den Belt. 1997. The total value of the world's ecosystem services and natural capital. Nature 387: 253-260.

Coulthard, S., Johnson, D., and J.A. McGregor. 2011. Poverty, sustainability and human wellbeing: A social wellbeing approach to the global fisheries crisis. Global Environmental Change, 21 (2): 453-463.

Council on Environmental Quality [CEQ]. 1970. The First Annual Report of the Council on Environmental Quality. Washington, D.C.: Executive Office of the President.

Cummins, R.A. 2001. Life satisfaction: measurement issues and a homeostatic model, in B. Zumbo (ed.), Social Indicators and Quality of Life Research Methods: Methodological Developments and Issues, Yearbook. Amsterdam: Kluwer Academic.

Cummins, R. A., Eckersley, R., Pallant, J., Van Vugt, J., and R. Misajon, R. 2003. Developing a national index of subjective wellbeing: The Australian Unity Wellbeing Index. Social Indicators Research, 64 (2): 159-190.

Curtin R, and R. Prellezo. 2010. Understanding marine ecosystem based management: a literature review. Marine Policy, 34: 821–830.

De Groot, R.S. 1992. Functions of nature: evaluation of nature in environmental planning, management and decision-making. Groningen, the Netherlands: Wolters Noordhoff BV.

Deiner, E. 1994. Assessing Subjective Well-Being: Progress and Opportunities. Social Indicators Research, 31: 103-157.

Diener, E., Emmons, R. A., Larsen, R. J., and S. Griffin. 1985. The Satisfaction with Life Scale. Journal of Personality Assessment, 49(1), 71-75.

Diener, E., Oishi, S., and R.E. Lucas. 2002. Subjective well-being: The science of happiness and life satisfaction. In C.R. Snyder & S.J. Lopez (Ed.), Handbook of Positive Psychology. Oxford and New York : Oxford University Press.

Dillard, M.K., Goedeke, T.L.,Lovelace, S., and A. Orthmeyer. 2013. Monitoring Well-being and Changing Environmental Conditions in Coastal Communities: Development of an Assessment Method. NOAA Technical Memorandum NOS NCCOS 174. Silver Spring, MD. 176 pp.

Donovan, N. and D. Halpern. 2002. Life satisfaction: The state of knowledge and the implications for government. London: Prime Minister's Strategy Unit.

Easterlin, R. A., 1974. Does Economic Growth Improve the Human Lot? in Paul A. David and Melvin W. Reder, eds., Nations and Households in Economic Growth: Essays in Honour of Moses Abramovitz. New York: Academic Press, Inc.

Easterlin, R. A. 2001. Income and happiness: Towards a unified theory. Economic Journal, 777(473): 465 484.

The Economist. 2006. The birth of philanthrocapitalism. [Special section]. The Economist 23 Feb, 2006. Retrieved online November 22, 2014 from: http://www.economist.com/node/5517656 .

Feeney, R.G. 2012. The collection and use of sociocultural information in New England Fishery Management Council processes. Newburyport, MA: New England Fishery Management Council.

Environmental Protection Agency [EPA]. 2012. Indicators and Methods for Constructing a U.S. Human Well-being Index (HWBI) for Ecosystem Services Research. Report #EPA/600/R-12/023. Gulf Breeze, Fl: Office of Research and Development, Gulf Ecology Division.

Fitzpatrick, M. 2013. Death of scientific evidence mourned on Parliament Hill. CBC News. Retrieved online October 12, 2013 from: http://www.cbc.ca/news/politics/death-of-scientific-evidence-mourned-on-parliament-hill-1.1218019 .

Fluharty, D. 2012. Recent Developments at the Federal Level in Ocean Policymaking in the United States. Coastal Management. 40: 209-221.

Flyvbjerg, B. 1998. Rationality and Power: Democracy in Practice. Chicago: University of Chicago Press.

Foley M. M., Armsby, M.H., Prahler, E.E, Caldwell, M.R., Erickson, A.L., Kittinger, J.N., Crowder L.B. & P.S. Levin. 2013. Improving Ocean Management through the Use of Ecological Principles and Integrated Ecosystem Assessments. BioScience. 63 (8): 619-631.

Folke, C., S. Carpenter, T. Elmqvist, L. Gundersen, C. S Holling, B. Walker, J. Bengtsson, F. Berkes, J. Colding, K. Danell, M. Falkenmark, L. Gordon, R. Kasperson, N. Kautsky, A. Kinzig, S. Levin, K-G. Mäler, F. Moberg, L. Ohlsson, P. Olsson, E. Ostrom, W. Reid, J. Rockström, H. Savenije and U. Svedin. 2002. Resilience and Sustainable Development. Science Background Paper commissioned by the Environmental Advisory Council of the Swedish Government in preparation for WSSD. ICSU Series on Science for Sustainable Development Vol. 3. Paris, International Council for Science.

Folke, C. 2006. Resilience: The emergence of a perspective for social-ecological systems analyses. Global Environmental Change. 16: 253-367.

Foucault, M. 1975. *Surveiller et punir : Naissance de la prison*. Paris: Gallimard.

Frick, E., Borasio, G., Zehentner, H., Fischer, N., and I. Bumeder. 2004.Individual quality of life of patients undergoing autologous peripheral blood stem cell transplantation. Psycho-Oncology, 13:116-124.

Fried, M. 1963.Grieving for a Lost Home. In L. J. Duhl (Ed.), The Urban Condition (pp. 151-171). New York: Basic Books.

Gallup. 2009. Gallup-Healthways Well-Being Index: Methodology Report for Indexes. Washington, D.C.: Gallup, Inc.

Gallup-Healthways. 2013. State of Washington Well-Being: 2013 State, Community, and Congressional District Analysis. Franklin, TN: Gallup-Healthways Well-Being Index. Retrieved online December 12, 2014 from: http://cdn2.hubspot.net/hub/162029/file-624702203-pdf/WBI2013/Washington_2013_State_Report.pdf?t=1417557607467

Gilmartin, K. J., Rossi, R.J., Lutomski, L.S. and D. F. B. Reed. 1979. Social Indicators: An Annotated Bibliography of Current Literature. New York: Garland Publishing.

Giuliani, M.V. 2003. Theory of attachment and place attachment. In M. Bonnes, T. Lee and M. Bonaiuto (Eds.), Psychological theories for environmental issues (pp. 137-170). Aldershot: Ashgate.

Greenwood, C. 2013. Muzzling Civil Servants: A Threat to Democracy? University of Victoria Environmental Law Clinic. Retrieved online November 11, 2013 from: http://www.elc.uvic.ca/press/documents/2012-03-04-Democracy-Watch_OIPLtr_Feb20.13-with-attachment.pdf

Gregory, R., Lichtenstein, S. and P. Slovic. 1993. Valuing Environmental Resources: A Constructive Approach. Journal of Risk and Uncertainty, 7: 177-197.

Hagerty, M.R., Cummins, R.A., Ferriss, A.L., Land, K., Michalos, A.C., Peterson, M., Sharpe, A., Sirgy, M.J., and Vogel, J. 2001. Quality of life indexes for national policy: review and agenda for research. Social Indicators Research, 55(1): 1-96.

Hák, T., Moldan, B. and A. L. Dahl (Eds). 2007. *Sustainability Indicators: A Scientific Assessment*. Washington, DC: Island Press.

Halpern, B.S., Longo, C., Hardy, D., McLeod, K.L., Samhouri, J.F., Katona, S.K., Kleisner, K, Lester, S.E., O'Leary, J., Ranelletti, M., and others. 2012. An index to assess the health and benefits of the global ocean. Nature 488:615–620.

Hamilton, K. and M. Clemens. 1999. Genuine savings rates in developing countries. World Bank Economic Review 13(2): 333-56.

Harnett, C. 2013. Another round of cuts planned for Fisheries and Oceans Canada. Times Colonist. Retrieved online October 26, 2013 from: http://www.timescolonist.com/business/another-round-of-cuts-planned-for-fisheries-and-oceans-canada-1.96029

Hartwick, J. 1994. National wealth and net national product. Scandinavian Journal of Economics, 99(2): 253-56.

Hatton, C. 1998. Whose quality of life is it anyway? Some problems with the emerging quality of life consensus. Mental Retardation, 36 (2): 104-15.

Hazards and Vulnerability Research Institute [HVRI]. 2014. Social Vulnerability Index for the United States – 2006-2010. Retrieved online November 15, 2014 from: http://webra.cas.sc.edu/hvri/products /sovi.aspx

Helliwell, J. F. 2003. How's life? Combining individual and national variations to explain subjective well being. Economic Modeling, 20: 331-360.

Helliwell, J., & Putnam, R. D. 2005. The social context of well-being. In F. A. Huppert, B. Keverne & N. Baylis (Eds.), The science of well-being (pp. 435-459). Oxford: Oxford University Press.

Hobbes, T. 1651. *The Leviathan: Or the Matter, Forme, and Power of a Common-Wealth Ecclesiasticall and Civill*. I. Shapiro, ed. Cambridge, MA: Yale University Press, 2010.
Huppert, F.A., Marks, N., Clark, A., Siegrist, J., Stutzer, A., Vittersø, J., and M. Wahrendorf. 2009. Measuring Well-Being across Europe: Description of the ESS Well-Being Module and Preliminary Findings. Social Indicators Research, 91 (3): 301-314.

Idle No More. 2013. Calls for Change. IdleNoMore.com. Retrieved online November 11, 2013 from: http://www.idlenomore.ca/calls_for_change.

IOC-UNESCO, 2011. Methodology for the GEF Transboundary Waters Assessment Programme. Volume 5. Methodology for the Assessment of Large Marine Ecosystems. Nairobi, Kenya: United Nations Environment Programme.

Innes, J.E. 1990. Knowledge and Public Policy: The Search for Meaningful Indicators. New Jersey: Transaction Publishers.

Interorganizational Committee on Guidelines and Principles for Social Impact Assessment [ICGPSIA]. 2003. Principles and Guidelines for Social Impact Assessment in the USA. Impact Assessment and Project Appprаisal, 21 (3): 231-250.

Jenkins, G.W. Who's Afraid of Philanthrocapitalim? *Case Western Reserve Law Review*, 61: 1-69.

Kant, I. and M. J. Gregor. 1998. *Groundwork of the metaphysics of morals*. Cambridge, U.K: Cambridge University Press.

Kelble, C.R., D.K. Loomis, S. Lovelace, W.K. Nuttle, P.B. Ortner, P. Fletcher, G.S. Cook, J.J. Lorenz and J.N. Boyer. 2013. The EBM-DPSER conceptual model: integrating ecosystem services into the DPSIR framework. *PLOSone* 8(8): e70766. doi:10.1371/journal.pone.0070766.

Kemmler, G., Holzner, B., Neudorfer, C., Meise, U., and H. Hinterhuber. 1997. General satisfaction and domain specific quality of life in chronic schizophrenic patients. Quality of Life Research, 6: 265-273

Kirchhoff, D., Gardner, H.L., Tsuji, L. 2013. The Canadian Environmental Assessment Act, 2012 and Associated Policy: Implications for Aboriginal Peoples. The International Indigenous Policy Journal, 4 (3).

Kuznets, S. 1962. How To Judge Quality. The New Republic, October 20, 1962.

Kuznets, S., 1934. National Income, 1929–1932. Cambridge, MA: National Bureau of Economic Research.

LaMarche, G. 2014. Democracy and the Donor Class. *Democracy*, 34: 48-59.

Lau, A. L. D., Cummins, R. A., and W. McPherson. 2005. An investigation into the Cross-Cultural Equivalence of the Personal Wellbeing Index. Social Indicators Research, 72 (3), 403-430.

Leahy, S. 2011. Canada cuts environmental spending. The Guardian. Retrieved online October 25, 2013 from: http://www.theguardian.com/environment/2011/nov/09/canada-cuts-environment-spending

Leiby, J. 1960. Carroll Wright and Labor Reform: The Origin of Labor Statistics. Cambridge: Harvard University Press.

Levett, R. 1998. Sustainability Indicators—Integrating Quality of Life and Environmental Protection. Journal of the Royal Statistical Society, Series A (Statistics in Society), 161 (3), 291-302.

Levin, P.S., Fogarty, M.J., Murawski, S.A. and D. Fluharty. 2009. Integrated Ecosystem Assessments: Developing the Scientific Basis for Ecosystem-Based Management of the Ocean. PLoS Biol 7(1): e1000014.doi:10.1371/journal.pbio.1000014

Locke, J. 1689. *Two treatises of government*. P. Laslett, ed. Cambridge, UK: Cambridge University Press. 1988.

Machlis, G.E., Force, J.E. and W.R. Burch. 1997. The human ecosystem Part I: The human ecosystem as an organizing concept in ecosystem management. Society & Natural Resources, 10(4): 347-367

Malone, E. 2009. Vulnerability and Resilience in the Face of Climate Change: Current Research and Needs for Population Information. Washington, D.C.: Population Action International.

Manzo, L.C. and D.D. Perkins. 2006. Finding Common Ground: The Importance of Place Attachment to Community Participation and Planning. Journal of Planning Literature, 20 (4): pp. 335-350.

Marin, A. and F. Berkes. 2010. Network approach for understanding small-scale fisheries governance: The case of the Chilean coastal co-management system. Marine Policy, 34:851-858.

McDonnell, M.J. and S.T.A. Pickett. Ecosystem Structure and Function Along Urban-Rural Gradients: An Unexploited Opportunity for Ecology. Ecology, 71(4): 1232-1237.

McCubbin, L.D., McCubbin, H.I., Zhang, W., Kehl, L. and I. Strom. 2013. Relational Well-being: An Indigenous Perspective and Measure. Family Relations, 62: 354-365.

McGregor, J.A. 2008. Wellbeing, Poverty and Conflict WeD Policy Briefing 01/08. Retrieved August 14, 2014 from: http://www.bath.ac.uk/econ-dev/wellbeing/research/bp/bp1-08.pdf.

McShane, T.O., Hirsch, P.D., Trung, T.C., Songorwa, A.N., Kinzig, A., Monteferri,B., Mutekanga, D., Thang, H.V., Dammert, J.L., Pulgar-Vidal, M., Welch-Devine, M., Brosius, J.P., Coppolillo, P. and S. O'Connor. 2011. Hard choices: Making trade-offs between biodiversity conservation and human well-being. Biological Conservation, 144: 966-972.

Mill, J.S. 1863. "Utilitarianism", in *Collected Works of John Stuart Mill, Vol. X: Essays on Ethics, Religion and Society*, J. M. Robson (ed.), Toronto: University of Toronto Press, 1969.

Millennium Ecosystem Assessment [MEA]. 2005. Ecosystems and Human Well-being: Synthesis. Washington, DC: Island Press.

McLeod, P. 2013. Defence, Fisheries under axe. Ottawa Bureau. Retrieved online October 25, 2013 from: http://thechronicleherald.ca/novascotia/1083223-defence-fisheries-under-axe

Morgan, G. 2005. The Idea of a European Superstate: Public Justification and European Integration. Princeton: Princeton University Press.

Murawski, S., and G. Matlock. (Eds.) 2006. Ecosystem Science Capabilities Required to Support NOAA's Mission in the Year 2020. Technical Memorandum NMFS-F/SPO-74. U.S. Department of Commerce, NOAA.

National Marine Fisheries Service [NMFS]. 2007. Guidelines for Assessment of the Social Impact of Fishery Management Actions. Silver Spring (MD): National Oceanic and Atmospheric Administration.

National Marine Fisheries Service [NMFS]. 2013. Groundfish Essential Fish Habitat Synthesis: A Report to the Pacific Fishery Management Council. NOAA NMFS Northwest Fisheries Science Center, Seattle, WA, April 2013. 107 p.

National Marine Fisheries Service [NMFS]. 2014. Annual State of the California Current Ecosystem Report. Northwest and Southwest Fisheries Science Centers. Retrieved December 12, 2014 from: http://www.pcouncil.org/wp-content/uploads/C1a_ATT1_IEA_STATE_of_CA_CURRENT2013b_MAR2014BB.pdf

National Ocean Council [NOC]. 2013. National Ocean Policy Implementation Plan. Washington, D.C.: Executive Office of the President.

National Oceanic and Atmospheric Administration [NOAA]. 2010. NOAA's Next-Generation Strategic Plan. Silver Spring, MD: NOAA Office of Program Planning and Integration.

National Oceanic and Atmospheric Administration [NOAA]. 2014. Japan Tsunami Marine Debris. Retrieved August 14, 2014 from: http://marinedebris.noaa.gov/tsunamidebris/faqs.html

Ness B., Anderberg S., and L. Olsson. 2010. Structuring problems in sustainability science: the multi level DPSIR framework. Geoforum, 41: 479–488.

Niemeijer, D. and R.S. de Groot. 2008. Framing environmental indicators: moving from causal chains to causal networks. Environmental Development & Sustainability, 10: 89-106.

Noll, H. 2000. Social indicators and social reporting: the international experience, in Canadian Council on Social Development (Ed.) Symposium on Measuring Well-Being and Social Indicators, Ottawa.

Norman, K., Sepez, J., Lazrus, H., Milne, N., Package, C., Russell, S., Grant, K, Lewis, R.P., Primo, J., Springer, E., Styles, M., Tilt, B., and I. Vaccaro. 2007. Community profiles for West Coast and North Pacific fisheries–Washington, Oregon, California, and other U.S. states. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-85, 602 p.

Nussbaum, M. 2000. Women and Human Development. New York: Cambridge University Press.

Ohio v. United States Department of the Interior. 880 F. 2d 432 (D.C. Cir. 1989).

Organisation for Economic Cooperation and Development [OECD]. 2001. The well-being of nations: the role of human and social capital. Paris: Centre for Educational Research and Innovation.

Pacific Fishery Management Council [PFMC]. 2005. Social science in the Pacific Fishery Management Council process. Pacific Fishery Management Council, Portland, Oregon 97220-1384. July 2005.

Pacific Fishery Management Council [PFMC]. 2011a. Fishery Management Plan for the U.S. West Coast Fisheries For Highly Migratory Species. Portland, OR: Pacific Fishery Management Council.

Pacific Fishery Management Council [PFMC]. 2011b. Coastal Pelagic Species Fishery Management Plan. Portland, OR: Pacific Fishery Management Council

Pacific Fishery Management Council [PFMC]. 2012. Pacific Coast Salmon Plan. Portland, OR: Pacific Fishery Management Council.

Pacific Fishery Management Council Staff [PFMC's Staff]. 2012. An FMP Amendment to Change the Groundfish Specifications and Management Measures Process. Portland, OR: Pacific Fishery Management Council.

Pacific Fishery Management Council [PFMC]. 2013a. Pacific Coast Fishery Ecosystem Plan for the U.S. Portion of the California Current Large Marine Ecosystem. Portland, OR: Pacific Fishery Management Council.

Pacific Fishery Management Council [PFMC]. 2013b. Research and Data Needs. Portland, OR: Pacific Fishery Management Council.

Pacific Fishery Management Council [PFMC]. 2014. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery. Portland, OR: Pacific Fishery Management Council.

Pacific Fishery Management Council [PFMC] and National Marine Fisheries Service [NMFS]. 2006. Proposed Acceptable Biological Catch and Optimum Yield Specifications and Management Measures for the 2007-2008 Pacific Coast Groundfish Fishery, and Amendment 16-4: Rebuilding Plans For Seven Depleted Pacific Coast Groundfish Species; Final Environmental Impact Statement Including Regulatory Impact Review and Initial Regulatory Flexibility Analysis. Portland, OR: Pacific Fishery Management. October 2006.

Palazzo, D. and D.F.R. Steiner. 2011. Urban Ecological Design: A Process for Regenerative Places. Washington, D.C.: Island Press

Pavot, W., Diener, E., Colvin, C. R., and E. Sandvik. 1991. Further validation of the Satisfaction with Life Scale: Evidence for the cross-method convergence of well-being measures. Journal of Personality Assessment, 57(1), 149-161.

Pearce, D.W. and J.W. Warford. 1993. World without end: economics, environment and sustainable development. Oxford: Oxford University Press.

Penn University Positive Psychology Center. 2014. Positive Psychology Center. Retrieved August 14, 2014 from: http://www.ppc.sas.upenn.edu/

Pimentel, D. and C. Wilson. 1997. Economics and environmental benefits of biodiversity. BioScience 47(11): 747-58.

Pollnac, R.B., Abbott-Jamieson, S., Smith, C., Miller, M.L., Clay, P.M., and B. Oles. 2009. Toward a Model for Fisheries Social Impact Assessment. Marine Fisheries Review, 68 (1-4): 1-18.

Puget Sound Partnership [PSP]. 2011. Puget Sound Science Update. Seattle, WA: Puget Sound Partnership.

Rabinow, P. (Ed). 1991. The Foucault Reader: An introduction to Foulcault's though. London: Penguin.

Rapley, M. 2001. Policing happiness, In: C. Newnes, G. Holmes, and C. Dunn (eds), This is Madness Too. Ross-on-Wye: PCCS Books.

Rapley, M. 2003. Quality of Life Research: A Critical Introduction. London: SAGE Publications Ltd.

Rapport, D.J., Gaudet, C., Karr, J.R., Baron, J.S., Bohlen, C., Jackson, W., Jones, B., Naiman, R., Norton, B., and M.M. Pollock. 1998. Evaluating landscape health: integrating societal goals and biophysical process. Journal of Environmental Management, 53 (1): 1–15.

Rekolainen, S., Kämäri, J., and M. Hiltunen. 2003. A conceptual framework for identifying the need and role of models in the implementation of the water framework directive. International Journal of River Basin Management, 1(4), 347–352.

Richard, A.M. 2009. Mediating Dilemmas: Local NGOs and Rural Development in Neoliberal Mexico. *Political and Legal Anthropology Review*, 32: 166-194.

Robeyns, I. 2011, April 14). The Capability Approach. The Stanford Encyclopedia of Philosophy. Stanford, CA: The Metaphysics Research Lab.

Rousseau, J.J. 1762. *The Social Contract and Discourses*. Trans., D.H. Cole. London: Everyman's Library, 1913.

Rydin, Y. 2007. Indicators as a governmental technology? The lessons of community-based sustainability indicator projects. Environment and Planning D: Society and Space, 25: 610-624.

Rydin, Y., Holman, N. and E. Wolff. 2003. Local Sustainability Indicators. Local Environment, 5(2): 153-169.

Samhouri, J. F., Haupt, A. J., Levin, P. S., Link, J. S., and Shuford, R. 2013. Lessons learned from developing integrated ecosystem assessments to inform marine ecosystem-based management in the USA. ICES Journal of Marine Science, doi:10.1093/icesjms/fst141

Sandvik, E., Diener, E., and L. Seidlitz. 1993. Subjective Well-being: The convergence and stability of self-report and non-self-report measures. Journal of Personality, 61 (3), 317-342.

Schiaffino, K.M. 2003. Other Measures of Psychological Well-Being. Arthritis & Rheumatism, 49 (5S): S165-S174.

Scott, K. 2012. Measuring Wellbeing: Towards Sustainability? London: Routledge.

Scottish Executive Social Research [SESR]. 2005. Well-being and Quality of Life: Measuring the Benefits of Cultura and Sport: A Literature Review and Thinkpiece. Victorial Quay, Edinburgh: Information and Analytical Services Division, Scottish Executive Education Department.

Seidlitz, L., Wyer, R.S., and E. Diener. 1997. Cognitive correlates of Subjective Well-being: The processing of balanced life events by happy and unhappy persons. Journal of Research in Personality, 31 (2): 240-256.

Sen, A. K. 1981. Poverty and Famines: An Essay on Entitlement and Deprivation. Oxford: Clarendon Press.

Sen, A. K. 1999. Development as Freedom. Oxford, United Kingdom: Oxford University Press.

Sheltair Group. 2009. Ecosystem Based Management Human Well Being Indicators 2006 Baseline Report - Final. Ecosystem Based Management Working Group.

Sherman K., Sissenwine M.P., Christensen V., Duda A.L., Hempel G., Ibe C.A., Levin S., Lluch-Belda D., Matishov G., McGlade J.M., O'Toole M.J., Seitzinger S., Serra R., Skjoldal H.R., Tang Q., Thulin J., Vandeweerd V., Zwanenburg K.C.T.. 2005. A global movement toward an ecosystem approach to management of marine resources. Marine Ecology Progress Series, 300: 275–279.

Sherman, K., Aquarone, M.C. and S. Adams. (Eds.). 2009. Sustaining the World's Large Marine Ecosystems. Gland, Switzerland:IUCN.

Smith, A. 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations*, E. Cannan, ed. London: Methuen & Co, Ltd. 1904.

Smith, C.L. and P.M. Clay. 2010. Measuring Subjective and Objective Well-being: Analyses from Five Marine Commercial Fisheries. Human Organization, 69: 158-168.

Smith, J. A. 1991. The Idea Brokers: Think Tanks and the Rise of the New Policy Elite. New York: Free Press.

Smith, L.M., Case, J.L., Smith, H.M., Harwell, L.C., and J.K. Summers. 2013. Relating ecosystem services to domains of human wellbeing: Foundation for a U.S. Index. Ecological Indicators, 28: 79-90.

Spinoza, B. 1677. *Ethics*. Trans. Curley E. London: Penguin Classics, 2005.

Starace, F., Cafaro, L., Abrescia, N., Chirianni, A., Izzo, C., Rucci, P., and G. de Girolamo. 2002. Quality of life assessment in HIV-positive persons: Application and validation of the WHOQOL-HIV, Italian version. AIDS Care,14:405-415.

Statistics Netherlands. 2011. Sustainability Monitor for the Netherlands 2011. The Hague: Statistics Netherlands.

Steiner, F. 2004. Urban human ecology. Urban Ecosystems, 7: 179-197.

Stiglitz, J., A. Sen and J.P. Fitoussi. 2009. Report of the Commission on the Measurement of Economic Performance and Social Progress. Paris. Available online from the Commission on the Measurement of Economic Performance and Social Progress: http://www.stiglitz-sen-fitoussi.fr/en/index.htm

Stiglitz, J. E, Sen, A. and J.Fitoussi. 2010. Mis-Measuring Our Lives: Why GDP Doesn't Add Up. New York: The New Press.

Stone, A.A., Shiftman, S.S., and M.M. DeVries. 1999. In F. Strack, M. Argyle, & N. Schwarz (Eds.), Subjective Well-being: an interdisciplinary perspective (pp.27-48). Oxford: Pergamon.

Summers, J.K., Smith, L.M., Case, J.L. and R.A. Linthurst. 2012. A Review of the Elements of Human Wellbeing with an Emphasis on the Contribution of Ecosystem Services. AMBIO, 41: 327-340.

Sutinen, J.G. (Ed). 2000. A Framework for Monitoring and Assessing Socioeconomics and Governance of Large Marine Ecosystems. Woods Hole, MA: NOAA-NMFS Northeast Fisheries Science Center.

Social Wellbeing Indicators for Marine Management [SWIMM]. 2014. SWIMM Working Group Meeting 1 Summary Notes. Seattle, WA: NOAA-NMFS Northwest Fishery Science Center.

Svarstad H., Petersen L.K., Rothman D., Siepel H., and F. Wätzold. 2008. Discursive biases of the environmental research framework DPSIR. Land Use Policy 25: 116–125

Talberth, J., Cobb, C., and N. Slattery. 2007. The Genuine Progress Indicator 2006: A Tool for Sustainable Development. Oakland, CA: Redefining Progress.

Terry, A. 2008. Community sustainable-development indicators: a useful participatory technique or another dead end? Development in Practice, 18 (2): 223-234.

Thumboo, J., Fong, K., Machin, D., Chan, S., Soh, C., Leong, K., Feng, P., Thio, S., and M. Boey. 2003. Quality of life in an urban asian population: The impact of ethnicity and socio-economic status. Social Science & Medicine, 56: 1761-1772.

Tscherning, K., Helming, K., Kripperner, B., Sieber, S., and S. Gomez y Paloma. 2012. Does research applying the DPSIR framework support decision making? Land Use Policy. 29: 102-110.

ul Haq, M. 1995. Reflections on Human Development. New York: Oxford University Press.

United Kingdom Environmental Audit Committee [UKEAC]. 2006. The UN Millenium Ecosystem Assessment. First Report of Session 2006-07. London: House of Commons.

United Nations Development Programme [UNDP]. 1990. Human Development Report. Oxford: Oxford University Press.

United States Census Bureau. 2013. Well-Being. Retrieved August 14, 2014 from: http://www.census.gov/hhes/well-being/

United States Census Bureau. 2014. 2013 American Community Survey 1-Year Estimates. Web. Retrieved December 12, 2014 from: http://www.census.gov/fastfacts/

United States Environmental Protection Agency [USEPA] 2013. Indicators and Methods for Constructing a U.S. Human Wellbeing Index (HWB) for Ecosystem Services Research. Report #EPA/600/R-12/023. Gulf Breeze, FL: Office of Research and Development, Gulf Ecology Division.

Veenhoven, R. 1997. Advances in the understanding of happiness. Revue Québécoise de Psychologie, 18: 267-93.

Watson, D., Clark, L.A. , and A. Tellegen. 1988. Development and validation of brief measures of positive and negative affect: The PANAS scales. Journal of Personality and Social Psychology, 54(6): 1063-1070.

West Coast Governors Alliance on Ocean Health [WCGAOH]. 2008. West Coast Governors' Agreement on Ocean Health Action Plan. Retrieved August 15, 2014 from: http://www.westcoastoceans.org/action-plan-documents

Wilcox, L. D., R. M. Brooks, G. M. Beal & G.E. Longan. 1972. Social Indicators and Societal Monitoring: An Annotated Bibliography. San Francisco, CA: Jossey-Bass.

Williamson, M. 2012. The serious business of creating a happier world. The Guardian. 11 April 2012. Retrieved July 12, 2014 from: http://www.theguardian.com/sustainable-business/united-nations-happiness-conference-bhutan

World Commission on Environment and Development [WCED]. (1987). Our common future : report of the World Commission on Environment and Development. Oxford: Oxford University Press.

World Economic Forum [WEF]. 2011. Global Risks 2011 Sixth Edition. Geneva, Switzerland: World Economic Forum.

World Health Organization [WHO]. 1995. The World Health Organization Quality of Life (WHOQOL) assessment: Position paper from the World Health Organization. Social Science Medicine, 10:1043-10.

8 Appendices

Appendix A: Human Wellbeing & Quality of Life Definitions

Definition	Reference
"QOL is a multidimensional evaluation of an individual's current life circumstances in the context of the culture in which they live and the values they hold. QOL is primarily a subjective sense of well-being encompassing physical, psychological, social and spiritual dimensions. In some circumstances, objective indicators may supplement or, in the case of individuals unable to subjectively perceive, serve as proxy assessment of QOL."	Haas (1999) referenced in SESR (2005)
"Quality of life is multidimensional in construct including physical, emotional, mental, social, and behavioural components"	Janse (2004) referenced in SESR (2005)
"'Quality of life' and more specifically, 'health-related quality of life' refer to the physical, psychological, and social domains of health, seen as distinct areas that are influenced by a person's experiences, beliefs, expectations and perceptions (which we refer to here collectively as 'perceptions of health'. Each of these domains can be measured in two dimensions: objective assessments of functioning or health status, and more subjective perceptions of health."	Testa et al (1996) referenced in SESR (2005)
"Quality of life is a feeling of overall life satisfaction, as determined by the mentally alert individual whose life is being evaluated. Other people, preferably those from outside that person's living situation, must also agree that the individual's living conditions are not life-threatening and are adequate in meeting that individual's basic needs."	Meeberg (1993) referenced in SESR (2005)
"A multi-faceted construct that encompasses the individual's behavioural and cognitive capacities, emotional well-being, and abilities requiring the performance of domestic, vocational, and social roles".	Emerson (1985) referenced in SESR (2005)
"The satisfaction of an individual's values, goals and needs through the actualisation of their abilities or lifestyle".	Tartar et al (1988) referenced in SESR (2005)
"A subjective matter, reflected in a sense of global well-being".	Lehman (1983) referenced in SESR (2005)
"Personal values as well as life conditions and life satisfaction interact to determine quality of life. The significance of either the objective or subjective assessment of a particular life domain is interpretable only in relation to the importance the individual places on it."	Cummins (1992) referenced in SESR (2005)
"Wellbeing is a state of being with others, which arises where human needs are met, where one can act meaningfully to pursue one's goals, and where one can enjoy a satisfactory quality of life''	McGregor (2008)
"Human well-being has several key components: the basic material needs for a good life, freedom and choice, health, good social relations, and personal security. Well-being exists on a continuum with poverty, which has been defined as ''pronounced deprivation in well-being.''	Millennium Ecosystem Assessment (2005)
"human wellbeing is a relational construct encompassing all dimensions of the human ecology (Bronfenbrenner & Ceci, 1994), inclusive of the family unit, ancestors, the physical and the natural environment, extended family, adopted family, community, society, culture, and the world."	McCubbin et al. 2013

"Well-being is utilized as a measure of quality of life in many countries, cities, and localities and is typically broken into components related to economics, environment, basic human needs, and the subjective well-being of people. Many definitions of well-being include the following key components: basic material needs, freedom, health, good social relations, and personal security. A distinction is often made between basic human needs and subjective well-being. Basic human needs are things that are required for survival such as food, water, and shelter. Subjective well being, on the other hand, encompasses more by including those things that are not necessary for survival but are important to a positive emotional and psychological sense of life such as culture and aesthetics. Health is important to both. While personal safety such as the absence of acute trauma and disease is a basic need, chronic health issues are important to subjective well-being."	Dillard et al. 2013
"Wellbeing refers to the degree to which an individual, family or larger social grouping can be characterized as being healthy (sound and functional), happy, and prosperous."	Pollnac et al. 2009
“human wellbeing is a broad concept, one that encompasses many aspects of our everyday lives. It encompasses material well-being, relationships with family and friends, and emotional and physical health. It includes work and recreation, how one feels about one's community, and personal safety.”	Puget Sound Partnership 2011
“From birth to death, life enmeshes individuals within a dynamic culture consisting of the natural environment (light, heat, air, land, water, minerals, flora, fauna), the human made environment (material objects, buildings, roads, machinery, appliances, technology), social arrangements (families, social networks, associations, institutions, economies) and human consciousness (knowledge, beliefs, understanding, skills, traditions). Wellbeing depends on all the factors that interact within this culture and can be seen as a state of health or sufficiency in all aspects of life. Measuring wellbeing therefore involves mapping the whole of life, and considering each life event or social context that has the potential to affect the quality of individual lives, or the cohesion of society. At the individual level, this can include the physical, emotional, psychological and spiritual aspects of life. At a broader level, the social, material and natural environments surrounding each individual, through interdependency, become a part of the wellbeing equation”	ABS (2001: 6) referenced in Rapley 2003
"The presence of the highest possible quality of life in its full breadth of expression, focused on but not necessarily exclusive to: good living, standards, robust health, a sustainable environment, vital communities, an educated populace, balanced time use, high levels of democratic participation, and access to and participation in leisure and culture."	Canadian Index of Wellbeing 2014
"Individual well-being is intended to be measured here by people’s overall assessment of their own well-being. This assessment includes not only people’s thoughts and feelings but also how much meaning and purpose they attribute to the activities they do in their lives. Individual well-being is best understood by relating it to areas that directly affect overall individual well-being, as well as to more contextual domains that are important but contribute less directly to individual well-being. The overall effect of these different factors varies for different individuals, raising important considerations for analysis and policy beyond looking at individual well-being. Therefore, equality, fairness and sustainability issues are part of national well-being measures."	Beaumont 2011
Based on Diener & Kahneman: "Diener defines subjective well-being as “all of the various types of evaluations, both positive and negative, that people make of their lives. It includes reflective cognitive evaluations, such as life satisfaction and work satisfaction, interest and engagement, and affective reactions to life events, such as joy and sadness.” Kahneman makes particular note of the distinction between experienced well-being and evaluative well-being. Experienced well-being is concerned with momentary affective states and the way people feel about experiences in real-time, while evaluative well-being is the way they remember their experiences after they are over. Experienced well-being seeks to bypass the effects of “judgment and memory” and historically has been measured using the experience sampling method or the day reconstruction method, both of which seek to capture feelings and emotions as close to the subject’s immediate experience as possible. "	Gallup, Inc. 2009
"Mainstream opinions in more advanced societies tend to differentiate ‘quality of life’ from ‘standard of living’. Standard of living refers to the level of achieved satisfaction in basic materialistic needs. In addition to life chances and satisfaction in basic physiological needs, quality of life also covers satisfaction in emotional needs, such as being satisfied with freedom, justice, and opportunities for the complete development of individual capabilities."	Chan et al. 2005
"Happiness, like physical and mental health, denotes the degree to which people flourish in a society "	Veenhoven 1997

"Sufficient quality of life, that is not at the expense of the ability of future generations to meet their needs, and that does not have a detrimental effect on the quality of life in other countries."	Statistics Netherlands 2011
"an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations values and concerns… incorporating in a complex way the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of the environment... Quality of life refers to a subjective evaluation which is embedded in a cultural, social and environmental context... quality of life cannot simply be equated with the terms 'health status', 'life satisfaction', 'mental state', or 'well-being'. Rather it is a multidimensional concept"	WHOQOL Group (1993) referenced in Rapley 2003
"QOL is experienced when a person's basic needs are met and when he or she has the opportunity to pursue and achieve goals in major life settings… the QOL of an individual is intrinsically related to the QOL of other persons in his or her environment.. the QOL of a person reflects the cultural heritage of the person and those who surround him or her"	Goode (1994) referenced in Rapley 2003
"The degree to which a person enjoys the important possibilities of his or her life… This definition can not be simplified to - 'How good is your life for you?'"	Woodill et al, (1994) referenced in Rapley 2003
"Quality of life encompasses the basic conditions of life such as adequate food, shelter, and safety plus life enrichers such as inclusive social, leisure, and community activities. These enrichers are based on the individual's values, beliefs, needs and interests."	Schalock and Parmenter (2000: 7) in Rapley 2003
"Quality of life is defined as an overall general well-being which comprises objective descriptors and subjective evaluations of physical, material, social and emotional well-being together with the extent of personal development and purposeful activity all weighted by a personal set of values."	Felce and Perry (1993) in Rapley 2003
“Subjective well-being (SWB) comprises people's longer-term levels of pleasant affect, lack of unpleasant affect, and life satisfaction.”	Diener (1994)
“A person’s cognitive and affective evaluations of his or her life.”	Diener, Oishi & Lucas 2002

Label	Project	Arctic Project	Canada	United States	North America	In CCS Region	Europe	Australia, New Zealand & Oceana	Asia	Africa	International	Working Group Member	Fisheries Project	Indigenous Project	Recreation Project	Health Project	Subsistence Project	Reef Project	Agricultural Project	Forestry Project	Ntl HWB Project	U.S. Federal Resource Mgmt Project	NOAA Project	Enviro. Mgmt. Project	Sustainable Devo. Project	Participatory	Coastal/Marine Project Fo	Large Marine Ecos	Transboun	Ce
EM-1	Transboundary Waters Assessment Programme	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1
EM-2	Integrating Watershed & Coastal Areas Management in Caribbean Small Island Developing Stat	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1
EM-3	Nature Conservation and Human Well-Being in Bhutan	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	1	1	1	0	0	0
EM-4	Wellfish/Wellbeing in Developing Countries (WeD)/Governing Small-scale Fisheries for Wellbein	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0	0
EM-5	Ocean Health Index	1	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0
EM-6	Millenium Ecosystem Assessment	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1
EM-7	EPA Human Wellbeing Index	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0
EM-8	Developing Human Wellbeing Indicators for the Hood Canal Watershed	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0
EM-9	Vital Signs (African Monitoring System)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	1
EM-10	Evaluating Social and Ecological Vulnerability of Coral Reef Fisheries to Climate Change	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0	0
EM-11	Selecting Indicators to Protect and Sustain Experiences in the Eastern Arctic of Nunavut	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0
EM-12	Socio-economic drivers and indicators for artisan coastal fisheries in PICTsin Pacificislandcountri	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0
IND-1	Voices From The Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bior	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
IND-2	Social Indicators Study of Alaskan Coastal Villages	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
IND-3	West Coast Vancouver Island Coastal Strategy & Integrated Ocean Management Plan	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
IND-4	Arctic Social Indicators Project	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0
IND-5	Swinomish Indigenous Health Indicators	0	0	1	1	1	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0
IND-6	Te Kupenga Maori Wellbeing Survey	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1
IND-7	Indigenous Relational Wellbeing Index	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
IND-8	First Nations Health Indicators Toolkit	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0
IND-9	SARD Cultural Indicators of Indigenous Peoples' food and agro-ecological systems	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0
IND-10	UN Permanent Forum on Indigenous Issues	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
NOAA-1	Large Marine Ecosystems (NOAA; UNEP/RS; GEF)	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	0
NOAA-2	Evaluating Changes in Health and Well-being in Communities Affected by the Deepwater Horizo	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0
NOAA-3	Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. S	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1
NOAA-4	Fisheries Social Impact Assessment Model (Pollnac et al.)	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0
NOAA-5	Measuring the social and economic performance of catch share programs: definition of metrics	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0
NOAA-6	Marine and Estuarine Goal Setting for South Florida (MARES) - Noneconomic Indicators	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0
NOAA-7	Puget Sound Partnership	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0
NOAA-8	Socioeconomic Profiles of Fishers, their Communities and their Responses to Marine Protective	0	0	1	1	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	1	1	0	0	1	1	0	0	0
NOAA-9	Community Profiles for West Coast Fishing Community	0	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1
NOAA-10	Improving Community Profiles for the North Pacific Fisheries	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	0	0
NTL-1	Measures of Australian Progress (MAP)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
NTL-2	Canadian Index of Wellbeing	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
NTL-3	UK Measuring National Well-being Programme	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
NTL-4	The State of the USA	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
NTL-5	European Social Survey Round 3 Wellbeing Module	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0		
NTL-6	Commission on the Measurement of Economic Performance and Social Progress	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
NTL-7	Bhutan's Gross National Happiness Project	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
NTL-8	Gallup Healthways Well-Being Index	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
NTL-9	Hong Kong Quality of Life Index	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
NTL-10	Thailand Green & Happiness Index	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
SD-1	Community Foundations of Canada Vital Signs/Toronto Vital Signs	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
SD-2	Sustainable Consumption & Production Indicators for Developing Countries	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
SD-3	SUSTAIN Partnership	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
SD-4	Sustainable Neighborhoods for Happiness	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
SD-5	Sustainability Monitor of the Netherlands	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	
SD-6	UNDESA Indicators of Sustainable Development	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
SD-7	FAO Intl Guidelines on Securing Small-Scale Fisheries/Guidelines on collection of demographic a	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0
SD-8	Nova Scotia GPI Fisheries & Marine Environment Accounts	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
SD-9	Social and Cultural Sustainability: Criteria, Indicators, Verifier Variables for Measurement and M	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
SD-10	Blyth Valley Borough Council Case Study	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Label	Project Totals:	9	8	15	17	6	8	3	5	2	11	6	12	10	1	5	12	5	2	3	12	10	11	17	16	46	26	6	7	14
	% of Total Projects:	17%	15%	29%	33%	12%	15%	6%	10%	4%	21%	12%	23%	19%	2%	10%	23%	10%	4%	6%	23%	19%	21%	33%	31%	88%	50%	12%	13%	27%

ocus	ystem (LME) Focus	dary Focus	ntralized Data System for Core Indicators	NGO Project	Professional Consultant Project	Academic Project	Governing Body Project	Scope: International	Scope: National	Scale: Regional	Scale: State/Province	Scale: County	Scale: Local	Total Scale Value	Top-Down Approach	Bottom-up Approach	Objective Indicators	Subjective Indicators	Community Wellbeing	Individual Wellbeing	Linked to specific policy goals	Millennium Ecosystem Assessment	Millennium Development Goals	Values Framework	SMART Framework	Capabilities Framework	Integrated Ecosystem Management	Ecosystem Services Framework	Capacity Building Framework	Capital Assets Framework	Sustainability Framework	Adaptation/Vulnerability/Resilience Framework	Social Impact Assessment Framework	Index Use	Use of Secondary Data Sources	Listing of indicators in use by other sources	Surveys	Interviews	Workshops/Focus Groups	Working Group(s)	Expert review	Case Studies	Site Visits/Local Assessment	Scenarios	Mapping	Causal Chain Analysis	DPSIR Framework	Thresholds	Principal C	Inp
0	0	0	1	1	1	1	0	0	0	3	1	0	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	0	1	1	1	1	0	0	0	
0	0	0	1	1	1	0	0	0	0	2	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	
0	0	1	0	0	0	0	0	0	1	1	1	0	1	0	1	0	1	1	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	
0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	1	0	0	0	0	1	
1	0	1	0	1	1	1	1	0	0	4	1	0	1	0	0	0	1	0	1	0	1	0	1	1	0	0	1	0	0	1	1	1	0	0	0	1	1	0	1	0	1	0	0	1	0	
1	0	0	1	1	1	1	1	1	1	6	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	0	0	0	1	1	1	1	1	1	0	1	1	0	1	
0	0	0	1	0	1	0	1	1	0	3	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	0	0	1	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	
0	0	1	1	0	0	0	0	1	1	2	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	1	1	1	1	1	1	0	1	0	0	0	0	0	1	
1	0	1	0	1	1	0	0	0	0	2	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	0	0	1	1	0	0	1	0	1	1	1	1	0	1	0	0	0	0	0	0	
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0	0	0	1	1	1	1	1	1	1	6	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1	
1	0	0	1	0	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1		1	0	0	0	1	0	0	0	0	1	
0	0	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	
1	0	0	1	0	0	0	0	1	1	2	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	1	
0	0	1	1	1	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	1	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0	0	1	0	1	
0	0	0	1	0	0	0	0	0	1	1	0	1	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	1	1	0	1	0	1	0	1	0	1	
0	0	0	1	1	1	1	1	1	1	5	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	
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Appendix C: SWIMM Human Wellbeing Domain Definition Codebook

NOTES on DOMAIN CODING
Current as of May 29, 2014.

Convention for this document. _____

THEMES.

Domain

- **Subdomains or elements:** Coders understanding. (Notes on coding agreement/need for revision or clarification in parentheses).

CONDITIONS

ENVIRONMENT

- **Environmental Quality/Health**: Productivity large scale. Ecosystem Health. Conservation/ecology. Not about utility only but also about availability, distribution, productivity. Includes built environment—eg. Water quality. (broad agreement on what this term meant. Slight clarification.)

- **Resource Availability and Distribution:** How much stuff? Equitably distributed?

- **Infrastructure/Built Environment/Housing/Ports/Transit:** Shipping, shipping pollution. Recreational infrastructure. Transit includes everything from walking to shipping. Inclusive of broad sense of built environment and structure to facilitate movement/housing.

- **Pollution:** Focuses very tightly on unfortunate byproducts of otherwise productive endeavors. Very tightly focused. Matter out of place

ECONOMY

- **Commerce/Industry/Trade/Revenue:** Focus on business but larger scale. Generalized sense of allowing for/encouraging productive endeavors. (global trade difficult to quantify).

- **Jobs/Employment:** Income (also in job quality), presence/absence of job. Occupation. Unemployment. Jobs as resource dependent.

- **Corporate Consolidation/Local Economies/Dependency:** Consolidation of fisheries industry has lots of play. But this is mostly from Sen/Stiglitz. Local control/sovereignty of economy? Globalization. Freedom from commercial monoculture.

- **Material Wellbeing/Wealth/Prosperity/Material/Financial Security:** Poverty, GDP, Debt (as negative), productivity.

SAFETY

- **Disaster Preparedness:** Acute events—both singular and temporally brief like storms and fire but also more systemic and over longer time scales---climate change. Can also include man-made disasters rather than natural disasters (oil spills). Environmental risks. Floods, fire. Assumption of *environmental* catastrophe rather than bounded social impact.
- **Safety:** Individual choices and negotiation of everpresent hazards rather than singular events (disasters). Safety of life at sea, occupational safety and health, building codes, emergency services etc.

HEALTH:

- **Health:** Physical Health conditions for physical health. Brit incorporated cropland/arable land/food distribution.

- **Emotion/Mental Health/Attitude:** Somewhat subjective. Any reference to happiness or quality of life perceptions. Psychological issues—comes up in prevalence of mental health, disease, psychosomatic issues. Suicide rates (also under mortality). Questions asking "do you trust government?" are under this domain.

- **Demographics:** Birthrates, migratory patterns, age structures. Could be thought of as social health.

CONNECTIONS

CULTURE:

- **Archaeological/Historic Heritage:** Distinction from place based by focusing on historic value. Element of time removing this from present. Frequently mentioned specifically in legal text. Not well defined.

- **Cultural values/ traditions/ valued practices:** Ongoing connection to type of expression. Persistence of fishing communities. Elements of time---past practice valued in present but also projected as valuable onto future generations. Often cross-listed with future generations.

- **Identity:** Problematic element. Often limited to text regarding indigenous peoples—allusion to preservation of cultural sovereignty.

COMMUNITY:

- **Social relationships:** Participation in community events, volunteerism. Ties to civil society.

- **Social Capital:** Social capital implies people to turn to in times of distress, extra-statutory safety net. Ties to civil society but less formal/observable.

TANGIBLE CONNECTIONS TO NATURE:

- **Resource access/utility:** Ability exploit resources (assuming the resources exist---see "resource availability").

- **Access to Nature:** Largely spatially defined. How do you get to the nature? Signage, causeways, paths, publicly available space in natural worlds.

- **Conservation/Stewardship/Environmentalism:** Explicit acknowledgment of need to turn negative conditions into positive conditions for our future. Also applies to express acknowledgment of need to cultivate this sentiment in society at large. Precautionary sentiments. Volunteerism for environmental causes.

- **Non-consumptive uses:** Broadly defined acknowledgment that resources have utility beyond what can be exploited or provided easy valuation. Not focused on recreation or any particular use, but rather an explicit acknowledgment that nature contains uses beyond what we can harvest. Also applies to ecosystem services and provision of conditions for life.

INTANGIBLE CONNECTIONS TO NATURE

- **Beauty/Aesthetics:** Home values (value regression based on viewshed), views, splendor, spacious skies and amber waves of grain etc. Who doesn't love Ansel Adams amirite?

- **Place attachment/sense of place/place-based:** Unlike archaeological/historic heritage focuses on current people. Spatially unique resources that have intangible importance to contemporary people. Some connection to reservations/areas under indigenous control/sovereignty issues. Also salient to activities requiring very particular geographic space (eg. range of spiritually important animals).

- **Wonder/Spirituality/Ceremony:** Broad element. Lots of overlap with above two elements. Beauty/aesthetics pleasing to the eye, but wonder/spirituality/ceremony is pleasing to the soul. Inspiring of reflection, introspection. Lots of overlap with other elements in this domain.

CAPABILITIES

KNOWLEDGE AND TECHNOLOGY

- **Education/Outreach/Building Awareness/Access to Information:** Conveyance of what is already known. *Export* and *distribution* and *availability* of knowledge.

- **Science/Research/Production of knowledge/technology:** Differs from above in that this is focused on *creation* and *innovation* and *disruption* and *exploration* of ideas in the attempt to improve understanding or supplant state of the knowledge.

SENSE OF CONTROL

- **Agency/Self Governance/Sovereignty:** Government to government agreements, treaty rights and obligations. But also encompasses issues of leadership, agency sovereignty etc. Also about encouraging participation of state and local governments in policy process. Local/regional autonomy. Subsidiarity.

- **Public/Political Participation:** Voting, including stakeholders in decision making bodies, express mechanisms for public input into rulemaking, consultation, genuinely open and *influential* channels of communication between rulemakers and stakeholders.

- **Transparency in Government:** Mechanistic process for rulemaking, availability of records, good accounting, implication that constructive critique of government is taken seriously—government responsive to legitimate complaints. Reduction/elimination/acknowledgment of conflicts of interest.

LIVELIHOOD AND ACTIVITIES

- **Livelihoods:** Unpaid labor, can you make your living with chosen path? Pride in work. “Way of life” rather than simple wage earning---community

connection with labor and enterprise. This elements blends with many others.

- **Job Quality:** Beyond income. Pride in work? Equity, safety, job satisfaction, job stability/sustainability, job environmentally sustainable? Opportunities for advancement.

- **Personal activities/time allocation:** things done not to survive, but to thrive, relax, be human (beyond recreation and subsistence). This elements is really about time beyond being entertained or being productive in a narrowly focused job/employment sense. Time for: PTA meetings, child care, elder care. Tied to how much work is required of you to survive, what is left? Work per unit effort? (tied to job quality).

- **Recreation and Tourism:** Not just act of recreating or touring, but also in not being duly disadvantaged or experiencing deleterious effects from the tourism or recreation of others.

- **Subsistence:** Literal interpretation. Taking of resources for individual/family/community survival.

GOVERNANCE AND CIVIL SOCIETY:

- **Civil Society:** Presence/absence of NGOs, civic groups, level of participation within organizations/volunteerism, donations.

- **Conflict Reduction/Resolution:** Mechanisms for reduction of conflict among multiple users. Role of arbitration and arbitration agencies.

- **Diversity/Multiple Users:** Similar to conflict reduction but does not assume conflict. On the contrary, embraces or celebrates or protects diversity/multiple uses of resource. EBM values diversity and multiple users. Also about representation. So within governance structures representation should reflect demographic makeup of community. Empowers people.

- **Governance/Management/Public Services:** Literal element. Presence of agencies empowered to manage things, provide public services. Are there enough services to meet demands? Effective? Efficient? Responsive? Adaptive? Enough resources to meet need?

Cross Cutting

EQUITY AND JUSTICE

- **Social justice/equity**: Income inequality. Resource allocation, distribution. Comparing demographic group privilege and prioritizing fairness. Also elements of restitution, acknowledgment of historical injustice or undue burden shouldered by one group. Expressing care and concern for vulnerable populations. Rights. Advocacy for disadvantages/marginalized/dispossessed.

CERTAINTY & RESILIENCE:

- **Community Vibrancy/integrity/stability/adaptability:** How is social capital actually utilized? Not just that it is there, but that it is put to good use. Can community change and adapt? Can community prepare for, minimize, or respond to potential challenges. Flexibility to make good decisions rather than only decision left.

- **Certainty/predictability/ability to plan for future:** Difficult element. See below.

  (Brit hates this because it can set rules in stone and minimizes flexibility. Raz views this as an acknowledgment of need to take long view for future generations but this is natural resource paradigm--managed resources to ensure long term productivity and allows for those who rely on resources to participate in modern economies, finance homes etc. Brit makes point that this is institutionalization, enshrinement, codification of practice for achieving stable *regulatory* environment rather than stable productive environment—often at the expense of need for dynamism or adapability. Certainty is about commitment to plan, but resilience is about recognizing when plan is the problem, can change the plan to find better way forward.)

- **Resilience:** Checks on the system that allow it to bounce back from external stress (see above, measures for certainty can support this goal or frustrate this goal, depending on how these measures are implemented). Element of resilience is also ability to change course and pursue other options if something fails. Feedbacks within the system that allow for correction and honing and refining of policy/management etc.

- **Security/Peace:** Malfeasance. Crime. Discord and violence between people/states and everything in between.

FUTURE GENERATIONS

- **Future Generations' Wellbeing/Sustainability:**
  Policies/actions/approaches to management that take long view and explicitly acknowledge current generations' commitment to and preservation

of conditions required for future generations. Suppression of tendency to discount the future, takes much broader view of sustainability than merely being able to maintain current consumption patterns (eg. Paying close attention to ecosystem services and intangible connections/harmony. Does not just look at single services provided by ecosystems but rather to integrity of ecosystems as whole.

- **Energy Production and Consumption Patterns:** Acknowledgment of renewable vs. non-renewable forms of energy with preferential treatment/policy/regulatory landscape given to renewables. But issue is that growth is always given positive connotation in some ways. So, issue is energy production that allows for growth without stressing system. Implied efficiency. Growth/development without production of waste/toxics.

APPENDIX D. RESEARCH NEEDS IDENTIFIED BY AGENCIES AND ORGANIZATIONS (PFMC 2005).

1 = Basic information necessary to identify fishing communities, gear groups, and issues

2 = Important baseline information needed for basic analyses

3 = Useful information that contributes to better analyses

4 = Useful to management, but not federally mandated

5 = Useful to management, but outside scope of Council role

Other = General description of need or research tool

Fishing Communities: Baseline Descriptions Of Geographically Defined Communities

Keyword	Type	Research Need	Why information is needed	Source
Culture	1	Perceived importance of fishing to community members (regarding continuity or self-identification of the community).	Addresses major mandates; addresses cultural importance of fishing to communities	SPM
Culture	3	Assess cultural issues (attitudes, beliefs and values of fishermen, fishery-related workers, other stakeholders and their communities).	Addresses major mandates; addresses cultural importance of fishing to communities	SIAG, SIA
Demographics	1	Number of permit holders, crewmembers, vessel owners, and processor workers residing in the community; crew structure (residence, role, gender, age, etc.).	Addresses major mandates; provides needed baseline information about communities	SPM, SIA, PFMC-EDP

Fishing Communities: Baseline Descriptions Of Geographically Defined Communities

Keyword	Type	Research Need	Why information is needed	Source
Demographics	2	Individual demographic data: place of residence, place of work, sex, age, education, ethnicity, marital status, income, level of debt, access to capital, link to fishery/occupation, experience, household composition, attitudes/perceptions (e.g., job satisfaction, happiness, political values).	Addresses major mandates; provides needed baseline information about communities	SIA, PFMC-RDN, PFMC-EDP, SIAG
Demographics	2	Community demographic information: social structure, government, tax base, municipal revenue from fisheries, ethnic characteristics, crime rate, average or median household income, age structure, sex ratio, ethnic composition, occupational structure, aggregate attitudes/perceptions.	Addresses major mandates; provides needed baseline information about communities	SIA, PFMC-RDN, PFMC-EDP, SIAG
Demographics	2	Data on subsistence harvesters: number of households participating in subsistence harvest or consumption.	Addresses major mandates, including Environmental Justice; provides needed baseline information about communities	SPM
Demographics	3	Demographic trends: look at implications of changing coastal demographics and changes in natural resource availability and uses.	Provides information about demographic and economic trends; contributes to mandated analyses	OSG
Economic activity (commercial fishing)	1	Amount of base economic activity generated by fishing or directly related fisheries-dependent services: pounds of fish landed and processed in community, number of vessels landing fish to community, number of vessels homeported in community, commercial harvest opportunities by distance from community port.	Used to identify fishing communities	SPM, SIA, PFMC-EDP
Economic activity (recreational fishing)	1	Amount of base economic activity generated by fishing or directly related fisheries-dependent services: total sport catch, number of sportfishing trips originating in community, number of sportfish for-hire businesses (charter boats, party boats, guide boats, head boats) operating or landing in the community, number of tackle retailers & bait stores, number of sportfish licenses sold, number of sport fish license holders, marine recreational opportunities.	Used to identify fishing communities	SPM, SIA, PFMC-EDP

Fishing Communities: Baseline Descriptions Of Geographically Defined Communities

Keyword	Type	Research Need	Why information is needed	Source
Economic activity (dealers/buyers)	1	Number of dealers and buying stations in community.	Used to identify fishing communities and measure flexibility/resilience	SPM
Economic activity (processing)	1	Processor information: number of processors, employment, wage basis, capacity, products, equipment, markets, recovery rates, etc.	Used to identify fishing communities (degree of dependence on fishing)	SPM, SIA, PFMC-EDP
Economic activity (general)	4	Study how economic diversity stabilizes/destabilizes coastal communities.	Provides contextual information	CSG
Employment	2	Employment opportunities for fishers during the off season, etc.; strategies for making a living; labor markets and opportunities.	Used to identify fishing communities (degree of dependence on fishing)	CSG
Employment (regional)	2	Include general description of population and employment in the region in which the community/communities are located.	Provides context, identifies non-fishing influences on community & economy	SIAG
Employment	3	Consider and record participants' involvement in fisheries other than the one being considered for any particular management measure.	Addresses NEPA cumulative effects mandate; helps identify unforeseen consequences of management actions	SIAG

Fishing Communities: Baseline Descriptions Of Geographically Defined Communities

Keyword	Type	Research Need	Why information is needed	Source
Environmental justice	2	Collect, maintain, and analyze data on minority, etc. populations, especially when a management action affects subsistence consumption.	Addresses EO 12898 (Environmental Justice)	EO 12898
Flexibility/resilience	2	Develop and assess measures of community flexibility and resilience (social capital, interrelationships between fishing sectors, social/business networks, alternative work, vessel characteristics, social safety nets, quality of life, community cohesion).	Helps judge management impacts and community response to change	SIA
General	1	Develop and assess measures of community dependence on fisheries (including historical dependence); this is reflected in structure of fishing practices, income distribution and rights.	Used to identify fishing communities	COMES, SIAG
General	2	Improve understanding of the socioeconomic aspects of fisheries, and socioeconomic data collection and analysis. Examples could include ethnographic baseline data on specific fishing communities; cost-income data; analyses of the socioeconomic impacts of specific management measures in certain fisheries; analyses of factors influencing demand for recreational fishing trips by anglers; and market analyses to determine factors that influence demand and supply of specific seafood products, including imports.	Would help with all socioeconomic analyses	SK, NMFS, PSMFC
General	Other	Need baseline description of the fishing industry and communities (combined with) periodic assessment of "status of the fisheries."	General description of need	PFMC

Fishing Communities: Baseline Descriptions Of Geographically Defined Communities

Keyword	Type	Research Need	Why information is needed	Source
History	1	Past and present participation of communities in fishing industry (history of fishery, past experiences).	Used to identify fishing communities and measure flexibility/resilience	SK, SIA, SIAG, SPM
Infrastructure	1	Identify and describe institutions and structures that support the fishery (for example, fishing-related businesses, seasonal dependence of businesses on fishery; transience of workers; community investment in docks and infrastructure).	Used to identify fishing communities and measure flexibility/resilience	SIAG, PFMC-RDN
Infrastructure	2	Assess current economic/social changes in shoreside infrastructure, human resources.	Provides context, identifies non-fishing influences on community & economy	COMES
Infrastructure	2	Identify social systems associated with support services.	Helps measure community flexibility & resilience	SIAG
Quality of life	3	Assess quality of life in fishing communities (confidence in the future of the fishery, social problems, non-compliance and illegal behavior; desire of community members to stay in community or fishery).	Helps measure cultural & economic importance of fishing, community flexibility and resilience	SIA
Social capital	3	Assess social capital in fishing communities (social resources, demographics, infrastructure, social networks, political capital, etc.).	Helps measure community flexibility & resilience	SIA

Fishing Communities: Baseline Descriptions Of Geographically Defined Communities

Keyword	Type	Research Need	Why information is needed	Source
Social capital	3	Assess human capital (education, training).	Helps measure community flexibility & resilience	SIA
Subsistence	1	Number of subsistence fish landings in the community.	Used to identify fishing communities; helps address environmental justice mandates	SPM
Tools	Other	Build standardized framework for community assessments and associated recommendations/ uncertainty to fishery managers and constituents.	Tool would help with all socioeconomic analyses	NMFS, SIA

Baseline Descriptions Of The Commercial And Recreational Fishing Industry

Keyword	Type	Research Need	Why Data Is Useful	Source
Cultural factors	2	Include data on cultural value of fishery (fishery-related job satisfaction, family and community cultural values related to fishing, religious and other norms satisfied by fishing activities).	Addresses major mandates; measures cultural importance of fishery	SIAG
Economics (general fishery status)	1	Continue to collect information on landings, exvessel prices, exprocessor prices, permit and license prices, etc.	Used for baseline descriptions of fishery and community impacts; addresses mandates	SIA, PFMC-EDP
Economics	2	Analysis of economic [and cultural/social] links between ports and fisheries.	Addresses major mandates; helps describe economic resilience	COMES, SIA
Economics (commercial harvesters)	2	Collect harvester cost, earnings, and expenditure information. Include debt burden of fishing businesses; length of employment opportunities; extent of unemployment coverage; labor opportunity costs; experience of employees by fishery and gear type.	Helps identify regulatory costs/benefits to communities	PFMC-RDN, PFMC-EDP
Economics (recreational)	2	Collect information on charter and recreational sectors: effort and gear data (average number of passengers, trip length, travel time); average angler expenditures per trip; fishing gear and methods used.	Helps weigh economic costs of management decisions, identify costs/benefits to fisheries	COMES, PFMC-EDP
Economic (processors)	2	Collect processor cost, earnings, and expenditure information.	Helps weigh economic costs of management decisions, identify costs/benefits to fisheries	PFMC-RDN, PFMC-EDP
Economics	2	Non-fishing employment of crew and skippers.	Helps define community impacts and community resilience	PFMC-EDP

Baseline Descriptions Of The Commercial And Recreational Fishing Industry

Keyword	Type	Research Need	Why Data Is Useful	Source
Economics	3	Study economic [and social] interactions between commercial and recreational sectors.	Contributes to fishery description	COMES
Fishery demographics	2	Describe gear groups (e.g., trawl, pot, hook and line) and allocative sectors (commercial, recreational, nearshore). Include vessel characteristics, fishing strategies, dependence and involvement in specific fisheries, catch mixes, and vessel mobility for both commercial vessels and recreational charter vessels. Include information on ethnic groups, large and small fishing operations, inshore and offshore fishing operations.	Used for baseline descriptions of fisheries	PFMC-RDN, PFMC-EDP, COMES, CSG, NAS, SIAG, SIA, others
Fishery demographics	2	Include information about vessels: relationships among the crew, number in the community.	Used for baseline descriptions of fisheries	SIA, PFMC-RDN, SIAG
Fishery demographics	2	Identify fishery participants, including those who follow a stock throughout its range and those who fish from local ports when a stock passes through their area.	Used for baseline descriptions of fisheries	SIAG
Fishery demographics	3	Collect and analyze data on the social and economic characteristics of trawl, dredge, and non-mobile gear fisheries to assess the tradeoffs among various management alternatives.	Helps weigh impacts and benefits of management measures	NAS
Fishery demographics	4	Obtain data on distribution of marine recreational fishermen in the general population.	Helps identify constituents, address impacts of recreational management decisions	SIAG

Baseline Descriptions Of The Commercial And Recreational Fishing Industry

Keyword	Type	Research Need	Why Data Is Useful	Source
Fishing business strategies (commercial)	2	Collect information on commercial fishing business strategies: use of hired skippers, method of crew payment (share, wage, piece), annual and season round .	Used to describe commercial fisheries; helps identify management impacts	PFMC-EDP, SIAG, SIA
Fishing business strategies	2	Information on the (economic and business) diversity of fishermen and fishing activities.	Measures resilience of fishing industry	COMES, SIA, PFMC-EDP
Fishing business strategies (recreational)	3	Charter fishery business marketing strategies; range of commercial activities that might be undertaken by recreational charter vessels along the coast.	Used to describe recreational fisheries; helps assess resilience of charter sector and identify management impacts	PFMC-EDP, PFMC-RDN
General	2	Conduct economic and social analysis of groundfish and salmon harvest and management strategies.	Used for baseline descriptions of fisheries; provides information on effectiveness of management	PFMC-RDN
General	Other	Develop better understanding of socioeconomic issues for West Coast groundfish in order to guide development of an economically viable fishery.	Would help in all socioeconomic analyses	NMFS
Geographic range	2	Describe geographic range of fishery. Map and consider home ports of vessels, as well as ports of landing.	Helps identify fishing communities; contributes to baseline description of fishing industry; helps identify management impacts	SIAG

Baseline Descriptions Of The Commercial And Recreational Fishing Industry

Keyword	Type	Research Need	Why Data Is Useful	Source
Infrastructure	2	Identify and map commercial fish processing facilities, ice plants, and vessel services directly involved with the fishery.	Helps identify fishing communities; contributes to baseline description of fishing industry; helps identify management impacts	SIAG
Infrastructure	2	Identify relationships between processors, fish buyers, and fishermen.	Would help in all socioeconomic analyses	Other
Infrastructure	2	Identify points of access (ports or communities) to the recreational fishery for anglers. Identify and map services directly related to the fishery or used by participants.	Helps identify recreational fishing communities; contributes to baseline description; helps identify management impacts	SIAG
Mobility/flexibility	2	Actual and potential mobility of vessels between fisheries.	Used for baseline descriptions of fisheries; provides insight into resilience of fishing industry	SIAG, PFMC-EDP
Mobility/flexibility	3	Collect information about the location of alternative fishing grounds.	Contributes to fishery description; identifies potential future impacts of management measures	PFMC-RDN
Recreational vs. commercial values	3	Gather information of comparative value of recreationally or commercially caught fish.	Helps identify community & fishery impacts	CSG

Baseline Descriptions Of The Commercial And Recreational Fishing Industry

Keyword	Type	Research Need	Why Data Is Useful	Source
Subsistence	2	Identify and include any subsistence fishing activities and any participation by Native Americans or other indigenous peoples in the fishery.	Addresses major mandates, including Environmental Justice; identifies impacts on native populations	SIAG, PFMC-RDN
Tools	Other	Find ways to improve information listed on fish tickets (gear codes, etc.).	Would enable more data to be collected for research efforts	PFMC-EDP
Tools	Other	Improve accuracy of recreational catch data by reviewing statistical design and implementation of MRFSS on West Coast. Seek cost-effective ways to reduce potential bias and improve precision of estimates of recreational catch.	Now obsolete; MRFSS has been replaced by CRFS	NMFS

Nonconsumptive Values

Keyword	Type	Research Need	Why Data Is Useful	Source
Cultural importance	2	Social and cultural importance of the resource (commercial, recreational, tribal).	Addresses major mandates; identifies non-economic impacts on resources & communities	NEPA
Cultural importance	4	What do non-extractive and extractive marine users contribute to the social and cultural structure of coastal communities?	Contributes to community descriptions	CSG
General nonconsumptive values	2	Assess nonconsumptive value of marine resources (intrinsic, esthetic, recreational, experiential, public benefit value).	Addresses major mandates; identifies non-economic importance of resources	CSG, PFMC-RDN, COMES
Regulatory impacts	2	Impacts of regulations/policies on nonconsumptive uses.	Helps identify all regulatory impacts, as opposed to impacts on fisheries and communities only	SIAG
Unquantified benefits	2	During scoping, identify unquantified social and environmental benefits and values associated with the fishery, and non-economic social aspects of the proposed action or policy (lifestyle issues, health and safety issues, nonconsumptive and recreational uses of managed species, habitats).	Addresses major mandates; identifies non-economic importance of resources	SIAG, COMES

Assessing Regulatory Impacts

Keyword	Type	Research Need	Why Data Is Useful	Source
Affected parties	1	During scoping, identify as many as possible of the user groups and communities that may be affected by the action.	Basis requirement for beginning analysis of an action	SIAG, NEPA
Affected parties	2	Consider effects of management measures on participants in fisheries conducted in adjacent areas under the authority of another Council.	Helps identify cumulative and unanticipated effects of policies	MSA
Controversy	1	Describe level of controversy regarding proposed actions.	Required by NEPA; helps identify if action requires EA or EIS	NEPA
Cumulative effects	3	Need to develop baseline data on costs/benefits of management (cumulative effects) and/or develop time series; and/or develop time series study to look at long-term impacts of management.	Tool; contributes to cumulative effects information required by NEPA	CSG, SIA
Duration of effects	3	Consider and describe the duration of effects and the scale of possible changes caused by a management action.	Addresses major mandates; identifies impacts to fisheries and communities	SIAG
Economic impacts	2	Assessment of the economic impacts of regulations on all sectors; e.g., commercial, recreational, charter, processing, suppliers, and other shoreside businesses	Addresses major mandates for regulatory actions	COMES
Economic impacts	2	Economic impacts of regulations on communities	Addresses major mandates for regulatory actions	COMES, SIAG, CSG, NMFS

Assessing Regulatory Impacts

Keyword	Type	Research Need	Why Data Is Useful	Source
Economic impacts	5	Financial institutions need to know impacts of regulation on industry	Helps ensure community resilience & adaptability	COMES
Equity	2	Research ways to ensure equity among different fishing populations	Addresses major mandates, including Environmental Justice	EO12898
Equity	2	Consider economic impacts on small entities (small businesses, organizations, governmental jurisdictions).	Addresses major mandates, including Regulatory Flexibility Act	RFA
General community impacts	4	Better define the longer-term interests of coastal communities, making sure to capture the full range of local interests. One source of useful information that is sometimes overlooked is anecdotal data and oral history. Community interests should then be placed into the perspective of management goals and objectives.	Helps communities adapt to change; helps coordinate regulations with community needs	CSG
General regulatory impacts	2	Consider and describe possible effects of the proposed action on the major categories of human behavior (the way fishermen and fishing communities live; the ways they organize and meet social needs; demographic and sea-use patterns)	Addresses major mandates; identifies impacts to fisheries and communities	SIAG
Health & safety	1	Describe health and safety concerns related to management measures	Addresses NEPA; identifies possible concerns regarding management measures	NEPA
History	2	Consider how the proposed action fits with historical trends.	Addresses major mandates; helps identify cumulative effects	SIAG

Assessing Regulatory Impacts

Keyword	Type	Research Need	Why Data Is Useful	Source
Infrastructure	2	Management impacts on the built environment in fishing communities (including coastal infrastructure, historic and culturally important areas/structures)	Addresses major mandates; helps identify community impacts	NEPA
Infrastructure	2	Impacts of policies on commercial viability of ports and harbors	Addresses major mandates; helps identify community impacts	CSG
Relevant issues	1	During scoping, identify key social and resource availability issues.	Required by NEPA; basic first step in analyses	SIAG
Risk	2	Describe degree of uncertainty, risk and likelihood of unknown risks	Required by NEPA	NEPA
Tools	Other	Develop protocols for industry-supplied information	Would help with all socioeconomic analyses of fisheries	COMES
Tools	Other	How to assess impacts on communities with different local economies and different fisheries? Assess the feasibility of tools and methods we have to carry these out, such as detailed contingent valuation study (expensive). Review the socioeconomic toolbox.	Would help improve socioeconomic analyses	PFMC-RDN

Research Needs For Special Projects And Issues

Keyword	Type	Research Need	Why Data Is Useful	Source
Adaptive management	4	Need to conduct adaptive management experiments in fisheries and determine the socio-economic costs and benefits.	Could lead to more efficient management	CSG
Allocation	3	Study social aspects of allocation issues.	Addresses major mandates; helps identify appropriate allocation schemes, identify impacts	Other; NEPA
Alternate management strategies	2	Conduct economic and social analysis of alternative roundfish and salmon management strategies. For salmon this analysis should include 1) the potential economic and social implications of watershed-based management approaches; 2) the costs and benefits of alternative hatchery practices; 3) the costs and benefits of alternative harvest strategies; and 4) cost-effective analysis to meet objectives stemming from achieving biological objectives (e.g., Endangered Species Act) and treaty rights obligations. For groundfish, this analysis should include the costs and benefits of alternative harvest and management strategies, including capacity reduction.	Would help design more effective management approaches	PFMC-RDN
Communications	4	Improve communications and decrease fragmentation within the fishing community, particularly between gear types and between the industry and agencies.	Helps address constituent needs, improve understanding of regulations, and increase effective constituent involvement	OSG
Communities	3	Study how new regulations affect economic and social behavior patterns. For example, communities are impacted by establishment of marine reserves. Study how effort shifts in fisheries affect coastal communities.	Addresses major mandates; helps create effective regulations; identifies community impacts from marine reserves	CSG

Research Needs For Special Projects And Issues

Keyword	Type	Research Need	Why Data Is Useful	Source
Constituent involvement	4	Find ways to improve constituent involvement in decision making and garner constituent support.	Helps increase effective constituent involvement; improves compliance with regulations; helps develop appropriate regulations	Other
Discards	3	Evaluate benefits and costs of technical discard reduction and utilization methods and possible socioeconomic incentives/ disincentives to discard reduction.	Helps reduce discards	NMFS
Education	5	Develop programs to educate people of all ages about the ocean and its needs through studies and educational materials in marine science, engineering, health issues, and stewardship practices.	Outside Council role, but improves constituent involvement	NMFS, CSG2
Fish consumption	5	Need more knowledge about the fish-consuming public.	Outside Council role, but could help tailor effective management measures and improve constituent involvement/response	CSG
Fishing effort control, social aspects	4	Study social aspects of fishing effort control and motivation to control effort.	Helps develop appropriate effort control mechanisms	Other
General	Other	Based on the provisions of the Magnuson-Stevens Act and NMFS guidelines, determine what information is needed for decision making, then determine data and research needed to produce that information.	Very general; contributes to all analyses	PFMC-RDN
IFQs	2	Collect information on historic diversity of vessel classes, and how to preserve it under an IFQ system.	Addresses major mandates regarding IFQs; helps design effective IFQ programs	Other
IFQs	2	Collect ownership information related to prevention of absentee/foreign control of fishing enterprises.	Helps design effective IFQ programs that avoid undesirable impacts	Other

Research Needs For Special Projects And Issues

Keyword	Type	Research Need	Why Data Is Useful	Source
IFQs	3	Analyze attributes of different property rights systems; research implications of IFQs in other areas; evaluate property rights.	Addresses major mandates regarding IFQs; helps design effective IFQ programs	COMES, CSG
IFQs	3	Understand implications of IFQs for displacement of fishers and crew.	Helps understand community impacts of IFQs	Other
Incentives	3	Understand incentives created by management policies.	Helps tailor effective management policies	CSG
Incentives	4	Analyze attributes of different property rights systems; research implications of IFQs in other areas; evaluate property rights.	Helps tailor effective management policies	COMES
Incentives	4	What are the economic incentives for sustainable fisheries?	Helps tailor effective management policies	COMES
Local knowledge	4	Studies are needed to integrate local knowledge into resource management.	Enhances breadth and depth of data; involves constituents in decision-making	CSG
Management effectiveness	4	Assessing fishery management measures for historical effectiveness: what have been the impacts of management measures in the past? How have past policies affected social and economic patterns?	Helps understand past and future management impacts, and tailor effective management policies	CSG
Marketing	5	Facilitate industry cooperation and outreach to promote and enhance marketability of regional U.S. fishery products.	Outside current Council role, but helps improve economic status of fisheries	SK

Research Needs For Special Projects And Issues

Keyword	Type	Research Need	Why Data Is Useful	Source
MPAs: fishing industry response	5	Study how fishers respond to existing marine reserves.	Outside current Council role (MPA NEPA analyses are conducted by Sanctuaries). Helps identify impacts from marine reserves and tailor appropriate management measures	CSG
MPAs: economic impacts	5	Model the potential impact of Marine Protected Areas on the long-term economic viability of various user groups (consumptive and nonconsumptive).	Outside Council role, but would help with MPA planning and management	CDFG
MPAs: economic impacts	5	Collect information on the socioeconomic impacts/effects of recently established Channel Islands MPAs and its usefulness in evaluating proposed MPAs in other areas.	Outside Council role, but would help with MPA planning and management	CDFG
MPAs: economic impacts	5	If the impacts of a marine reserve on commercial landings to a specific port can be estimated, study whether product is processed locally or shipped to another location for processing or direct sale.	Outside Council role, but would help with MPA planning and management	PFMC-RDN
MPAs: nonconsumptive value	5	Value of reserves to nonusers - surveys of nonusers (of National Marine Sanctuaries) could be combined with surveys of non-consumptive recreational users.	Outside Council role, but would help with MPA planning and management	CINMS
MPAs: charter industry	5	Conduct survey of the for-hire industry passengers in national marine sanctuaries.	Outside Council role, but would help with MPA planning and management	CINMS
MPAs: socioeconomic impacts	5	Socioeconomic studies are needed to determine impacts of marine reserve siting and to develop effective means for community acceptance and enforcement.	Outside Council role, but would help with MPA planning and management	NMFS

Research Needs For Special Projects And Issues

Keyword	Type	Research Need	Why Data Is Useful	Source
MPAs: scientific use	5	Track scientific use of sanctuaries. Look at annual numbers of researchers using the islands and MPAs. Are researchers accessing the islands and MPAs?	Outside Council role, but would help with MPA planning and management	CINMS
MPAs: educational use	5	Track educational use of sanctuaries. Estimate numbers of educators accessing the islands in general and MPAs in particular. Are educators accessing the islands and MPAs?	Outside Council role, but would help with MPA planning and management	CINMS
MPAs: public perceptions	5	Study knowledge, perceptions and attitudes of local user groups and public. Look at public and user group knowledge, attitudes, and perceptions of MPAs. How are knowledge, attitudes, and perceptions regarding the MPAs changing over time?	Outside Council role, but would help with MPA planning and management	CINMS
MPAs: nonconsumptive value	5	Conduct a survey of the non-consumptive charter industry. Look at travel cost study of charter boat users, with additional information on knowledge of MPAs and regulations. What is the value of MPAs to non-consumptive users and are these users accessing the islands because the MPAs are there?	Outside Council role, though information could be useful to management	CINMS
MPAs: public perceptions	5	Conduct regional surveys on public knowledge, attitudes, and perceptions of MPAs.	Outside Council role, though information could be useful to management	CSG, CDFG
Socioeconomic tools	Other	Develop long-term database with baseline data for socio-economic issues.	Tool would help with all socioeconomic analyses	CSG
Socioeconomic tools	Other	How to assess impacts on communities with different local economies and different fisheries? Assess the feasibility of tools and methods we have to carry these out; improve socioeconomic data collection and analysis.	Tool would help with all socioeconomic analyses	CSG, NMFS, PSMFC
Socioeconomic tools	Other	Develop new methodologies for measuring recreational value.	Tool would help with analyses of recreational fisheries	COMES

Research Needs For Special Projects And Issues

Keyword	Type	Research Need	Why Data Is Useful	Source
Socioeconomic tools	Other	Identify types of social analysis that may help fishery management decision-making, and identify data collection programs that should be initiated to support such analyses over the long-term, particularly regarding impacts on coastal communities. Based on the provisions of the Magnuson-Stevens Act and NMFS guidelines, determine what information is needed for decision making, then determine data and research needed to produce that information.	General research goal to help with all socioeconomic analyses	PFMC-RDN
Stewardship	4	Determine ways to create stewardship for coastal and marine resources.	Could improve general marine resource health	CSG
Tool	Other	Develop industry response models to project responses to alternative management regulations, and to predict the effect of management measures on angler effort and harvest in the groundfish fishery and ocean and inriver components of the salmon fishery.	Would help tailor effective management measures for salmon and groundfish	PFMC-RDN, NFCC
Tradeoffs	3	Assess tradeoffs between efficiency and other social objectives (e.g. retaining small boats).	Addresses NEPA, RFA; helps tailor appropriate management measures	COMES

* While each research need here is not specifically identified in NEPA, MSA, SIA, or CEQ regulations, the information may be used in fulfilling these mandates.