

Human and Environmental Well-being in Alaska's Kachemak Bay Watershed: An Ecosystem Services Assessment

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*Prepared for the Kachemak Bay National Estuarine Research Reserve and the
community members of the Kachemak Bay watershed*

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An Ecosystem Services Assessment**

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Abstract

The Kachemak Bay watershed, located on the Kenai Peninsula in Alaska, encompasses several terrestrial and aquatic ecosystems. The Kachemak Bay National Estuarine Research Reserve (KBNERR) conducts research, monitoring, education, and community engagement that helps inform decision making in the region. This project provides insights for KBNERR regarding current ecosystem services valued in Kachemak Bay using a socio-cultural, place-based, ecosystem services framework. Major ecosystem services and values, community-perceived drivers of ecosystem health, and community relevant indicators were identified to help inform future monitoring and outreach. Methods employed include 31 semi-structured interviews with residents in public and private sectors and three focus groups with KBNERR's Community Council.

When asked what ecosystem services they valued, participants frequently mentioned fisheries, other wildlife (including moose, shellfish, birds), recreation, aesthetics, ecological processes, agriculture, and forests. Using a social value typology framework, this study analyzed the value orientations associated with these natural systems and resources. Several common value types emerged that align with existing literature, including: values for pristine environments, recreation opportunities, and life-sustaining ecological processes. However, other values outside of existing typologies were also present, including the value of connections to community, family, self and nature that were inspired by ecological systems.

Interviewees discussed perceived drivers of ecosystem change, organized here as threats and assets. Major threats mentioned include pressures from population growth, climate change, social division/conflict, extraction, overharvesting, and aquaculture. Conversely, assets for positive ecosystem change include an engaged and concerned community, large scientific community, and aquaculture. Interviewees offered differing perspectives on the positive and negative impacts of natural resources management decisions on ecosystem change.

Moving forward, the most salient ecosystem services values in the Kachemak Bay watershed that KBNERR could continue to monitor and target include pristine, economic, access, and cultural values. Indicators based on literature and interviewee responses are provided across provisioning, cultural, regulating, and supporting ecosystem service types. Methodologies to plan future research on coastal and marine ecosystem service valuation, both monetary and non-monetary, are provided. Using complementary methods and a larger sample size, KBNERR could continue to use the ecosystem services, values, and drivers in this report in their ongoing research and outreach.

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Chapter One

Introduction





Introduction

Kachemak Bay and KBNERR

Kachemak Bay is an estuary system located in south-central Alaska on the Kenai Peninsula (Figure 1.1). It is one of the most biologically productive ecosystems in the world (Alaska Department of Fish & Game, 2000). Many ecosystems exist within the Bay, and the 28-foot tidal range provides exceptional intertidal habitat. Over 1,500 species have been identified within the Bay ecosystem, including diverse wildlife populations of sea otters, bears, moose, bald eagles, salmon and halibut. Given these diverse ecosystems, the area supports a profitable commercial fishing industry and has become increasingly popular for ecotourism, and residential development.

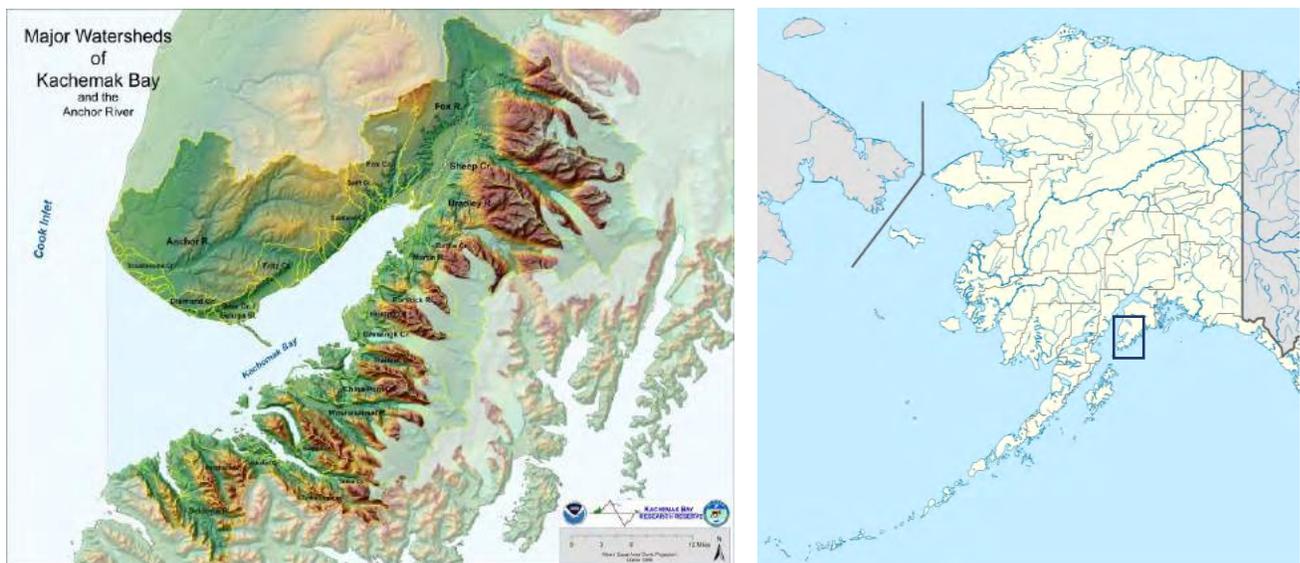


Figure 1.1: Major watersheds of Kachemak Bay
Source: Kachemak Bay National Estuarine Reserve & Wikimedia Commons

The Kachemak Bay National Estuarine Research Reserve (KBNERR) was designated as a National Estuary Research Reserve in February 1999 and is one of twenty- nine coastal Reserves in the National Oceanic and Atmospheric Association (NOAA) National Estuary Research Reserves System (NERRS). In 1997, the Alaska Department of Fish & Game began gathering and compiling ecological information within the Kachemak Bay which KBNERR would later use to inform their research, monitoring, and educational programs. This gathering of information was called the Kachemak Bay Ecological Characterization Project (KBEC).

The KBEC provided a thorough examination of the physical environment (hydrology, soil surveys, climate, etc.), the estuarine environment (productivity and diversity of intertidal and subtidal communities), and a complete species list of documented species at the time of the KBEC's development. It also examined the human dimensions present in the Kachemak Bay

community through historical perspectives, recreational uses, subsistence, and a socioeconomic profile. Management plans for Kachemak Bay, written by the Alaska Department of Fish & Game, Kachemak Bay State Park, and Alaska Department of Natural Resources, were also included in the KBEC.

The original goals of the “KBNERR Research and Monitoring Plan” focus on inventory and monitoring, general research of wildlife and ecosystem processes, and applied research that examines various impacts on local resources. More recently, KBNERR has become prompted to study not only the biophysical, but also the social and ecological benefits of ecosystem services within the Reserve region.

In addition to the ongoing ecological monitoring, KBNERR is developing a set of tools to enable the effective communication and application of ecosystem services in land management and policy decisions. As experts on the area’s natural systems, proponents of responsible ecosystem management, and educators within the Kachemak Bay community, the Reserve requires this set of tools to be widely applicable in their work with area stakeholders, decision makers, agency/industry representatives, and community members.

Project Purpose and Goals

This project’s purpose is to expand on KBNERR’s current work to encompass social and ecological benefits of ecosystem services and to include applications of ecosystem services frameworks for research and outreach. Analysis includes local non-monetary valuation of ecosystem services, socio-cultural perspectives of area stakeholders and decision makers, and community-relevant indicators by which to measure the health of these natural systems. This research informs a community-based, regionally-specific ecosystem service framework for KBNERR’s present and future use.

This project has four goals:

1. Understand local connection to and valuation of regional ecosystem services in the Kachemak Bay watershed.
2. Identify what members of the Kachemak Bay community perceive to be threats and assets to the health of resources and ecosystem services of the Bay.
3. Develop a place-based ecosystem services typology framework for KBNERR that will help to inform ongoing program development.
4. Develop indicators to help KBNERR continue evaluating and monitoring the socio-cultural, ecological, and economic values of ecosystem services within Kachemak Bay.

Guided by these goals, this project will provide KBNERR with a regional overview of the suite of ecosystem services valued by Kachemak Bay community members, as well as perceptions of these services. While this study is specific to Kachemak Bay and the ecosystem management goals of KBNERR, this model will ideally be adaptable for other reserves within the NOAA NERRS to facilitate ecosystem service focused management and outreach.

Ecosystem Service Assessment

To address concerns about environmental degradation, many researchers have applied an ecosystem services (ES) framework to measure and analyze the natural environment. The concept of ecosystem goods and services has received significant attention over the last 30 years in fields across natural and social sciences. This project's analysis was based on the definition presented by Daily (1997):

“Ecosystem services are the conditions and processes through which natural ecosystems and the species that make them up, help sustain and fulfill human life.”

Examples of ecosystem services are seafood, clean water, climate regulation, and recreation. Many ecosystem service frameworks utilize the Millennium Ecosystem Assessment (MEA), which organizes ecosystem services into four different typologies: provisioning (the providing of food, clean water, and other necessary resources), regulating (climate regulation, air/water filtration, erosion control, etc.), supporting (rearing habitats, protection of gene pools, etc.), and cultural services (aesthetic, recreational, inspirational, familial, and spiritual values/benefits).

Other frameworks use more specific, place-based typologies. This project applies a social value typologies framework proposed by Cole (2012) and a place-based lens as described by Potschin and Young (2013), which is a bundled analysis of ecosystem services with particular attention given to current and future states. The place-based framework provides a holistic view of ecosystem services and the personal significance that these services have for individuals and community groups. The MEA framework and other frameworks used in ES assessments are detailed in Chapters Two, Five, and Six.

Ecosystem service valuation is explored regularly through either a biophysical or socioeconomic lens, often with the goal to apply some form of monetary value to connect natural systems with the economic benefits they provide. However, socio-cultural or non-monetary valuation of ecosystem services has been relatively underrepresented as a means of understanding and communicating ecosystem service values (Scholte et al., 2015). This socio-cultural component is vital, however, to understanding individual and community values as they pertain to these services, as well as the social and decision-making contexts that may influence or alter these natural systems. This project primarily explores methods for collecting and analyzing these qualitative socio-cultural factors to expand the research and utilization of this area of ecosystem service valuation. Figure 1.2 depicts the general framework this study followed to determine Kachemak Bay's major ecosystem services.

As shown in Figure 1.2, this project focuses on the ecosystem services of value in the Kachemak Bay area. In ecosystem service literature, these services are often identified and measured using ecological and monetary values. Moving beyond these common valuation techniques, our project identified the social values of ecosystem services in Kachemak Bay. Additionally, this project identifies the social and ecological drivers (i.e. threats and assets) that impact ecosystem service health. As these drivers impact the quality of and quantity of ecosystem services, they also impact the perceptions of ecosystem health. By asking about signs of health, this project identifies community relevant indicators of health in Kachemak Bay for future outreach and study.

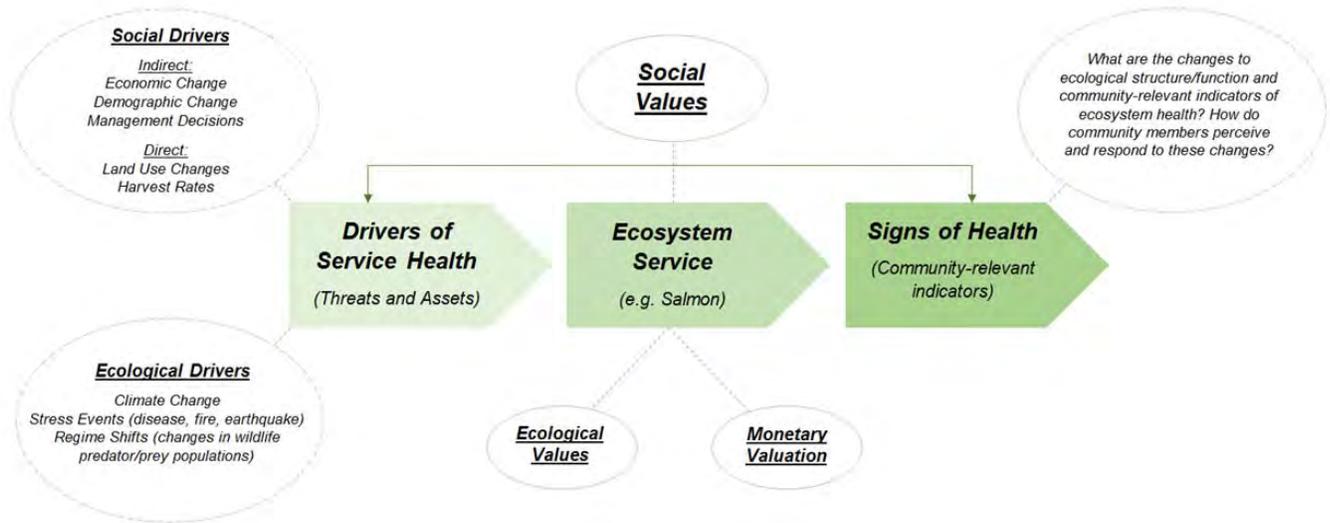


Figure 1.2: Flow chart describing ecosystem service analysis

Research Methods

Socio-cultural based ecosystem service studies usually employ a range of methods including: meta-analysis/document-based research, questionnaires, in-depth interviews, and focus groups (Scholte et al., 2015). The two primary methods used in this study were semi-structured interviews and focus groups. This approach enabled the collection of data derived from open-ended questions which provided a comprehensive illustration of the socio-ecological context of Kachemak Bay.

Qualitative methods are useful when working in a socio-cultural context for several reasons. First, the open-ended, adaptive design of qualitative methods enables an in-depth assessment of the experiences, perceptions, and values associated with ecosystem services (Young et al., 2018). Interviews broaden the scope of analysis by allowing interviewees to identify and explain values that include tangible provisioning services as well as intangible, cultural services (Scholte et al., 2015 Christie et al., 2012). Second, semi-structured interviews and focus groups can help engage and communicate with diverse stakeholder groups. Karrasch (2014), found that in-depth interviews helped to establish rapport with local communities and ground the esoteric language associated with ecosystem service research.

Information gained from qualitative data can inform future ecosystem service research including questionnaires, monetary evaluation, and biophysical monitoring. The qualitative methods used in this study establish a means for KBNERR to apply an ecosystem services framework to their five-year management plan and future research. By identifying major ecosystem services and their associated indicators, this study provides KBNERR with the knowledge to inform future projects including Blue Carbon initiatives, monetary valuation, and interview protocols.

Two primary frameworks were used to organize and synthesize interview and focus group data. The first and most commonly used framework organizes types of ecosystem services by the general benefits they provide. This framework from the Millennium Ecosystem Assessment consists of four categories: provisioning, regulating, supporting, and cultural. It was used as a primary method of communicating the concept of ecosystem services to diverse audiences and providing cursory organization of the suite of ecosystem-derived benefits discussed in interviews and focus groups.

An extensive social value typology framework for coastal areas developed by Cole (2012) was used to further synthesize the range of values expressed by interviewees and focus group participants. This framework consists of sixteen typologies that could fit within the four Millennium Ecosystem Assessment categories but better capture the nuance of this rich dataset. The application of these frameworks is discussed further in Chapters Five and Six.

Semi-structured interviews

In conducting interviews, two primary sampling techniques were applied: key-informant sampling and snowball techniques. Several existing studies have explored the socioecological context of the Kenai Peninsula (Gordon et al., 2013; Flint & Luloff, 2007). These studies outlined key user groups, stakeholders, and decision makers including: government agencies (local, state, and federal), commercial and sport fishermen, business leaders, tourism-based industries, longtime residents, short term or seasonal residents, news media, nonprofit organizations, environmental organizations, volunteers, Alaska Natives, and educators. KBNERR is well-connected in the Homer community and was able to provide contacts within these pre-defined groups. Additionally, interviewees were asked to provide additional contacts they believed would provide a valuable perspective for this project. KBNERR also provided access to their Community Advisory Council which is made up of agency representatives, researchers, local leaders, economists, and other involved or concerned community members. The KBNERR stakeholder network sampled is detailed in **Appendix A**.

Involving the Community Advisory Council and contacts from KBNERR in this manner is a form of “Key Informant Sampling” also called “Purposive Sampling” (Young et al., 2018). This method can be effective in identifying “knowledgeable experts” within a community when conducting place-based or cultural research. Key Informants are generally individuals who are known to be knowledgeable on the research topic and can be helpful to understand the social and ecological contexts in a place previously unfamiliar to researchers. These Informants can also provide leads to other community members, stakeholders, and decision makers who might contribute valuable perspectives and knowledge to the research (Tongco, 2007). While this technique elicits knowledgeable responses, it may be limiting as other community members not connected to the Informants or the previously identified sampling groups might be overlooked.

In total, 31 interviews were conducted. This sample size goal is consistent with previous socio-cultural ecosystem service research (Rawlins & Morris, 2010; Klain & Chan, 2012). The following groups were represented among the 31 interviewees:

- Local Government
- State Government
- Federal Government
- Non-profit
- Research
- Business Owner
- Recreation
- Long-term Resident
- Homesteader
- Economic/Development
- Artist
- Ecotourism
- Fishing
- Education
- Conservation

The interview guide was designed to answer five primary questions (Figure 1.3):



Figure 1.3: Interview Questions

To elicit interviewee responses that answer these five questions, a variety of techniques were employed in the interview guide. The guide was designed so the interview would be conversational, and so the interviewee could feel comfortable to share stories, anecdotes, experiences, ideas, and perceptions. The interview protocol was designed to take approximately one hour and was approved by the University of Michigan Institutional Review Board in May 2018.

Each interview encompassed three primary focus areas: a community characterization (to better understand the socio-cultural characteristics of the Kachemak Bay watershed), the description(s) of ecosystem services that are used/valued by the interviewee, and the factors interviewees perceive to be impacting the state of these valued services. Each focus area began with a guiding question and included several additional prompts to draw more specific information and/or help focus the conversation around the study objectives. The complete interview guide is provided in **Appendix B**.

Focus Groups

Focus groups were conducted with members of KBNERR's Community Council during the semiannual Community Council meeting on June 6, 2018. The eighteen-member council includes a variety of agency representatives, managers, researchers, and community members. These eighteen individuals were divided into three breakout sessions that were facilitated by this project's team members. Sessions were one hour long and were designed to follow a

similar set of questions as the interview protocol. The goals of these focus groups were to facilitate collective conversations about ecosystem services perceived to be valuable individually and/or collectively to the Kachemak Bay community, the benefits derived from these services, as well as any assets/threats affecting natural systems in the Kachemak Bay region.

During these focus groups, participants identified valued ecosystem services, the benefits they receive from these services, and the factors they perceive as impacting the health and/or availability of these ecosystem services. Prior to the focus group session, there was a presentation given to the Community Council to define and explain “ecosystem services” and provide an overview of the structure and goals of the focus groups. The complete focus group protocol is provided in **Appendix C**.

Data Analysis

Each interview was transcribed verbatim and analyzed using NVivo 12.0 software. Analysis included inductive and deductive coding. Deductively, two ecosystem services and social valuation frameworks from Cole (2012) and the Millennium Ecosystem Assessment (2005) were applied to compare data with existing literature. Other inductive codes were developed based on emergent themes or patterns from the interview data. This dual approach to analysis was helpful in providing a holistic view that compared new data with current literature while also allowing for emergent findings.

Report Roadmap



Introduction

Chapter One introduces the Kachemak Bay ecosystem, the Kachemak Bay National Estuarine Research Reserve (KBNERR), this project’s goals, and the methods used to collect data.

What the Community Values: A Stepping Stone to Identifying Ecosystem Services

Chapter Two describes natural or ecological aspects of the Kachemak Bay watershed that interviewees perceive as valuable to themselves individually or to the community as a whole. This chapter describes natural systems, resources, or processes identified by interviewees, and outlines the multiple types of social benefits received from these systems.

Perceived Drivers of Ecosystem Change in the Kachemak Bay Watershed

Chapter Three describes the factors that interviewees perceive to be “threats” or “assets” to the health and/or availability of valued ecosystem services. Chapter Three also describes the perceived “signs of ecosystem health” that interviewees used to measure or monitor the state of the places and resources they value. These threats, assets, and signs of health provide a community-relevant means of communicating the health and well-being of the Kachemak Bay watershed and its resources.



4

Perceptions of Natural Resource Management, Policy, and Practices

Chapter Four describes interviewee perceptions of current natural resource management in the Kachemak Bay watershed. This chapter outlines both negative and positive perceptions regarding the level and effectiveness of state and local fish, wildlife, and land management practices.

5

Kachemak Bay-Specific Ecosystem Services Framework

Chapter Five describes the concept of “Social Value Typology” (SVT) frameworks for organizing, understanding, and communicating the many social benefits received from natural systems. It provides an introduction to SVT literature, as well as the previously designed SVT framework for coastal ecosystems that was used as the basis for analysis in this study. Chapter Five also discusses ways in which applying an existing SVT framework to newly collected data from Kachemak Bay was unsuccessful in fully capturing the details and nuances that emerged in interviews. The case is made for developing a place-based, Kachemak Bay area-specific SVT framework. This SVT framework designed specifically for the Kachemak Bay region is then outlined and detailed.

6

Ecosystem Service Research Applications for KBNERR

Chapter Six provides tools for KBNERR to apply and maintain an ecosystem service framework for communication and management goals. This chapter outlines existing ecosystem service literature and several existing frameworks; reviews several previously completed ecosystem service studies whose methods could be applicable for KBNERR in continuing and updated ecosystem service research; and, details the focus group methods employed in this study as an additional tool for KBNERR to use in the future.

Chapter Two

What the Community Values: A Stepping Stone to Identifying Ecosystem Services





What the Community Values: A Stepping Stone to Identifying Ecosystem Services

Introduction

The primary goal of ecosystem service frameworks is to connect human and social well-being to natural systems and ecological processes. Specifically, through a socio-cultural lens, the term ecosystem service can be used to describe the various benefits that individuals *perceive* that they derive from natural systems (Cole, 2012). Therefore, in order to identify the ecosystem services present in the Kachemak Bay region, we first had to understand what aspects of the Kachemak Bay area are valued by community members and the different ways in which they are valued. To gather this information, interviewees were asked:

How would you describe your community? What is particularly special about it?

Are there particular places/resources in the Kachemak Bay region that are important to you or your family?

What specifically is valuable about this place/resource to you? What is its relative importance to you or your community?

How do you interact with the natural landscape?

What are your hopes and concerns for the future of this resource?

These questions elicited lively discussion and a wide range of responses about what is special about the Kachemak Bay region and why. This chapter describes the most frequent and salient interviewee perspectives on those aspects of Kachemak Bay that are especially important to community members.

Table 2.1: What is valued by the Kachemak Bay community (% of Interviews = total percentage of interviews that contained the associated value) (n = 31).

What is Valued	% of Interviews
Fish (salmon, halibut)	93
Wildlife	99
Recreation	87
Aesthetics	87
Ecological Processes	71
Research and Education	61
Agriculture	42
Forests	26

Fisheries

Twenty-nine interviewees (93%) valued the fish or fisheries in Kachemak Bay or other areas within the broader watershed (e.g. Cook Inlet, Anchor River, etc.). The primary species discussed include: salmon (red, chinook, pink) and halibut. Other marine species including: king crab, clams, oysters, and other shellfish are also included in this category if they were discussed in the context of harvest (commercial, recreational, or subsistence). Often a single interviewee cited multiple values or benefits they associate with, or receive from, the area's fisheries. Values and benefits related to the fisheries range from economic and subsistence; to cultural, community, and family ties; to a sense of individual identity that is informed by the connection to the fisheries in the Kachemak Bay watershed:

Up here, everybody cares about fish. They either derive their livelihood from it, they fill their freezer with it, it's a big part of their recreation. Even if you're a bear-watcher, you care about fish because the bears are chasing fish.

Economic Values

The majority of interviewees who expressed a value associated with the Kachemak Bay watershed's fisheries discussed it in an economic context. Fishing commercially or recreationally is largely seen as the lifeblood of Homer's economy as the town supports a substantial port for commercial fishing and is a popular destination among recreational fishermen (both locals and those coming from other areas of the state and country). For some interviewees, fishing was discussed as a personal livelihood (either their own or that of their family/specific family members); however, most discussed the economic benefits fishing provides for the community as a whole:

There's a lot of people that want to come to Homer/Kachemak Bay to kind of get away from the city and that sort of thing, so they come down to fish and be on the beach and go across the Bay and do things. And I think they typically have a pretty positive impact and they definitely help our economy. People are trying to make a living from running charter business or ecotourism and that kind of stuff and they help us, for sure.

We're kind of a hub for not only Kodiak but also the chain and for traffic there and all of those boats need to be worked on. So, they're hauled out during the winter and we give welders jobs and we give electricians jobs and, you know, it's part of the diversity of the web that holds the community together and that diversity is really important because it's not all fishing or all tourism or all healthcare or all one industry and I think that's what has allowed Homer, as a community, to do pretty well. You know, we are one of the more diverse places, I think, in Alaska. You know, you go to ... like, some places it's all oil and gas workers or all tourism workers and we've got a nice mix here.

Interviewer: So what benefits do you get from fishing?

Interviewee: Strong economic benefits. It's been my husband's business here for 30 years and 10 years before that in Kodiak. But I have also derived great benefits – my kids are captains because of all the seas time they had and no matter what they go off

and do, being a sea captain is a great benefit. It impresses people who aren't sea captains first of all, no matter what job you're applying for.

Many interviewees did note that the fishing industry in and around Kachemak Bay has changed significantly in the last thirty to forty years. This change was largely attributed to various stresses on the resource which are further discussed in Chapter Three. Despite these changes in the scale of the fisheries or the state of the industry, fishing remains a top economic driver in the area. Several interviewees discussed that some are rethinking the traditional commercial fishing business model and are either transitioning to a greater reliance on hatchery-raised fish, or are expanding their businesses to include additional facets like value added products and restaurants:

When we first arrived, commercial fishing was the primary industry, and during that time we had a number of vibrant fisheries out in the Bay. We had commercial shrimp fishery, commercial crab fishery, commercial halibut fishery, commercial salmon fishery right in the Bay. Now, within probably ten years or more, those fisheries all but disappeared because they weren't as carefully managed as they are today with Fish and Game. People were dragging for shrimp, predominantly for crustaceans. ... So, as we saw that industry changing, I think people became more and more aware of the resource we have with Kachemak Bay.

When I first started [working], I had a lot of mom and pop, small commercial fishing operators that would buy property, and their whole livelihood was based on just getting up, going out, getting on their boat, and going around the Bay getting their resource. They're not here anymore. So, that has been stressed and done away with.

And then the other one you're seeing right now is with a lot of the younger people coming back to the area, and those that moved away and are coming back, and they are really reinventing the way you do commercial fishing. They're looking at value added products.

Halibut stocks are down, really hard to say, natural salmon stocks, what'll happen to them. A lot of these big fisheries are relying on hatcheries.

Community Culture

Many interviewees discussed how the area's fisheries have shaped Homer's community and culture. There is a strong pride of place that is associated with the area's deep connection to its fishing resource. Many described how this connection between humans and the area's resources (most prevalently, the fisheries) sets Homer apart from other areas around the world that may otherwise be similar. Some noted how this connection to the fishing resource was originally built on the community's economic or subsistence dependence on fishing, and over time has fostered a community identity and sense of place. Others emphasized that this identity and sense of pride and ownership that is centered around fishing causes people to be exceptionally passionate about this resource. Some also explained how the fisheries continue to be one of the primary draws for people to travel or permanently relocate to the area:

I think the main thing is that this is a coastal community, and a coastal Alaskan community that depends on marine resources in a variety of different ways. So, it's very cool to live in a place where people really care about what we do because it either matters for their work or their recreation or things like salmon fishing which is subsistence, the kind of subsistence that we all do.

In Homer we have, I think, the largest population of fishermen or people who own IFQ [Individual Fishing Quota] and live in Homer as opposed to anywhere else in the state so we're a fishing community and we're also an oceans-focused community.

Interviewee 2: *Do you eat oysters? Are you a regular oyster eater?*

Interviewer: *I've tried them, not a regular oyster eater though.*

Interviewee 1: *Well, you should have some while you're here because they are the best in the world.*

Subsistence Values

Some interviewees who discussed the Kachemak Bay watershed's fisheries also explained the subsistence benefits the salmon, halibut, and clam/shellfish fisheries provide. A common theme among almost all interviewees who valued the fisheries for their subsistence purposes was that personal harvest is the most reliable means to get fresh seafood in and around Homer unless eating out at a restaurant. Most of the fish harvested in the Kachemak Bay watershed are exported:

Even in a fishing town if you aren't catching your own fish it can be hard to get fresh fish, but people are figuring that out. It used to be that for salmon it was fairly easy, but for halibut you had to go out for sport fishing or have your own boat or be paying gas for a friend's boat because everything getting caught is shipped out. And you know you'll still find it in the restaurants but not anywhere else.

I fish on the Kenai, from the Kasilof River which is just north of Kachemak Bay, and my son and I fish there...every July for dip-netting, and we try to harvest 20 to 40 sockeye salmon during that period of time to fill our freezer and I still think that's a fairly liberal amount for an Alaskan to get when they can just drive there with their car to get it.

I do a little bit of fishing for myself, for my own freezer. I do a little bit of hunting when I can. You know, once a year.

Well I'm not a sport fisherman. I like to go out and fish for personal use, not sport. It's a little bit of recreational. I love fishing but it's for personal use.

Being able to take a water taxi across the Bay and hike to a glacier or fishing...we do more like dip-netting. That's one thing, we're not big sport-fishermen, but we have a lot of friends that are fishermen and they drop off fish to us and then we go dip-netting in the Kenai, and just having access to be able to harvest our own food is really important.

As Homer has developed, the concept of subsistence fishing has shifted among some of its residents. Some interviewees who were early residents of Homer discussed that before there were local grocery stores, there was a *reliance* on subsistence fishing for basic needs. Most present-day subsistence fishing, however, was discussed as a welcome addition or alternative to purchasing meat from the grocery store. There are still communities in and around Homer that rely on subsistence fishing in the traditional sense, but most interviewees seemed to fall into the latter category:

The period of time I was going to talk about was just after the highway was open, and we could drive to Anchor Point. So our family, along with 3 or 4 other families, took one of the families, they were fishermen, commercial fishermen, so we should have had access, but we took their gillnet up to Anchor River and we would stretch that gillnet across the river, and us kids would stand up the stream and throw rocks in the river to drive the fish up into that net. Then turn one end loose and seeing it around with the current and pull it up on the beach, and we'd get probably 25-30 king salmon... Then we would spend 2-3 days processing those, both smoking and canning them.

Then there's fishing and I'm not a huge fisherman, but I do like to fish occasionally to have some salmon or halibut in the freezer. So definitely some fishing and drop netting over at China Poot for some red salmon is always nice for getting fish and is also just an amazing experience. So yeah, it's mostly recreation and some harvest.

Interviewee 1: *Population has made it harder to get subsistence, and then clamming is a really good example of that. It used to be you could go to Clam Gulch...*

Interviewee 2: *It was over harvested!*

Interviewee 1: *... and you could get 60 a day and it would take 2 buckets to get 60, because they were that big. Now, well we haven't gone for years, but people were saying you could do 120 in one bucket because they're not getting big enough.*

Recreational and Sport Fishing

Other interviewees who discussed the fisheries also mentioned the opportunities for recreational fishing they provide. There is a certain degree of ambiguity between those that “subsistence” fish and those that fish for purely “recreational” purposes. Most interviewees who fish personally do so, at least in part, to have access to fresh seafood. However, some interviewees stressed that because they do not “need” to fish in order to survive, they are recreational, not subsistence fishers.

Some interviewees described recreational fishing as one of the magnets that draws visitors from other areas of Alaska and the United States to the Homer area. The Kenai Peninsula was dubbed “Alaska’s playground,” and several interviewees noted that this branding partially refers to the area’s recreational/sport/charter fishing opportunities. There were some mixed opinions about whether or not the high volume of individuals using the fisheries for sport/recreation is a positive influence on overall fishery health. Some questioned the merit of the “Alaska’s playground” brand:

The Kenai Peninsula really is Alaska's playground. When you come to Alaska, you make a decision to go one of two places—you're either going up, for the most part, north to Denali, or you're coming south to the Kenai Peninsula. And most people, we try to draw them down here. This is world-class fishing, whether it's salt water or whether it's in the river.

But I know there's tourists that come down here, and we're kind of the playground for Anchorage and there's a lot of—Kenai/Soldotna – so there's a lot of people that want to come to Homer/Kachemak Bay to kind of get away from the city and that sort of thing so they come down to fish and be on the beach and go across the Bay and do things.

Solitude

Many who discussed recreational or subsistence fishing also discussed a value associated with the quiet and tranquil experiences one can have when fishing in or around Kachemak Bay. While some enjoyed participating in the “combat fishing” that occurs on the Anchor River, others expressed a preference for more secluded and peaceful fishing experiences in other areas. Many interviewees described the “non-motorized” areas as valued quiet places to be on the water. Others valued the open-wilderness experience one receives when fishing out on the Bay, and how it provides calming, therapeutic experiences and a connection to nature:

Hopes and concerns for the future? I'd say a sustainably managed fishery with shellfish and fish for sure. Continued quiet places to go enjoy. Non-motorized....

...the Bay itself and just being on the water. Whether you're fishing or just enjoying the wildness and openness of just being out there.

So, Kachemak Bay is really the thing that draws me. I'm not much into crowds. I love to fish, but I really don't fish like the Anchor River and places like that, there's just too many people there. So, I've got a boat in the harbor and I spend a lot of time on the water.

Personal Identity and Connections

Some interviewees also discussed how a connection to the fisheries has become deeply important on some personal level, or even fostered an individual identity. They noted how fishing commercially, recreationally, for subsistence, with their families, and others has become a core part of their lives and who they are. Many also expressed that this personal connection to the fishing resources also ties them to the Kachemak Bay area and Homer community, and makes the Kachemak Bay area home:

Now, in fact, my oldest stepson commercial fished for crab and shrimp here in the Bay. Then, in later years, as those fisheries moved out of town, he ended up going right with them to the Bering Sea. Then, he would come home and take his own little boat and go across the Bay and set his shrimp pots and then harvest shrimp as long as that was available. He's a fisherman, fishing is in his blood.

I came to Kachemak Bay as an infant, just a few weeks old. My father had found work running a fishing boat and we went directly to some land near the Kilcher homestead and lived there and eventually my parents bought some land nearby, and they were drawn to very much the same thing that had drawn Ruth and Yule Kilcher, the good and simple life. They had very little cash in their lifestyle and did a lot of stuff by hand... grew up fishing commercially, gardening, making our clothes, serving a lot of food.

Many interviewees discussed familial connections that are tied to fishing. For many interviewees, recreational or subsistence fishing is a family tradition, and a way for family members to spend quality time together. Many interviewees expressed that Homer is an excellent place to raise a family, partly because of the access to fishing and other natural resources and outdoor activities:

Interviewee 1: *Subsistence fishing. We don't do it so much anymore because it's become such a circus. For years we subsistence fished on the Spit, and it was a family thing, we'd camp out the night before, get up and set the net.*

Interviewee 2: *Had a fire, had the kids there...*

Interviewee 1: *We'd eat the first fish that we caught, and we'd spend a couple nights out there and run out twice a day and do all that. So, our son grew up and was like, 'Oh it's fishing time, yay!'*

The set net sites are mainly families that have handed it down... It's really wonderful family life where you have your set net and you're at the beach, collecting your fish, and I'd hate to see that go away.

Wildlife

Moving beyond fisheries, interviewees also identified a range of other terrestrial and aquatic species that they deemed important to their well-being and the community more broadly. Wildlife was mentioned as a valuable resource by 99% of interviews. Although the natural systems in Kachemak Bay are host to hundreds of species, interviewees primarily mentioned terrestrial species such as moose, bear, and birds. Major aquatic species such as otters, intertidal communities, and whales were also mentioned. The array of wildlife communities provides a range of benefits to the Kachemak Bay area including subsistence and personal harvest, intrinsic valuation and personal connections, community culture, and economic values.

Subsistence & Personal Harvest

Many individuals and families rely on wildlife as a subsistence good, whether hunting moose and bear or gathering shellfish. When asked what value these species brought, respondents noted that they "filled my freezer." The level of attachment to subsistence-gathering varied, with some individuals focused on securing a moose or bear as essential to their sustenance, while others felt it was important but not quite to the extent of dependence. The following quotes highlight this range of interactions with subsistence hunting and gathering:

We moose hunt, too, so that is a huge ordeal around the fall ...It's like, our whole world is around the moose hunting.

There's something pretty special about thawing out moose meat or whatever, game meat, that came from a hunt that's like ... There's just something, I mean, nothing like it.

Well, now of course it is recreation. I won't say subsistence. Because now I don't need moose meat... to live. Yes, it's nice to have those things, but I would have to say that now I am a recreational user of the resources.

Intrinsic Value and Personal Connections

In addition to the importance of harvest, interviewees mentioned a personal connection to viewing and coexisting with wildlife in the Kachemak Bay area. For many there was an intrinsic value associated with wildlife populations, meaning they value the right of wildlife species to live and thrive simply because they have value in existing. These individuals were very aware of shifts in wildlife populations, and species loss was often seen as a personal or emotional loss. Additionally, living with moose, bears, and birds was seen as an important part of everyday life, often impacting the way they viewed the world around them:

We're lucky that we live in a place where we have this amount of wildlife around us, and we've changed how we wanted to do things. I wanted to have a compost pile, and it's just never worked because the bears just come and get into it. We had to shoot a bear once because it was just getting into our house, getting into our shed and stuff like that, and it just wouldn't leave, and I felt like we trained it because we had the compost available for the bear. So, we just tried to change the way we were doing things.

This time of year, the moose come around quite a bit. Yeah, most people, like dogs, sense that you're afraid of them they'll pick up on that – same thing with moose. You have to be careful, so I'm always sure that there's a railing or deck or something in between me and the moose A lot of people, they see a moose, they're going to run or shout but not if you can just cautiously get off to the side away from the moose and realize that the moose is not going to be able to come and kick you or charge you and you can more fully appreciate watching the moose for a little while.

Community Character and Culture

Connections to wildlife extend beyond personal appreciation. Many interviewees commented on the importance of the Kachemak Bay area's abundant wildlife to the community character and culture of Kachemak Bay. Local organizations and events are tied to these species including the annual Shorebird Festival and art events. Although some interviewees mentioned that some community members may overuse or mistreat the wildlife in the area, overall there was a sense of community bonding from seeing and interacting with wildlife on a daily basis. One interviewee commented on the types of interactions almost all community members have with the area's wildlife, and how these experiences foster shared experiences and commonality among community members:

One thing that we haven't talked about much is this basic wildlife that walks through town. Everybody loves their moose and so a lot of people choose not to garden because they prefer that moose walk through their yard openly or whatever. So there's lots of aspects of wildlife, nature, that interacts with us here in town. Bald eagles on telephone poles and stuff like that. Yeah, so, a lot of that constant interaction, the constant view changing across the bay, all of that is just... you're not even participating in it, but it is such a prevalent part of your day even if you're just working in an office all day. That bringing it home on a regular basis. Everybody's got to watch for moose on the way home from work. It keeps you much more connected and attentive to the natural world than if you lived in a city.

Other interviewees described ways in which the Kachemak Bay area's abundance of wildlife and natural areas is a draw for people moving to Alaska, leading to a community of people who value and respect wildlife:

People are here because of the natural landscape and the resources here, too, I think a lot of them are. Not everybody here, some people are just here for a job. But I do believe that that tie to the landscape and the fish and the wildlife is kind of a part of why they're here. And I think when people have that in a community, I think that really enables more of a healthy landscape.

Economic

Some interviewees valued the Kachemak Bay region's wildlife populations for the economic benefits that they provide, specifically through ecotourism. Many tourists come to the area each year for birding opportunities, to go on whale watching trips, to observe wildlife in the State Park, or to hunt. The influx of visitors supports Homer's ecotourism, dining, and hospitality industries.

Interviewer: *So, then also it seems like your business is kind of based around the natural environment with in terms of water taxi service and what other kind of ... What other kinds of stuff do you offer?*

Interviewee: *We do tours, which is scenic and wildlife... [When] it snows you often see seals and then come July there's whales everywhere, and we just go for a cruise and whales pop up, and then people get to watch them. And so, tours ... And then scenery, like we go back into Halibut Cove and just do a little loop, come out. King Cove has goats this time of year. I don't think they're there in the summer, but it's just a kind of a neat experience for people to see what's over there.*

Now I'm not involved in bear viewing but bear viewing is becoming more and more of a draw for people to come to Homer. I get, my business, benefits from people coming to Homer. They may come here for another reason but once they get here, they find out there's a park and they might want to go hiking and then I benefit from that.

Recreation

Homer is generally considered to be “Alaska’s playground” largely because the Kachemak Bay is a hub for many different activities for residents and tourists alike. Popular activities include: hiking, biking, fishing, kayaking, skiing, using off-road vehicles/snow machines, and hunting. 87% of all interviewees pointed to recreational opportunities as something they particularly value about the Kachemak Bay region:

Well, Homer has a lot of different user groups. So, I mean you have to just pick your neighbor and say, ‘Oh what does he do?’ So, interacting... A lot of seasonal work with ecotourism, kayak guides, people working on the Spit, then you’ve got a lot of fishermen, it’s a big port for long-lining the salmon, Lower Cook Inlet access, the Gulf of Alaska access, a lot of hunters, a lot of recreational sport fishing.

It’s just so cool to be living in a community where so much depends on the ocean in one way or another. I’ve got friends that are the fisheries managers at Fish & Game, that are the sea bird managers at FWS, that are sport fish charter operators, that are commercial fishermen, that run ecotourism -- like our kayak guides and whale watching and all that kind of stuff. You know, those aren’t the only things that make up the economy, that collection of things, but Homer is really based in that.

In describing their recreational activities, each interviewee mentioned specific places of importance where they particularly appreciate the natural environment or enjoy a deeper connection with nature. These places often were trails (48% of interviews), public beaches (41%), or the Kachemak Bay State Park (58%):

So, Grace Ridge is, in a pretty short period of time, probably for a fast walker about 30 minutes, you’re up above the tree line, and even part way up there’s a waterfall you can see so it’s not even dull. You get an added benefit of that. But, once you’re out in the open country you really have almost a 360-degree view and it’s breathtaking, spectacular, beautiful, and awe inspiring...It’s a great place to be away from town, sit and reflect. It’s a great place to sit and eat the blueberries or the salmon berries.

Bishop’s Beach by Two Sisters, it’s a community beach, It’s where everybody goes whether you take hikes or just sit there in your car. You take your dogs down, your kids there, it is where people go, and it’s usually within a half a mile strip.

Yep, we do hiking, camping, hunt...not tons right around here. I did a little bit of black bear hunting across the bay in the park with my kids, mostly my son. And we do a lot of hikes over there and camp outs and stay in cabins periodically so...yeah, to me Alaska is a wonderful place but there’s places in Alaska I wouldn’t necessarily want to live, like Anchorage. What’s great about [living] here is that [I] have such easy access to the things that I enjoy [and there are not] a lot of people. So, the State Park is a wonderful place and there’s great recreation opportunities there and we do a lot of that as a family.

Accessibility

Nearly all interviewees recognized the tremendous recreational opportunities in the area and appreciated the easy accessibility to many places. This accessibility is promoted by a number of organizations that aid the community in recreational access:

Kachemak Nordic Ski Club is doing a great job maintaining trails for getting people outside pretty quick after work, both at McNeil and Eveline State Recreation area, and up at Lookout. That's pretty cool. The Homer Cycling Club is pretty awesome at coordinating things like the big festival in the fall, so that gets some people out enjoying some healthy, intact natural systems for sure. The water trail is a good interaction, seems to be a good way to do it. State Parks does a great job of keeping access open to some of these places across the Bay in a pretty lower-impact way.

While community members appreciate the easy access to certain parts of the Bay, some also recognize that there are some areas of the Bay with limited access. Journeying across the Bay to Halibut Cove or the Kachemak Bay State Park is only possible by boat or plane. Since many citizens do not own a boat and water taxis can be expensive, a portion of the community seldom gets out across the Bay:

Yeah, Little Tutka Bay ... we spend a lot of time there. Probably more than anywhere else. Little bit in Halibut Cove and Seldovia. I just sold the sailboat though, so, the connections over there are going to be a little bit less.

But mostly what I heard from my husband -- growing up was they never had a boat, so he didn't have access to any of that, and there's a lot of families that can't afford it . . .

However, there is recognition that limited access is important in maintaining the health of certain recreational areas. Notably, some community members appreciate the limited access to certain areas because it reduces human impact:

And what we have is fabulous hiking, fabulous wilderness experiences, bear viewing opportunities, fishing opportunities, recreational opportunities, and just sitting at the beach opportunities. The fact that we have a non-motorized vehicle on the beach restriction. The majority of the beach you can't have a motorized vehicle on it.

Economic

Many interviewees value recreation because they recognize the draw of the Bay to tourists, which contributes positively to the economic base of Homer and south Kenai Peninsula. Ecotourism was referenced in 51% of interviews. The "tourist" population in the Kachemak Bay watershed in general comprised of cruise tourists and ecotourists. There are also many individuals from other areas of Alaska and the country that come to Homer to fish, but many interviewees considered these individuals to be sport fishers, not tourists.

Cruise tourism is a somewhat controversial issue and some interviewees consider it a threat to ecosystem health (this is discussed in greater detail in Chapter Three). However, most

interviewees acknowledged recreational ecotourism (those that come to camp, hike, kayak, etc.) as a positive contribution to the local economy and community character. Recreational ecotourism is seen by many interviewees as more of a “sustainable” method of bringing economic growth to the Bay:

... the whole kind of ‘we’re open for business mentality’ of wanting to attract more development, but instead of doing that, just really appreciating the natural resources we have here, the wilderness and the uniqueness of our ecosystems and encouraging more sustainable type things—tourism and that sort of thing.

Interviewee 1: *So, the people that stay in an Airbnb or one of the hotels or camp out, something on that level, they interact more with the community. They tend to do more trips like kayaking and a trip to go birding or go to Halibut Cove.*

Interviewee 2: *Or even rent bikes and ride around.*

Interviewee 1: *So, they come here to really see the community.*

Recreational Culture & Identity

Connection to one’s individual identity was often referenced by interviewees when describing routine recreational activities they love to pursue. Many interviewees mentioned being “avid” skiers, bikers, kayakers, etc. These activities contribute to the recreational culture of the Bay, further strengthened by many recreational clubs and organizations, and the idea that Homer is “Alaska’s playground.”

Well, you know, growing up in Alaska, it’s kind of a given that you spend a lot of time outside and, you know, your recreation is kayaking and hiking and biking and bonfires on the beach and all of those things. So, when I went away to school, actually, to the lower 48, I was, like, wait, not everybody does this? That’s weird. So, yeah, I mean, I do more, like I said, outdoor recreation than, like, hunting and fishing, I suppose, just because of my kind of time and interests, personally.

I am a kayaker. I’m also a skier and a hiker. I love hiking and love walks.

Ecotourism is also tightly tied with the local culture of the Bay and the connection to the community. Many interviewees appreciate the positive feedback loop that comes from the connections between ecotourism, the economy, the development of the culture, community growth, and a desire to protect the resource that initially draws tourists so the community can continue thriving:

We’re not just about work, for sure, because once you have a certain size that you have to sustain then all the other side industries come in. But we’ll predominantly be commercial fishing and sports fishing and burgeoning ecotourists, which are kind of the main economic drivers and that, therefore, has created things like the hospital and because there’s people living here we have doctors and electricity, and it becomes kind of a chicken and egg thing.

...If you could be a tourist and go to a place that has this great environmental backdrop, and then see incredible social functioning, where there are areas that have their own music and own dance and own food, there is the rich cultural identity that comes from those processes and those interactions...you'd want to visit that. You'd want to be a part of it. And you'd end up dropping your money and you'd call that part of your economy.

Aesthetics

The Kachemak Bay region's spectacular aesthetics is highly valued by the community. Aesthetics refers to what people call "the view." This view along Kachemak Bay includes snow-capped mountains, glaciers, acres of forest, and the wildlife that is contained within it all. Aesthetics was mentioned in 87% of all interviews.

Recreation and aesthetics are valued closely together, with the beauty and accessibility to the pristine nature of the Bay affecting ecotourism as well. Generally, interviewees saw the aesthetics of Kachemak Bay contribute positively to their recreational experiences. Many interviewees enjoy their recreation because of the stunning views and appreciated that these views were all around them:

...and you're up on top of out by the Russian villages and it's just spectacular mountains and just the whole thing. You're just in the middle of it. Or if you're kayaking and going up into China Poot or if you're leaving lab and going over to Jackalof, you're looking at not only the incredible scenery but also there's a whole rack of sea otters!

But, once you're out in the open country, you really have almost a 360-degree view and it's breathtaking, spectacular, beautiful, and awe inspiring...

I believe you're pretty hard pressed to find a place here that doesn't have a view... I spent a lot of time just looking at the place and feeling that connection.

On the other hand, some interviewees noted that there are tradeoffs associated with having great access to the view. They mentioned the spruce tree die-off, and how losing these trees was a sad loss for many, but it also made real estate along the Bay more desirable:

All of the hillside in the flats are facing south, so it's your best solar gain so you want your biggest windows on your south side of the house and it just so happens, luckily, that that is the beautiful view of the mountains and glaciers across the bay. So when everything had trees, there were a lot of places that didn't have a view and they didn't even think about. So imagine cutting the trees and then seeing this beautiful landscape and you're really upset because you missed the trees but you sell your house because someone wants to pay you hundreds of thousands of dollars for it because it's an amazing view.

Then personally I think both of us felt that there was a big grieving process of losing these old trees that were not only... just made up the community, but it changed how we felt about the area. It changed the view of the area.

Natural and Pristine

A large part of what makes the aesthetics of the area so important to community members is the natural and pristine ecosystems. Many appreciated that the aquatic and terrestrial environments are relatively untouched by humans, benefitting the community in many different ways.

Interviewees often expressed gratitude at living in such an environment:

Here it's like living in a postcard. So, the environment and the megafauna [are] still mostly intact, both marine and terrestrial, that's a seductive thing. And, if that doesn't hit them between the eyes in terms of 'This is valuable and worth making concessions to work with,' I don't know what will.

We live in one of the world's most beautiful, natural environments, and I think as I'm aging gracefully and doing more international travel, I come back and realize just what a world class environment we have here. Between the glaciers, the Spit, the historical elements of that, and, more importantly, the Kachemak Bay...

Community Culture & Identity

Community culture is an amalgam of the historical culture of the Bay, common community practices, or common experiences that people living in the area tend to have. For example, the main road into Homer can be a memorable experience for first-time visitors to the area as the landscape creates a sudden, breathtaking view of the Bay once you reach the top of the hill.

You see a bird's eye view of the mountains, the waterways, and the forest:

I think part of what you'll hear from most people in Homer, it's that view when you come over the hill. It's very captivating.

Aesthetic is also tied to Alaskan culture in general. One interviewee explained how Americans tend to think of the "Alaskan wilderness," which is tied to its wildlife and pristine qualities, both of which are essential to the Alaskan experience:

I think that fundamentally, the idea of the wilderness is very, very important to the American mind. It's important to humans, it's important to people who are in Europe and arrive at this place when they come to visit. But I think it's that kind of Alaska ethos. It's very important.

Interviewees recognized that appreciating the area's beauty is often a shared experience among community members. They noted that the community culture and pristine environment attracted a certain type of person with common goals and values:

But here in Homer, if you're fortunate enough to live here, chances are you are in the right forest and you're going to find, you know, if you apply yourself, an opportunity. We are kind of like that cosmic hamlet. We have that, we are known for being the cosmic

hamlet. Where just things happen here but, you know, what makes that happen is all of the networking and connections to... I think Homer -- because of the natural beauty -- we draw a unique group of people that are citizens and so all of us [are] helping each other.

Many interviewees also expressed a sense of connection with the view through their individual identity and the community. As mentioned, that initial moment when first coming over the hill into Homer impacted them so much that they remember it well many years later. The view was captivating, and enjoying the view became ritualistic. The entire experience was something that many interviewees expressed as essential to their happiness:

I think the draw to come to Homer was halibut fishing at the time but then having just booked a bed & breakfast and stayed on Mission Ave... that morning, going out for breakfast on the deck there and seeing the incredible view, that's what got me.

You know it's hard to put into words, but you know it's just these odd things, like, you're walking the beach and the light catches a ray and there's the frozen rocks because it's in February. There's that great winter, low-angle light and the eagle comes soaring by and you just have this sense of peace and grounding and it just sort of takes you out of things for a while. That kind of stuff, that's just priceless.

Natural Processes

Throughout interviews, interviewees frequently mentioned the value of ecological structure and processes in maintaining other wildlife and their overall well-being. Although these processes are not visually or economically striking like fish and ecotourism, interviewees often described them as essential to other aspects of the natural landscape. The major ecological processes mentioned throughout interviews include nutrient cycling, hydrological cycling, wildlife habitat maintenance, climate regulation, and biodiversity. Overall, 71% of interviewees mentioned one of these ecological structures and functions. One interviewee captured the personal and health benefits provided by these indirect processes:

The healthy nature of the ecosystem has been integral to our physical health and the health of our business. We can only do what we do because we have clean air and clean water and intact systems that we can live and co-evolve with. Nutrients and natural inputs from fish and other organisms living in the Bay and the forests...

The other important thing to recognize, and you probably know this, is the connection between salmon and our forests. You can find the atoms that are referred to as "marine derived nutrients" that salmon bring into our watersheds that make it up to the top of our trees that make it into the bear eyelashes or whatever. They feed our system nutrients.

Habitat

Interviewees often mentioned the importance of available wildlife habitat. They stressed the need for landscape connectivity to promote healthy habitat for terrestrial and marine life which,

in turn, promotes subsistence opportunities and the pristine aspects of the natural environment. One interviewee discussed different habitat disruptions that can impact biotic integrity:

...There are some areas where some land features and land uses are pretty disruptive of the energy flows and biotic integrity, and we see—you can generally capture those as some kind of environmental degradation. There might be things like roads that are very intrusive to things that get trampled on from concentrated activity to sanitary problems around roads – like pull-offs that lack proper sanitation facilities.

Issues of habitat were also emphasized in relation to increased population and ATV use:

But in flying around and inspecting the different systems and stuff, one of the things that I've noticed significantly is access by four-wheel ATVs has really spread out, and you can see the damage of the landscape from the air where you used to not see any kind of a track out there or very limited tracks.

Temperate Climate

Many interviewees highlighted the unique benefits associated with the temperate climate of the Kachemak Bay area in relation to personal and economic well-being. The climate was often described as a 'best of both worlds' including both temperate and colder weather patterns:

One of the things that I really love about Kachemak Bay is that we are this kind of “edge” environment, and that’s something that we tell people too when we do our tours. It’s just really neat to see that influence of being the northernmost extent of that temperate coastal rainforest—so you go across the Bay to the field station and you’re kind of in that environment and you have the plants that reflect that and the trees and the birds, but then we’re also the southernmost extent of the boreal forest, which is what you get up at the Wynn Nature Center on the bluff. And so you have this “edge” environment where you have the best of many worlds for Alaska without having the extreme rain of the temperate coastal rainforest like we have in Cordova – 140 inches of rain a year. Here we have 30, but it’s really great and you’re right here on the ocean, and then you have the boreal forest and you have a lot of the plants and animals that you find in the boreal forest but you don’t have -30 degree weather and all the darkness.

It’s that temperate, marine environment that allows those of us from south central Alaska that live in a sub-arctic environment to access a much more temperate area. Someplace that we could go all year.

Biodiversity

The importance of biodiversity was also mentioned by 45% of interviewees. For some, high biodiversity in the Kachemak Bay area is a sign of ecosystem health, others described the loss of biodiversity from various species diseases or overharvest:

Biodiversity would be the biggest indication of a healthy ecosystem.

And you know we've just seen such radical changes, and a lot have been climate induced, you know. Sea star wasting disease, 20 years ago we had the spruce bark beetle, and now the past couple of years we've had a spruce aphid. Seabird die offs, sea otter die offs, we don't have any hardshell clams in Kachemak Bay virtually anymore, we don't have any dungeness crab. So just in Kachemak Bay, you've seen ample evidence of a lack of sustainability in our management, but because of the way our systems are, because of the way our systems function, we don't have an adequate response to deal with it.

And [species] are not coming back. It's not coming back in the same way. You lose your genetic diversity, which is so important right now.

Other Supporting and Regulating Services

Many interviewees also mentioned various other natural systems/processes that are considered “supporting” and “regulating” services in the Millennium Ecosystem Assessment (MEA) ecosystem services framework. The MEA framework is described in greater detail in later portions of Chapter Two and in Chapter Six. The many supporting and regulating services highlighted by interviewees include: ocean chemistry stability; water temperatures (particularly in salmon streams); nutrient cycling; hydrological cycling (particularly snow/glacial melt rates and freshwater inputs to the Bay); and, cleanliness of air and water. Some representative comments include:

Kelp, it's important for, not only—it can be a very important habitat type for critters and for birds and for buffering pH...

With all these warmer air temperatures we're melting glaciers, we're altering the timing of snow pack, we're having less snow, or more snow, or at different times, we're getting runoff earlier, and this ocean system is really driven by the inputs of freshwater. So you know all the way from the Gulf of Alaska up to the Bering Sea, the whole system is connected by freshwater. It structures the water column which means growth is based on that, and it's just going to change that.

Well, first and foremost the healthy nature of the ecosystem has been integral to our physical health and the health of our business. We can only do what we do because we have clean air and clean water and intact systems that we can live and co-evolve with. Nutrients and natural inputs from fish and other organisms living in the Bay and the forests, even though they aren't natural as this is a prairie landscape, are also a core part of supporting the work on our farm.

Research and Education

Many interviewees (61%) also valued the high volume of local scientific research on the Kachemak Bay watershed and fisheries. They discussed the importance of ongoing research in fostering well-informed fishery and wildlife management, as well as land-use and development choices. A common theme among many interviewees was the importance of preserving

headwater streams when building or developing. Before KBNERR was established, it was unknown that the area's headwater streams were vital habitat for spawning and juvenile salmon, and there was little to no protection for these areas. Now, there is Kenai Peninsula Borough policy that requires a 50-foot buffer around salmon streams that is protected from development and human use. While there remains significant controversy over these types of local policies (discussed in Chapter Three), it was generally agreed that having this kind of knowledge is crucial:

There's a lot of streams around here and many people didn't think there were fish in them or anything to do with fish. But, Coowe with her research and all her teams that have been here, they found out that most of these streams that feeds into not only Kachemak Bay, but also Cook Inlet, all have different types of fish... red salmon or pink or... anyway, all the different species. But, in the olden days, a lot of people and these homesteaders would take their four wheelers and just drive across these areas and wipe them out, so the fish couldn't get up them.

Homer also has a wide variety of non-profit organizations and educational programming that focuses on educating children and the public about the Kachemak Bay ecosystem. Many interviewees see these programs as important community assets. Many expressed a passion for teaching their children and others in the community how to fish and care for the fisheries:

Fish and Game doing their Salmon Day up in Soldotna is pretty awesome. I think they do it at the Kenai River Center, or at least the river park up there, and it's a big celebration of spawning season. I think it's late spring and focuses more on elementary students [learning] about salmon life cycles and getting students outside.

Agriculture

In recent years, Homer and the surrounding Kachemak Bay area has seen a rise in agriculture production and local food systems. Federal programs to promote hoop house installation coupled with a social demand for local food has led to increased interest around agriculture as a major provisioning ecosystem service. Agriculture was mentioned in 42% of interviews as a major ecosystem service that people valued.

Subsistence

Agriculture production was frequently mentioned for its subsistence value. Many residents grow their own produce, both for fresh consumption and canning. The region's climate, particularly extended sunlight and southern exposure, were cited as major factors contributing to a growth in personal agriculture. Growing one's own food was seen as a way to connect to the outdoors and receive direct benefits from the natural environment. One interviewee described the experience in this way:

I enjoy being able to harvest my own food. We have a large garden which is a big aspect of our life is growing around food, and all of that stuff is important to the way of life here.

Community Culture

In addition to the rise in personal vegetable plots, the local food scene in the Kachemak Bay area was valued because of its contributions to public health and the character of the community. The local farmer's market was mentioned by 20% as important for community character and access to fresh produce. Some described the value of local food to the community:

There was a grant that was going around for the hoop houses or whatever, and there's like ... That's what really kicked up the farmer's market. And it became a really wonderful and great resource for fresh food, because it's really terrible in the winter.

There's agriculture here, high tunnels that were added here in Homer and the farmer's market. So now we have a way to have more locally produced vegetables, whereas in the past, you might be lucky if what you got, you know, was all shipped up from the lower 48.

Economic Values

Overall, there were few negative perceptions about the growth of agriculture and the farmer's market in the Kachemak Bay area. Some interviewees even saw tremendous potential for economic growth in the local food sector:

I really think that the Kenai Peninsula will become the breadbasket of south central Alaska... I see a real advantage and the cool thing that I see in Homer especially is this whole notion of trying to grow more of your own food. A lot of farms have been established using high tunnels for vegetables and such, but I actually think that there will come a time where there will be more actual agriculture where people are using the landscape.

I definitely would say it's a continuing, growing trend for people growing for themselves or growing for markets.

We have the ability to grow plants and some opportunities for crops that, at this point, [are novel] but in the future could be real products. I'm thinking of rhubarb and I'm thinking of hemp.

Forests

Dominated by spruce species, the Kachemak Bay area provides ample forest resources. Although forests were mentioned by only 26% of interviewees, there were a variety of uses and values derived from forests including fuel for heat, building materials, and economic benefits from timber exports. The area's thick forests are also a key part of the Kachemak Bay area's aesthetic, and were cited as a community identifier by several interviewees.

One individual described using local timber products as a resource for building as well as source of aesthetic inspiration:

What I've been doing is collecting a number of logs and I have a little sawmill and I cut them up on the sawmill. I got a bunch of three-sided logs. The goal was to build a cabin somewhere. I still have them stacked in a shed, but ... When one falls down, I cut it up and use some of the wood for firewood and some of the wood for building stuff. I do make wooden spoons from some of the birch that falls down and give it away as gifts.

Additionally, these interviewees often discussed the spruce bark beetle outbreak of the late 1990s that decimated the Kachemak Bay area's forests and contributed to significant landscape and aesthetic changes. While this event increased the availability of downfall for personal use, some interviewees also mentioned that it degraded quality of exported timber products, and lead to a significant decline in the local timber industry. The spruce beetle epidemic and other ecosystem stresses observed in the Kachemak Bay area are detailed in Chapter Three.

Translating what is Valued into an Ecosystem Services Framework

Through understanding what community members value about the Kachemak Bay area – what makes it special to them – this report starts to unpack what ecosystem services are of importance in the watershed. To begin translating what is valued by the Kachemak Bay community into an ecosystem services framework, this study first applied the Millennium Ecosystem Assessment (MEA, 2005). The MEA framework is comprised of four ecosystem service types:

Provisioning Services: Products obtained from the ecosystem. Examples of provisioning services from interviews include: fisheries (when valued for their economic or subsistence benefits), timber from forests, and agricultural/gardening/foraging opportunities (when valued for their economic or subsistence benefits).

Supporting Services: Necessary for the production of all other ecosystem services. They differ from provisioning, regulating, and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people. Examples of supporting services from interviews include: wildlife habitat and biodiversity.

Regulating Services: Benefits obtained from the regulation of ecosystem processes. Examples of regulating services from interviews include: glacial melt and fresh water input patterns, kelp forests (when discussed in the context of regulating ocean acidity), and nutrient inputs from salmon streams that increase the area's fertility.

Cultural Services: Nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences. Examples of cultural services from interviews include: the vibrant arts community that is centered around the beauty of the Bay area, opportunities for recreation, the special connection with nature

received when spending time on and around the Kachemak Bay, and Homer's cultural identity as a fishing town.

The MEA system (described in greater detail in Chapter Six) was a natural starting point as it is the most universally recognized ecosystem service framework, and the four categories are broad enough that all interviewee responses could be captured somewhere in the framework. In addition to providing this cursory organization of the different types of services implied by what interviewees value about Kachemak Bay, the MEA framework can be a useful means of communicating the concept of ecosystem services to technical and non-technical audiences.

However, in applying the MEA framework to data collected in Kachemak Bay, this study found significant details and nuances present throughout interviews that were lost when placed in one of the four major categories described above. To respond to this shortcoming and provide KBNERR with an ecosystem service framework that more accurately reflects the intricate perspectives expressed by interviewees, we designed a framework specific to the Kachemak Bay area. This place-based, Kachemak Bay-specific framework was developed using a more extensive socio-cultural ecosystem service framework provided by Cole (2012), and is described in Chapter Five.

Chapter Three

Perceived Drivers of Ecosystem Change in the Kachemak Bay Watershed





Perceived Drivers of Ecosystem Change in the Kachemak Bay Watershed

Introduction

The Kachemak Bay region has seen significant social and ecological change in recent decades. Increasing population, development, climate change, and other shock events continue to shape the landscape. Many interviewees spoke about these changes. Those who have been in the Homer area since the 1970s-1980s provided first-hand accounts. Some of the most common ecosystem changes discussed in interviews include: fish and wildlife population decline, biodiversity loss, and the effects of the Spruce Bark Beetle (SBB) epidemic in the 1990s. These observed changes were attributed to an array of social and natural influences.

Within ecosystem service research, the natural and human-induced factors that directly or indirectly cause a change in an ecosystem are often referred to as “drivers” (MEA, 2005). These drivers can impact the structure and function of ecosystems which in turn leads to changes in the availability of various ecosystem goods and services. Other terminology that can be used to describe “drivers” of ecosystem change are “threats” and “assets.” Threats describe negative influences that stress or degrade the health or availability of valued ecosystem services, while assets are positive influences that help to support and sustain ecosystem service health over time.

Interviewees discussed a range of drivers that they believe impact the state and function of the Kachemak Bay ecosystem, both directly and indirectly. Most often, these drivers were discussed in response to the interview questions:

What are your hopes and concerns for the future?

Can you describe a time this resource (of importance to the interviewee) was particularly healthy?

Can you describe a time this resource (of importance to the interviewee) was particularly threatened?

The responses to these questions revealed a collection of interviewee perceptions of drivers of ecological changes in Kachemak Bay and their root causes. These perceived drivers are outlined below as “Threats” and “Assets” to ecosystem service health.

Overall, this chapter describes the range of viewpoints on the many social and ecological changes observed in the Kachemak Bay area, the complex challenges facing the community, and the many assets that are perceived to support ecosystem and community health. These perceived drivers can provide a basis for future KBNERR research, planning, and outreach regarding ecosystem services.

Threats

One of the most common themes interviewees noted when discussing concerns for the future of Kachemak Bay was how humans impact the environment. As one interviewee put it: “Man is going to be the death of a lot of things.” Humans impact the environment in many ways. In Kachemak Bay specifically, interviewees highlighted multiple perceived threats including population growth, climate change, overharvesting, and pollution (Table 3.1). Each is discussed in detail below. Generally, these concerns could be categorized as human actions that have a negative effect on the environment and the community.

Table 3.1: Perceived threats to ecosystem health (% of Interviews = total percentage of interviews that contained the associated threat) (n = 31).

Perceived Threat	% of Interviews
Population Growth	94
Climate Change	61
Social Division/Conflict	58
Extractive Industries	45
Overharvesting	39
Aquaculture	35
Demographic Change	35
Pollution	23
Public Awareness & Attitudes	19
Cruise Tourism	13

Population Growth

Many interviewees consider population growth to be directly causing the resource issues Homer is facing today. Population growth brings increases in development and the general overuse of resources. Population growth, including overuse and development, was raised as a threat in a majority of the interviews (94%). One interviewee discussed how an expanding population will have significant impacts on the environment:

It really doesn't matter what it is. Recreational people, even the kayakers and the mountain bikers and the sports across the Bay who need access to what they want to do...

While there are significant economic benefits associated with increased full-time, visitor, and tourist populations, many interviewees also have concerns about the influx of people coming to the Bay to live, recreate and enjoy its environment. When discussing Homer and the Bay's growth and development, most interviewees struggled with the questions of “How much is too much?” and “Can there be a balance?”

[A friend] said something about growth and I said, 'Well Homer has about 5000 people, when should we stop growing? Should it be 10,000? 50,000? 100,000?' His response was, 'Well, we'll let the markets decide.' I said, 'Oh the markets, so when it's too shitty and denuded and polluted and no one will buy a piece of property from you, that's when we stop growing?' ... you can't answer the question; you can't have perpetual growth on a finite resource.

It's a tight rope we walk, on still being able to leave the gate open at the top of the hill and not be on a slippery slide to destroy our environment.

I really appreciate having that access opened up and introducing more people to the wilderness areas, but at the same time I want that to be done smart. I just came back from Glacier Lake, and it was great to see so many people visiting the lake, and I think State Park is doing a great job of managing or mitigating some of that degradation of some of the trails and stuff. But, you can't help but kind of worry that if we stay at that same pace that we're at, we might exceed the resiliency of some of those trails and stuff.

You see our business community here and everybody wants to see more jobs, more charters, more BMVs, more of everything, and no one stops and asks the question, 'What is a sustainable amount?' So in terms of what we see, we see an incredibly beautiful place that is seeing the very same abuse and lack of attention that is being seen all over the world.

It's this human growth. There's always a good reason, but at what point do you say 'Stop'? I mean, so the bird habitat's going to be gone, and it's trees and all that stuff, and half the trees are dead because of the spruce bark beetle, and they have fallen so it's all log-jammed...but that's great habitat for something—some animal. So you clear that off ...now they want to do sheep. Sheep and pigs and they're doing ducks and chickens...and it's all great...[but] it doesn't belong in wetlands! And it always comes at the expense of native vegetation and native habitat and it's a real struggle.

Increasing Development

With growing populations comes increased development. In Kachemak Bay, interviewees expressed concern about encroaching housing developments on salmon stream banks and other potential degradation. Many interviewees see this as a potential threat for the future health of Kachemak Bay; if development is not done responsibly, it could have unforeseen impacts on habitat, wildlife, ecological processes, and the overall pristine nature of the Bay:

There's always... I still feel like it's a pretty pristine area here, so there is always a concern in the future of more development and more just... taking away more of the natural, pristine places here.

...Just people living near [streams], and that affects the streams...And development along streams, the whole thing, impacting that whole habitat with more and more people and houses and more property, more real estate people, which is a natural function of

increasing population, but it's really having some big impacts on plant life, on animal life....

It's so pretty, it's so beautiful, and the developmental encroachment on the Bay...Ever since I've been here, like I was saying, Bishop's Beach – and that was just some trees and the beach. And my concerns... we just don't have the funding to evaluate. Harvesting kelp, that's one of the things... People with all the high tunnels and stuff like that, people wanting kelp from the beach, and so as you get more and more people and the impact on the environment in Kachemak Bay...we don't know where those critical limits are.

It's a full time job around here for clean water so we just have to be very careful about the projects that we take on and the development around here. Sometimes it's the smallest change can cause – over time – can cause great damage so we just have to be aware of that and not take any development for granted. Really look at development in the long view and see, you know, what is this going to do to our local environment? ... You start building lots of houses and you're basically changing the resource of the land. [I am] very concerned that we are going to overfish, we are going to overpopulate, we are going to overproduce, we are going to start bringing cruise ships in 3 and 4 a day, we're going to pollute the waters. Yeah, I got concerns.

Overuse of Resources

Population growth can also lead to overuse, which can then lead to disruptions in the natural environment. Overuse refers to too many people doing too many things in the Kachemak Bay region as well as more broadly within the Cook Inlet.

Probably the big share of them have been man and -- I don't know if I'd use the term overuse, but at least used to the max, and possibly on beyond the max. But definitely, we men are pushing the limits on a lot of things.

I guess my biggest concern is just loving the place to death.

...And everybody loves what they see, and I think we're slowly losing what everybody loves because everybody wants to be a part of it. Nobody thinks that they individually are creating that, but we're all creating that. I mean, now, we're as guilty as anything. We don't live a subsistence lifestyle, we do have electricity, we do have running water, we do drive a car, we do live in a house that's way too big for us.

Climate Change

Many interviewees (61%) discussed the various risks that climate change poses to the quality and stability of the Kachemak Bay area's ecosystem and resources. For some, climate change was perceived as the root cause of some ecosystem stress events, including: fish and wildlife population decline, loss of biodiversity, paralytic shellfish poisoning (PSP) outbreaks, and the spruce bark beetle epidemic in the 1990s:

All those things I mentioned before I think you can bring back to [climate change]. The spruce bark beetle and aphid, sea star wasting disease, harmful algae and paralytic shellfish poisoning, sea otter and seabird die offs, those types of things.

With warming temperatures affecting animals and their habits... we had a big die-off of murrens a couple years ago, and they believe that it was because ... the fish had moved to deeper water because of the temperature, and the birds were not able to get to them, and they basically starved.

There was the whole thing where we had the seabird mortality event as well. Just a huge seabird mortality event in 2015 and 2016 all across the northern Gulf of Alaska associated with the warmer waters and all the changes that came with that and there's still a lot of be figured out about why that happened. They were starving, and they didn't breed, didn't have chicks, and one of the thoughts was that the warmer water temperatures ramp up the metabolism of the fish and so they eat more and there is less for the birds.

You know we've just seen such radical changes, and a lot have been climate induced, you know. Sea star wasting disease, 20 years ago we had the spruce bark beetle, and now the past couple of years we've had a spruce aphid. Seabird die-offs, sea otter die-offs, we don't have any hard-shell clams in Kachemak Bay virtually anymore, we don't have any Dungeness crab.

The first summer that I was here in 1996 it was so hot that the beetles actually had two gestation periods, and you hear people saying, 'Oh, the homing pigeons used to darken the sky before we wiped them out!' These beetles, I saw a couple flights where they literally darkened the sky and they were just everywhere and they really changed the whole complexion of our systems here, and it was really a gut punch to the people here. People considered pesticides that weren't very effective, but it really hit people hard because this is a very forested community, so to see a lot of that stuff lost was a big deal.

Years ago the spruce bark beetle, that was huge impact when we lost all the trees – both physically and emotionally for people that kind of moved here to be in their little cabin in the woods and all the sudden the woods are gone—but then we're seeing some of that again with some of the aphids and the spruce bark beetle maybe coming back because of the warming temperatures.

Most interviewees who discussed the impact of climate change emphasized the impact of warming waters on fish (namely salmon) and shellfish. Several interviewees discussed the temperature-sensitive nature of salmon, and expressed a worry that increasing ocean temperatures would inhibit the future health and success of the Kachemak Bay watershed's salmon fishery:

We know cold water fish -- salmon -- are stressed by heat, and that stress makes them more vulnerable to pollution and predation and disease. We've seen rehabilitation efforts in the Columbia River literally die-off because of too-warm streams, and that trend will

continue here. So, the question becomes, how do you build a resilience into our system so that salmon can either extend their range north or have a fighting chance as things get hotter?

Interviewee 1: *Well, there's a lot of factors going into the resource. One is global warming. We're very concerned about that because salmon are so temperamental.*

Interviewee 2: *They're very temperature sensitive!*

Interviewee 1: *Yeah, two degree warming in the stream and they just don't go. That's not very much of an amount to warm the streams either. So, that's a big concern.*

Several interviewees who attributed the paralytic shellfish poisoning outbreaks and algal bloom incidents to warming water temperatures also expressed a concern for how these events could impact human health. Some discussed the warnings to “harvest at your own risk,” and the potential safety issues that occur when personal harvest is not restricted during these events:

You also see that we've had three years of paralytic shellfish poisoning and that was the first time we'd seen that in about a decade. And that's not something we've never had before and we see it all across Alaska, but it's directly related to warming waters and we've done research out of our lab to show that, and sure enough it popped... And here's the odd thing, it's kind of good and bad. If we hadn't had the decline of the clams before the PSP hit, especially in early 2015, and people know that it's around and sometimes the state does testing but they usually just test commercial product and not recreational. They basically say 'You harvest at your own risk.' If we had had the level of clams that we did when I first got here when the PSP outbreak hit, I would have been shocked if we hadn't killed people.

I think we're seeing a lot of threats from climate change for sure. So we're seeing the effects that it's having on the glaciers, on ocean acidification, on the warming temperatures of the waters so more harmful algal blooms and things that affect potentially – like we tell people 'Don't harvest things off the beach' because you never know, we have more harmful algal blooms so this is not really that safe.

Some interviewees also discussed the impact warming water temperatures will have on glacial melt patterns and water chemistry in the Bay. They expressed concern about the impacts of ocean acidification and altered freshwater input from increased glacial melt on the Bay's fish and wildlife, as well as the broader Kachemak Bay watershed's basic ecosystem functions. Several noted the interconnectedness of the Cook Inlet area, and emphasized that any changes they were witnessing in the Kachemak Bay would be amplified in this larger context:

With all these warmer air temperatures we're melting glaciers, we're altering the timing of snow pack, we're having less snow, or more snow, or at different times, we're getting runoff earlier, and this ocean system is really driven by the inputs of freshwater. So, you know all the way from the Gulf of Alaska up to the Bering Sea, the whole system is connected by freshwater. It structures the water column which means growth is based on that, and it's just going to change that. It's going to change the system. So, we have to figure out what all of these changes mean, some could be good, and some could be bad, but that's definitely a potential threat.

But you know that something I really worry about is ocean chemistry changes, in terms of pH, ocean acidification. And I also worry about the warming waters. If that will have an impact.

Climate change is a big one, that's always not just going to affect Kachemak Bay but really, to me, right tandem with that is ocean acidification. I'm actually probably more nervous about that in the near term than climate change. But they both concern me greatly and they have the potential to affect resources here tremendously, just as they do elsewhere around the world.

Some interviewees also discussed the magnitude of the climate change problem, debated root causes, and expressed a sense of responsibility to make a personal effort to reduce their contribution to the issue:

I think that we need to be aggressive in everything that we can do to slow down climate change. And it's such an overwhelming threat that we tend to ignore it because it's so big, but I think that we have to deal with our footprint. But that's global, it's local, it's global, it's household by the household. We just all have to participate with that together.

Social Division/Conflict

Some interviewees noted that Kachemak Bay can be a fairly divided community on a number of issues. Social division or conflict among the community was seen as a threat because it can prevent positive change and civil, open communication between community members. Many (58%) noted the political polarization that exists in the Homer community and discussed a number of reasons for the political differences. One explanation was what some interviewees considered Alaska's uncertain sense of identity:

When you look at the tensions within our culture and within our society and you look at our founding documents that call for equality and everyone says, 'Well, yeah, everyone should be equal, should be treated equal,' and that's a bedrock fundamental value. Then, on the other side is freedom, and everybody wants freedom and the ability to do exactly the things we want to do. Those two things, equality and freedom, are in conflict because equality essentially equates to collectivism. Everybody's equal, we're all in this together, I'm going to pay my school taxes even if I don't have a kid in school kind of thing. You do it for the benefit of the community. Whereas freedom has become bastardized as this selfish pursuit where, 'I'm going to get mine and forget everybody else.'

...it's pretty suburban around here even though people pretend that it's the Wild West and they can do what they want on their land... I mean, everyone has some sort of impact on the fishery...

These tensions between "equality and freedom" were evidenced in interviewee discussions of the "fish wars," economy versus environment debates, and personal property versus common resources.

Fish Wars

Some interviewees (19%) referenced what is sometimes referred to as the “Fish Wars” when discussing social discontent among the community and potential concerns for the future of the Bay. Fish Wars refers to the decades-old debate over catch limit allocation between commercial, subsistence or personal harvest, and sport fishermen. Some interviewees perceive that the sport/charter fishing industry is favored over commercial and subsistence fishing because, as one interviewee put it, “Tourism is king,” and provides the greatest immediate economic gains for the community. Others recognize that each user group has been restricted in some way:

Homer would be the same way as it is now with the charter boats losing those two days a week. Oh boy, you can hear them scream. And I've got friends...I enjoy going on his boat quite often when he has openings. He screams about losing those 2 days. So, I just keep my mouth shut about how much the commercial guys have lost too. It's not a one-sided thing here...there's definitely a feud between commercial and sport fish.

Interviewee 1: *The Cook Inlet is pretty political between splitting the fish between the commercial, subsistence, and sport. The sport industry is huge on the peninsula because it's the easiest place in Alaska to get to. You can fly into Anchorage and drive to many popular fishing spots, and nowhere else in Alaska can you do that. Other places you have to fly out or take a boat. So, it's less expensive for tourists to come and go to the Russian River. So, the sports fishermen have a very loud voice in how they split up the fish...I don't know the percentages, but I know that the set net fishermen on the Inlet are getting less and less every year, which is not...*

Interviewee 2: *They're the least of the voice. It's commercial and sport. Sport is tied to tourism, and tourism is king.*

The restrictions on personal/subsistence/recreational fishing, coupled with the reduced fish populations has created what interviewees referred to as “combat fishing.” Combat fishing describes when popular fishing spots become inundated with people attempting to fish at the same time, particularly in the Kenai River. Some interviewees described how combat fishing can change the quiet atmosphere of the Bay and make it more difficult for the community to enjoy its resources:

Well, a lot of the Kenai River is people coming down from Anchorage. The word got out that this is a good way to get your fish. It used to be that it was easy to get fish from the beach, or you could put your boat into the river. Now it takes hours to put your boat in, and it is just an ordeal now to go there, because there is so many people.

If you go over there on any opening weekend, because the king fishing is open, I think, Saturday, Sunday, Monday, and Wednesday. So, you go down there on any one of those days, and it's just an RV park. It's combat fishing. That's just something that has to be done, and it hurts, but what's the alternative?

We started fishing up at Kenai River, which is a little bit hit-and-miss because it takes two hours to drive there, you have to take your truck on the beach, you have to have ice,

and then you could get two fish and drive all the way back and do it again. And, it's turned into what used to be maybe 1,000 people to 10,000 people a day, and it's just crazy.

We'd hit the cabin and I'd help get the stuff out of the Jeep and I'd grab my fishing pole... and I think they had one of those boxes set up with a rope on it so you could drag it, and I'd head for the creek and we'd fish all weekend, and we kept what we caught. We'd either eat them, canned or smoked, or give them away to other people who would utilize the resource. But then again, you start seeing the population climb and instead of the three of us on the creek bank there would be a couple dozen.

Private Property Rights

A large portion of land along the Bay is private property. Some interviewees expressed their perception that while property owners, and people in Homer generally, understand the importance of maintaining good habitat for salmon, there is a conflict between what is considered best for the community and what is best for the individual property owner.

A few interviewees (13%) discussed issues associated with the Kenai Peninsula Borough's 50-foot salmon stream buffer policy. This local land use policy restricts certain building or development activities within fifty feet of an anadromous stream. Controversy over this policy was often provided as an example of how Homer residents want to protect the Bay and its resources, but may not want to make personal concessions they believe are unnecessary:

Everybody loves salmon, we know that, that's a great example, but still we've been in these knock-down, drag-out fights to maintain 50-foot buffers on our salmon streams. Well, then we run into these property rights people that say, 'Well, we love salmon, but you can't take our property.' It's like nobody thinks that their driveway or their lawn or whatever they are going to do, they won't have an effect, it's always the other guy. 'I'm for salmon but you can't take my property rights.' So there's a disconnect there and the concern is the public interest, the broader public interest is getting subsumed within the private interest.

There's a lot of people that would like [regulations] to just go away and to not have rules because they think that people are going to do the right thing on their own because they're good stewards of the land and people don't want to think that they're doing bad things, but they sometimes are. There's that disconnect of like, 'Oh I want to do things that are good for the fish and good for the Bay, but of course I'm going to have my fuel or my dock'. [There is a] disconnect between their actions and what they feel like the end goal should be.

And local agencies... So, at the borough level, things like buffers... Man. Whenever you get into managing other people's properties and stuff... when you go to some of those meetings and the testimony against stream buffer zoning, oh my god, the animosity toward some of those people that are proposing such a thing. Even though salmon fisheries are such a way of life for a lot of the constituency. It's kind of goofy.

Beach Access by Motorized Vehicles

A few interviewees (9%) mentioned accessing the public beaches with motorized vehicles. Some seemed to be in favor of closing vehicle access because they view the beach as a sensitive ecosystem or a quiet, passive recreational spot for enjoying the view. Interviewees who were passionate about preserving undisturbed habitat for migratory birds also expressed a disdain for motorized vehicles on the beach.

However, one interviewee did express how some people use the beach for hauling coal, a subsistence activity getting fuel to heat their homes, while providing a fond activity for the family:

Well, this whole beach area has underlying coal themes. So, if you take a walk down the beach, maybe a half mile, and look up back at the beach, you'll see these black stripes, and that's coal on the beach. So, a lot of us in the wintertime, and a lot of Homer, used to burn coal in the winter, because we have spruce which is a crappy firewood. The downside of coal is that this is not very good coal, this is sub-bituminous, between that and lignite which is soft coal and it's high sulfur and a lot of ash. It's garbage. But, you go down there and it's like the subsistence fishing. You go down there, take the truck down there, the family all walks along and picks up coal... That's a whole truckload. That's a whole winter's worth of coal. Oh, we're cutting that off. Because they weren't going to allow any motorized vehicle access to the beach.

While the residential use of coal has decreased as Homer has developed, driving on the beach remains a significant piece of Homer's culture for some interviewees.

Extractive Industries

Many interviewees (45%) consider Alaska to be an extraction-heavy state. They discussed several extractive industries, including mining, oil drilling, gravel pits, and even – on occasion – fishing. Most of these interviewees recognize the conflicts that arise from extractive industries. Many discussed how these activities can be devastating to the environment, but also acknowledged that Alaskans benefit economically from these industries.

Oil and Gas

The major concern with oil and gas is the threat of a spill (26%). For some, concerns about extractive activities, especially oil and gas, stem partially from memories of the Exxon Valdez oil spill in Prince William Sound, March 1989. Some interviewees, while not strictly against oil and gas, are hesitant to allow oil rigs in the Bay and the broader watershed because they are skeptical that any regulations or restrictions will be strong enough to completely protect the Bay from another major disaster. Interviewees recognize that these industries are politically powerful, and that efforts to prevent their presence or force responsibility for accidents have not been very successful:

I'm aware of the growing frequency of tankers hanging out to avoid bad weather waiting in order to continue their routes, these oil tankers that are in this beautiful bay, and I'm really aware of changes in legislation in Alaska that have lifted some of the

requirements, since Exxon Valdez required a double-hulled tanker, and it makes me very nervous. It's a dangerous combination.

Interviewee 1: *... so [Exxon Valdez executives] were buying people's silence by saying, 'Here we're just going to leave this here and we don't know what happened to it.'*

Interviewee 2: *Yeah, they would fill 55-gallon drums full of chainsaws and drop them with a helicopter along the beaches. Well, you just got three brand new chainsaws, how screaming are you going to be about it?*

Interviewee 1: *And generators and all sorts of stuff. ... it really became clear that they were trying to spend a lot of money. They weren't trying to clean it up. Then with the whole lawsuit, how they stalled it for so long that the interest that they made off the money was far greater than what they had to pay out. Then so many people had died by the time the 20 years had gone by that they never got the money... They hadn't had a bad interaction with a big corporation before. They hadn't felt the power. Everyone had been on the receiving end of being on the slope and getting that money, but not seeing the devastation that it can cause. And the total denial of responsibility.*

And then we sit in an area where the State of Alaska gets supplied through the Port of Anchorage, so we get carriers and tankers going up and down Cook Inlet all the time. Then we have huge currents and ice in the winter time, and we have the lack of an escort tug or anything like that, so we are always going to have the threat of an oil spill.

We have oil drilling in the Lower Cook Inlet that has picked up in both state and federal waters in the past several years. And they'll bring a drilling rig in from a place like Indonesia, and I don't know if you've ever seen the feet of drilling rigs, they are massive because they are meant to go into the bottom. And stuff can grow all over them, they have nooks and crannies everywhere, and it turned out the one that they brought up here took about a month to get here which gives it the ability to dry out, but you still wonder if that was enough to really take care of everything. And they weren't restricted from bringing that in at all, so there's concerns about that. There are concerns about ballast water and what that brings up. The invasive tunicates would be hugely detrimental to bird operations and oyster mariculture in the Bay.

If an oil company pollutes, and we've got oil platforms in the Cook Inlet that discharge millions of gallons of toxic waste each year. That is a subsidy because basically what they're saying is, 'We've got this waste product and we're going to dump it into a public resource, a public water body, because it's cheaper for us to externalize those costs than that internalize them and absorb those costs and reduce our profits.' So that decision plays out, at large, in basically every resource decision you see because 'protecting the environment,' and I put that in air quotes because it's not our environment, it's our petri dish, it's our self-support system.

I mentioned how we had the oil lease buyback in the mid-70s, what came out of that was a blanket prohibition that you cannot store a jack-up drill rig in Kachemak Bay. So a jack-up drill rig comes into Kachemak Bay and we say, 'Oh you want to stay more than a week? Well it's required that you get a permit if you want to stay more than a week. Oh,

but also you can't permit that because it's exclusively banned from the Bay.' So, jack-up drill rig means a lot of money, they're going to be drilling and employing a lot of people, so they invent some idea that, 'Oh, it's not storage unless the legs are down.' Then the wind blew, and they had to put the legs down in the jack-up rig, who would have known? 'So, what are you going to do now? It's in violation.' 'Well we aren't going to do anything.' There was no mechanism to sue and then they do what they always do, inconvenient law or rule, they just went and changed the law.

Mining

Some interviewees (16%) commented on the whole-system ecological processes that could be affected by mine operations and how mining within the watershed has the potential to affect Kachemak Bay and the fishing industry:

We get permit requests periodically for mining and stuff like that. And even Bradley Lake, a lot of work has been done there on the environmental impacts of it...and Battle Creek, diverting that throne to Bradley Lake. All of those things are freshwater into Kachemak Bay, important things. That's kind of on the fringes but it's all part of the ecosystem.

Although, if Pebble went in, there are some people that would want to see this as a major port, and that would bring about a lot of changes, and a lot of potential negative ones because of the traffic through here. We've got an incredible flushing system, so things are not going to linger here, it's going to get flushed out. Now, whether the solution to pollution is dilution or not... We don't have that issue here that you would have in other places where a larger port would go in, but I would rather see it upstream somewhere.

When we're looking at a coal mine on the west side of Cook Inlet that's going to wipe out a salmon stream, opponents will say, 'Oh, it's just a small salmon stream.' The response has to be that that stream is an important strand in this fabric and if you start pulling strands out the whole fabric will start to unravel. That's what we know and that's the way it is, but our management decisions don't reflect that.

Gravel Pits

While mining and oil/gas were the most common extractive industry threats mentioned by interviewees, some interviewees also discussed gravel pits. They remember an incident with Anchor River in 2002. An abandoned gravel pit flooded and impacted the Anchor River, which is an important stream for all five species of Pacific salmon. The main issue with gravel pits for interviewees seemed to be the limited regulations:

[People] may want more regulations in their neighborhood because a gravel pit just moved in...

Interviewee 1: *We had a friend that was really affected [by gravel pits]. There [were] gravel pits all around and his water was contaminated and they had to pretty much walk away from their house and go into debt.*

Interviewee 2: *And without compensation. So, there, you've just lost your whole homestead.*

Interviewee 1: *And he had to come buy a place somewhere else, so we need more regulations on the gravel pits, because they're just tearing up all of Anchor Point.*

Overharvesting

Overharvesting was mentioned in 39% of interviews. Some interviewees have seen the impacts of overharvesting first-hand. They remember what fishing, crabbing, or clamming was like during the 1950s – 1980s, when marine life was abundant, wildlife were much larger, and fishermen were satisfied with their catch:

It used to be you could go to Clam Gulch and you could get 60 a day and it would take 2 buckets to get 60 because they were that big. Now, well we haven't gone for years, but people were saying you could do 120 in one bucket because they're not getting big enough.

Some interviewees noted how overharvesting of the Bay's resources has changed certain industries, especially the fishing industry. There is the perception that fishermen cannot make as good a living now as they used to and that the commercial boats have to travel outside of the Bay in order to haul in a large enough catch:

[There were] a lot of Mom & Pop, small commercial fishing operators that would buy property, and their whole livelihood was based on just getting up, going out, getting on their boat, and going around the Bay getting their resource. They're not here anymore. So, that has been stressed and done away with...

Others are seeing how overharvesting has impacted salmon runs, which can be concerning for many who depend on salmon for their livelihood:

I can't imagine that, like our salmon runs have been getting more and more erratic and it's one of things that, like, you could study the water or the salmon stream temperature and recognize when they get to a point where they're not hospitable for the rearing of salmon. That looks like a very gradual curve and it's pretty steady.

As of May 29th, ninety [salmon] individuals were observed going up the south fork of the Anchor, which is crazy low. I think by that time last year it was five hundred-ish or something. There's weird data readily accessible if you want to check that out, but nothing has really come to fruition as far as a decent run in June. So, if that number was low, they didn't suspect that it would be great. So, they wanted to make sure that all the spawning adult salmon that were entering the river were going to some spawning grounds, and I'm sympathetic of that.

Aquaculture

While some interviewees valued the benefits provided by the aquaculture operations that exist in and around Kachemak Bay, others expressed concern about the potential environmental and ecological impact of these activities (35%). Kachemak Bay supports both salmon and oyster aquaculture/mariculture operations. Some interviewees raised the point that both operations introduce non-native populations into the Bay, and they believe that this could be cause for concern. However, other concerns raised were largely in regard to the salmon farms:

Hatcheries are a big deal. We don't have adult aquaculture, but we do have enhanced production in the form of putting a lot of little fish out there. And what is that doing to the system?

Many of the interviewees who consider aquaculture to be a potential threat to the Kachemak Bay watershed raised concerns about possible overpopulation of farm-raised fish and their impacts on the Bay. Two interviewees cited a particular event in which farm-raised salmon were seen in the Beluga Slough, triggering significant concern and unease throughout the community:

Right now, the other thing that's happening is, they raise certain salmon and let the eggs out, and they've been over-populating. So, they're showing up in weird areas and last year Pinks were showing up in the Slough.

There are some terminal fisheries -- Cook Inlet Aquaculture release a whole bunch and they come back in Tutka Bay Lagoon. So, you're kind of walking around in knee-deep pinks in some of these beaches right up into Beluga Slough, which is kind of sketchy. Yeah, the whole fisheries enhancement thing has some people worried, me personally.

Most of these interviewees also raised concerns about the impacts a large population of farm-raised salmon could have on natural stocks. Worries about the Bay's carrying capacity and resource availability were common themes:

We've been looking at a growing body of literature that shows that hatchery-raised pink salmon can outcompete wild fish and also can compete in open oceans in the same niche as king salmon. So, we've been seeing a decrease in king salmon size across our entire state, and there's probably several causative factors, but I think hatcheries are probably at the top along with bycatch from trough fishermen and other fisheries.

Oh, Fish & Game used to run the hatcheries. Now it's run by the aquaculture organization ... They got a permit to move the pens out of the lagoon and into upper Tutka Bay... Not that I think we need that many pinks because nobody wants pinks here. They can it, I guess, and sell it, but you can't get much money for them so why are we doing this? And is it affecting the natural fishery here?

Several of these interviewees discussed the degraded water quality in and around the areas where the fish pens are located in Tutka Bay. They also highlighted how the concentrated fish waste hinders subsistence fishing and recreational activities:

So, that little thing over there is impacting what we really want to keep, and that is the cleanliness across the Bay to go hiking and go kayaking and see the whales in there, and I don't even want to go in that area because it stinks. When you go across the Bay you don't want to think about that.

Interviewee 1: *They're polluting the whole area. So, people living across the Bay, whether it's just for the summer or all the time, in that area their waters are changing, it's bad.*

Interviewee 2: *Well, they pull their subsistence crab pot up, and it stinks so bad of fish waste that they can't utilize it. I mean, it's nasty. It would be like pulling out of a sewer down at the sewer treatment plant and going, 'That's supper?'*

A few of these interviewees also worried that there is not sufficient information or data to be confident in the success of farm-raised fish, or to predict the impacts of a farm-raised fish population on water quality and natural fish stocks. Some felt that this scientific uncertainty should be cause for aquaculture organizations and Fish & Game to act cautiously and limit expansion of aquaculture operations:

What we should be embracing is the precautionary approach, the idea that if something is important and we don't know then we just shouldn't do it. The hatchery stuff is a perfect example. If you think our wild fisheries are too important then you shouldn't go and release a million pink smolt if you don't know what the consequences are.

I'm not really a fish biologist or anything, I just kind of see what happened on the East Coast where I'm from and seeing what happened with the Atlantic salmon and seeing what happened with the Pacific Northwest, and it just seems like we're kind of on the same road. I know there's a lot of variables beyond just our local anadromous streams and all, but the precautionary principle doesn't always seem in place, and I'm kind of sold on that. I think that if you're saying that you know exactly how this management decision is going to affect the system, that seems kind of goofy. I think you should play a bit more on the safe side.

We have an issue with the hatchery over there. They just keep pumping out the pinks without knowing what the pinks are going to eat. There's not adequate food or sustenance. We only get the charge of nutrient rich phytoplankton coming around once in a while. It's not all the time. And nobody knows how much food they have in the Bay. We aren't testing for the zooplankton to see what the fish are going to eat... They did a zooplankton study that recommends that you better know how much food is out there before you put lots and lots of fish out. I know that's kind of a pet peeve of some people around here but, they think they're doing good for somebody.

This uncertainty over whether the benefits of having aquaculture operations in the Kachemak Bay watershed outweigh any associated risks is debated in the Homer community:

There's a fight between people who are looking at the facts and figures and people who are looking at it emotionally going, 'We've always fished this way, and we need to have

it.' But, when you look at the facts and figures, the pens that they're putting in across the Bay don't actually economically make sense.

Demographic Change

The Kachemak Bay area has seen a large demographic shift over the last 40 years. Interviewees commented on demographic changes triggered by in-migration and second home owners.

In-migration

Many different people settle in the Kachemak Bay area. While some people migrating into the Kachemak Bay are fellow Alaskans, a fair amount come from the "Lower 48" (as many interviewees refer to the continental US). Some interviewees look at Lower 48 residents with skepticism and distrust. Some interviewees perceive people who come from the Lower 48, residents and tourists alike, to be "troublemakers." They potentially threaten the Alaskan way of life because they do not truly understand what it is like to live there:

We wind up with a lot of folks, they get paid to come up here and raise hell. And that doesn't help anybody. And as I said, the best stewards of our environment are the people that are here. If you think a fisherman is going to overfish...that's their livelihood. And people don't get that, from the lower 48. They don't understand that.

If you're from Alaska, if you live in Alaska, we are the best stewards of our environment. Not some yahoo from New York City who's never been here [before].

[It benefits] Homer, if someone is born and raised here...someone with a deep comprehension, understanding and appreciation for what this community is all about.

Wealthy Retirees & Second-Home Owners

Some interviewees (16%) noted that a significant portion of the population living along the Bay, and in Homer specifically, are retirees. Homer has become the ideal spot for retirees as it is in a temperate location, a hub for recreational activities, and near a hospital. However, some interviewees expressed concerns about the community impacts of this demographic shift. Some discussed the ways in which an older demographic with specific needs and enough money can polarize the community politically, and the money they bring can make it difficult for others in different wealth brackets to make Homer home:

For [retirees], this is like grandparents at play. They're after the quality of environment, and what they seem to be concerned about is the street zoning laws and keeping the viewshed and things like that. Of course...in politics this year, as the national politics have become more polarized, we've seen that in Homer as well, with outside money especially coming into... let's say, disrupt politics more than people I know here have said it's happened previously.

I think we are getting more and more retired people. People with resources. People who have money and they are moving into the neighborhood. The value of land has gone up and so it's making it more and more difficult for young people to buy property around

here. Across the bay, where there used to be cabins, there are now mansions. So the demographics have changed considerably over the past few years.

A few interviewees (13%) expressed a greater concern about the relatively wealthy who are disconnected from the community. Those who come to Homer to build vacation homes only spend a limited time in and on the Kachemak Bay. Some are concerned that these individuals are not truly committed to improving the community since Homer is not their primary home. They are less aware of the needs of the community and do not contribute in a way that benefits different aspects of Homer:

Biggest change is just the number of people coming in, and probably a lot of second homes. Retirees or people with a lot of money that are coming in here and particularly adding to the impacts of our summer population that go along with increased tourism numbers.

... it kind of tears the heart out of the community. And, you would think that they'd like to engage...but they don't ... They come and they go to the restaurants and they do the things that we enjoy doing here, but they just never really participate or contribute. They're just kind of here to take. Then they're gone.

... the second home, wealthy people are coming in and getting their second home, are pushing affordable housing farther and farther away. That's what happened in Vail and it lost its community because it became a rich man's playground, and we are on that beginning edge of that happening here.

The privileged, people with a lot of money to spend, they can start encroaching on some very important places on the Bay. They have the funds to do that.

Pollution

Some interviewees (23%) discussed the effects of pollution events or chronic pollution on the health of the Kachemak Bay ecosystem. Several described the impact of the Exxon Valdez oil spill in 1989. This event seemed to partially inform some of the wariness that many interviewees expressed towards oil and gas development in the broader watershed. Although oil and gas development in the Kenai Peninsula is a significant distance from the Kachemak Bay, the interviewees who were in Homer during the Exxon Valdez spill vividly remember how oil was able to migrate from Prince William Sound and have a significant impact on the Kachemak Bay.

These interviewees discussed the substantial impact of the Exxon Valdez spill on the Kachemak Bay area's fisheries, wildlife, water quality, economy, and community. Commercial and subsistence fishing were interrupted, the daily lives of community members were uprooted as they were forced to take on clean-up responsibilities. There was also a significant loss of marine wildlife that occurred at this time:

I think the oil spill devastated this area and is the biggest devastation that has happened since the earthquake. People's way of life was changed, there was oil in Nanwalek or Port Graham, and they couldn't do shellfish for years.

Interviewee 1: *A lot of the oil spill was on the other side of the mountain, at Gore Point area, and most of the cleanup was in Prince William Sound. So, they weren't really dealing with us.*

Interviewee 2: *By the time it got over here, they thought it was no big deal. Well, it wasn't a little deal, it was a big mess. So, there were 20-30-50 people on the Spit, around the clock, getting logs, chaining them together, floating booms, all on their own thing. It was like... oh it reminded you of scenes from Les Misérables. Everybody is filthy and dirty and...*

Interviewee 1: *... unending. And then there was a big group of people from town, who on their own went to Gore Point and did that and they used all sorts of techniques to try to clean. That was a real take-the-soul-out-of-you job, because there was no electricity, no cleaning, they were trying to use some pressure washers, they were digging, they were doing anything they could.*

Interviewee 2: *There were all kinds of dead things.*

Interviewee 1: *Yeah, birds dying left and right, and fish, and otters.*

There is definitely the threat of things like spills with vessels that use this area and the ones that use the bay as a safe harbor place. They have a lot of stuff in them.

Other interviewees discussed chronic water pollution from human activity on the Kachemak Bay water quality and wildlife. Sewage discharge issues were of particular concern to some interviewees. They expressed concern about how the impact of this sewage discharge on the Bay's health and fish/shellfish populations will persist or expand as Homer's human population increases:

So now you go to Bishop's Beach and you see everyone driving on the beach, you see a lot more use, but you also see another 25 years of our sewage discharge. If you go out to the Bishop's Beach parking lot and look to your left there's a sign for the mixing zone, and the mixing zone is an area where they allow the pollution to assimilate or mix/dilute with the receiving water, and it says, 'Don't collect shellfish or fish in this mixing zone' because it doesn't meet the fishable or swimmable standards of the Clean Water Act, so that's been a chronic pollution source that we've had here. But, like everything in our natural systems that are so inherently complex that you can never really point to some kind of cause and effect.

Public Awareness and Attitudes

Some interviewees (19%) view some community members and visitors as having a general disrespect for the environment because they are not aware of how important certain systems are to the overall environmental quality and economy of the Bay:

People who move here don't have the connection to salmon that people currently live here or who've lived here a long time have. There's less understanding of the salmon life cycle. With just climate change, potentially changing stream temperatures for a variety of reasons...

Some interviewees suggested that it is not non-native community members who can mistreat the environment. Several expressed concern that some who have lived in the community for many years or even grown up in Alaska can also show a similar lack of respect. Some interviewees have witnessed littering into the Bay. Others perceive the use of motor vehicles or ATVs through the woods or on the beach as being disruptive and ultimately disrespectful to others and to the environment as well:

I think that people have become much more educated, and a lot of that has to do with the programs that happen through the Research Reserve. I remember coming back from Halibut Cove in the 80s and I was on a boat that was owned by commercial fishermen... Now, that's a person drawing their entire livelihood from the Bay. And, we stopped in the middle of the Bay and they threw out a chair and a couple of other things. And I said, 'What are you doing?' And they said, 'Oh, we're mailing this to Seldovia'. I said, 'What?' And they looked at me and just kind of laughed and shook their heads. Well, it was where they were dumping something that they didn't want to take all the way into the Harbor, put on a pickup truck, and take to the dump. So, I said, 'Well that's ridiculous! You can't do that!' They said, 'Oh, well this chair is going to provide a new crustacean environment.' And I said, 'You guys are crazy! You're making your living from this Bay!' I don't know how common the practice was, but this was somebody that had an environmental bent who knew better or should have known better.

But human interaction is always a big concern with environmental stuff and people who take advantage of it and people who don't and there's always a balance. And trash is a big one, like clean-up and we have, I think, some great trash clean-up, communal, community type stuff, that goes on but it's still ... With this being a small fishing village, some of the stuff you see, even from locals, it just blows your mind. You're like, 'Did you seriously just throw that over your boat? You live here.'

I think that, again, being clean, not having a lot of, like, running into trash or someone had a big party and left a bunch of junk out there, and like a lot of activity of people running their ATVs in circles for fun and kicks...I've seen them at Bishop's Beach going through the edge of the water, just up and down the beach, just for fun. Just driving around the beach for fun, for me, is very disruptive to all the critters. At low tide, you have all the critters that live there and just the quiet of this place and critical habitat area. I see motorized use being acceptable for travel to a place to do something, but not as an end use, not just for driving for the fun of driving.

Other interviewees are concerned with the general mistreatment of wildlife, especially salmon, because it shows a disconnect between humans and the environment. One interviewee described an experience where they tried to educate people on how to treat salmon while fishing:

...I try to educate people on how to treat their fish better, but to see how people treat their fish is just kind of gut wrenching. Because salmon to me are these beautiful entities, they really are, and Kenai River Reds are just beautiful fish. ...[T]his one family, it was a grandfather, father and son, little kid. And they were just beating the dickens out

of this fish. So, I went over, and I said, 'You know, if you hit it right on the head, you don't need to hit it more than twice and you're done'...because when you beat them all the way down the fish you'll bruise it and then you'll get that fishy smell. So, all three of them looked at me and said, 'Well what fun would that be?' And I was like, 'Oh, okay. I guess this isn't going anywhere.' ... So, after I talked to this one woman and I showed her how beautiful it is after you wash them off and lay them out, her husband came up and gave her a fish and she goes, 'Look! Look what I learned, this is how you do it!' And he just didn't care. But, I found that by talking to the person dealing with the fish, they were more receptive than the person that was beating them...So, some people are receptive, and some people just aren't.

Cruise Tourists and Ships

A common theme among interviewees was the distinction between “cruise tourists” and “recreational tourists.” Cruise tourists refer to those who visit the Bay briefly on cruise ships. Generally, cruise tourists were described as a threat because they impact the beautiful views, contribute less to the community and economy of the area, and damage the pristineness of the Bay:

There are the cruise people...they don't eat out much when they come here, they don't interact a lot with the community because they have their own home. So, the people that stay in an AirBnB or one of the hotels or camp out, something on that level, they interact more with the community. They tend to do more trips like kayaking and a trip to go birding or go to Halibut Cove.

So, when they're here for just a short day pumping money into Two Sisters and stuff, whatever go for it, but yeah once you start thinking about the footprint it has as a big, giant floating septic tank or something, that's kind of creepy.

...and I would get the notices whenever the cruise ships [come], which was regularly. So they are not supposed to empty their tanks, their sewage tanks, but they do anyway. Right when they get right outside of area or sometimes not even. Sometimes right in the Bay. And it's a violation but there's no oversight, no penalty.

I've seen that one of the things that is in our favor is that the Spit is so far from town, you can't get off the boat and wander around all the way to town. You just can't. So [cruise lines] rent busses and truck [tourists] around and make stops. And so one of the places, really the only place on the Spit, you will see when cruise ships are in town, the bus pulled up to the Salty Dog. I don't miss the Salty Dog. I realize that it's a bar but it's essentially a t-shirt shop now. Especially in the summer . . . [I do] derive some benefits from [cruise tourists]. Still, I would like them to go away.

Assets

In addition to the negative drivers, or threats, associated with changes in the Kachemak Bay's ecosystem health, interviewees also provided many examples of positive drivers that instill hope for the community and natural landscape. Whether it is the protection of habitat or the high prevalence of scientific research and engagement, respondents highlighted many positive attributes and actions in the area. We classify these positive drivers as “assets” to ecosystem health and well-being. We identified three general categories of assets: engagement and community concern, the presence of a robust science community, and benefits associated with aquaculture and mariculture operations in the Bay.

Table 3.2: Perceived assets to ecosystem health (% of Interviews = total percentage of interviews that contained the associated asset) (n = 31).

Perceived Asset	% of Interviews
Engaged and Concerned Community	71
Scientific Community & Outreach	61
Aquaculture/Mariculture	52

Engaged and Concerned Community

The first major category of assets mentioned across interviews is the high level of community engagement around the environment. Community diversity and common values/hopes among community members comprise the “engaged and concerned community” asset. Interviewees (71%) mentioned that most community members recognize the value of the natural landscape. Although there are often wide-ranging political and personal opinions, the landscape forms a common bond that was seen as a driver of positive change. Living in such a unique place and interacting with the landscape for work or recreation promotes a sense of identity for individuals and the community to maintain or improve their relationship with the ecosystem. Examples provided of the oil leasing debates illustrate the historic impetus surrounding this community ethic:

I do believe that that tie to the landscape and the fish and the wildlife is kind of a part of why they're here. And I think when people have that in a community, I think that really enables more of a healthy landscape. They respect the resource and they hopefully want to lend a hand in keeping it healthy.

...this whole idea of 'land ethic'... I've heard it from a number of different people... which is kind of neat that I'm hearing it, that people are starting to talk about it. Instead of creating more regulation, with education and understanding, people realize that their property, their land is an important contributor to our overall salmon conservation and salmon sustainability. And so, they voluntarily conserve their land, but they have an understanding, they have a pride in the ecosystem services that their land contains and provides. They want to protect those.

Citizen concern has led many interviewees to question the balance of economic growth for the community and natural resource protection. In order to find a balance, many interviewees turn to the local and state government to set restrictions for activities like fishing and recreational use of motor vehicles. Many interviewees seemed to be in favor of, or at least recognize the assets associated with some restrictions. City planning and zoning were discussed by several interviewees and seemed to be recognized as potential assets within the community if done right. With rising populations, some feel it is important that development is both responsible and thoughtful with the natural environment in order to avoid irreversible damage later on:

But I also know too that, in order to continue to go moose hunting, as the population grows and the hunting population grows, there's going to have to be some restrictions put in on the harvest levels... You know, I've got friends that are charter operators and they've lost 2 days out of the week now that they can't charter for halibut. Well, during that same period of time that's happened, the commercial halibut fishermen, the long liners, they've seen probably a 25 or 30 percent decrease in the allowable catch that they can get. So, both sides of the user group have seen a reduction in their allowable catch....

You can see where the winter trails are and where the summer trails are, and they are just being hammered with the off-road vehicles, and somewhere there's going to have to be a handle on that, and I don't know what it is. As there's more and more people coming, everybody has to get the bigger tires and the more aggressive machines, they're doing it. They can go deeper and drill in the mud farther. So, as the population increases there's got to be restrictions. End of story. Or the land is going to end up totally destroyed.

One of my big concerns for the Homer area is it's a popular place. Lot of people want to live here and there's a lot of private land here to develop, so just doing that in a manner that's kind of with a long view in mind and understanding, for instance, that sometimes it's a thousand small cuts that make the big impact and not just the one big....but sure, anytime you add people to landscape in high densities, you're going to have impacts. Some of them you can live with if it's kind of planned accordingly, and sometimes you shoot yourself in the foot if there isn't proper planning along those lines.

This asset of community engagement manifests in several other ways including a wide array of conservation organizations, public policies, and private conservation values. First, the range of public and private organizations involved in environmental issues was often mentioned.

Nonprofits including the Kachemak Heritage Land Trust, Nordic Ski Club, Homer Cycling Club, among others were mentioned for the opportunities, resources, and guidance they provide to residents and visitors alike to engage with conservation efforts.

Private entities within the community were also highlighted as positive assets. The art community, ecotourism businesses, and other service sector businesses were mentioned for their tie to the environment and impact on the culture of Kachemak Bay:

Kachemak Nordic Ski Club is doing a great job maintaining trails for getting people outside pretty quick after work, both at McNeil and Aveline state recreation area, and up

at Lookout. That's pretty cool. The Homer Cycling Club is pretty awesome coordinating things like the big festival in the fall, so that gets some people out enjoying some healthy, intact natural systems for sure. The water trail is a good interaction, seems to be a good way to do it. State parks does a great job of keeping access open to some of these places across the Bay in a pretty lower-impact way. Man, there's a big list. Fish & Game doing their Salmon Day up in Soldotna is pretty awesome. I think they do it at the Kenai River Center, or at least the river park up there, and it's a big celebration of spawning season. I think it's late spring and focuses more on elementary students [learning] about salmon life cycles and getting students outside.

I like the value that the community has in intact natural systems. So much is at stake with fisheries and wildlife management, and people put a lot of resources into that. There's a lot of like-minded individuals for sure.

With concerned citizens and community engagement, citizens are looking for ways to ensure the future economic and environmental success of the Bay. Some interviewees expressed a desire to move Alaska away from extraction dependency because it is not considered a long-term, sustainable action for the economy. It also troubles those who came to Alaska for the pristine wilderness that is especially present in the Kachemak Bay. There is a question of balance and the presence of dual personalities within Alaska and Kachemak Bay. Can the “Last Wilderness” and “Oil & Gas” live in harmony? Some seem to think it is possible if restrictions are truly restrictive, but others are in favor of finding different, more sustainable economic ventures. This mindset of environmental, social, and economic collaboration was seen as an asset for future policies and actions:

You know, I see potentially smaller solutions that some bright, young engineer who is thinking out of the box figures something out, and then we can use it on all our docks and that would be huge! And there's other ways, it could be geothermal or solar or ways of knitting those together, but I think Alaska will be in need of these technologies sooner because everything is so expensive, and because you've got rural issues and transmission issues and things like that. It's going to have to be creative, but that is an opportunity to push technology development because we are going to need that push and maybe things can get figured out in new ways, and I think that is a real opportunity for us going forward.

The hope that I see is that we take this term of 'economic' and this term of 'environmental' and this term of 'social', and we mix them back up. And we allow them to fuse. And then we come out to a conclusion that what economic means in its best form is in concert with the environmental and in concert with the social. And that there's not one of those terms that needs to dominate, that convention is empty at the end of the run. That's where I see things going, I see hope in realigning our ideas of environmental, social and economic so that there isn't a dominance of any one of them, but a positive feedback loop that exists by bringing them together...I think what you would have is you would have more local chains of production. You'd end up with more things that we think of in terms of 'artisan' and 'craft,' and you can see a little bit of it with the breweries. You can see a flavor of it in farmer's markets. I look at those as signs of a broader opportunity to localize and democratize our, I guess largely, our economic system. And

in that breath, we shape the definition of 'economy' to where there is alliance and harmony with social and environmental.

Scientific Community and Outreach

The second major asset expressed by interviewees (61%) was the positive impact that scientific research and outreach has on the community. Several interviewees discussed ways in which the area's scientific community is an asset for informing public opinion and policy, promoting collaboration across sectors, conducting research, and positively impacting younger generations to be more environmentally mindful. Organizations such as the Pratt Museum and the Center for Alaskan Coastal Studies provide field trips and educational resources to students and tourists in the region. By promoting ecotourism, environmental education, and land stewardship, some interviewees mentioned that these programs would ensure continued conservation into the future. When asked about how a large science community benefits younger generations, one interviewee said:

...what it does is educate their parents in the best way possible which is, of course, they want their kids to be as smart as they can be and know everything they can be. And it makes it easier for them to accept information because it's not a challenge to what they already know.

Benefits of Aquaculture and Mariculture

Oyster Mariculture

Most interviewees who discussed oyster mariculture in Kachemak Bay considered these operations to be assets for Homer's community, economy, and ecosystem. Because the water quality around oyster farms has not been degraded (like what has been observed in the salmon pens), oyster mariculture is perceived by many interviewees as having a benign ecological influence on the Bay. The ethics and commitment to environmental protection associated with the oyster operations in Kachemak Bay also instilled confidence in some interviewees that mariculture is an environmentally benign operation. One interviewee shared this perspective:

Since I've been here, we've introduced mariculture in the form of oyster farms and so the good news about that is it brings some hard-working people. Oyster farming is hard work and those people definitely support clean water and I think clean water benefits everybody and I think that's one thing we need to keep an eye on.

Oysters are also part of the Kachemak Bay area's culture and contribute to a sense of community pride. Successful oyster mariculture operations are a sign for some that the Bay is healthy as oysters are not a species that persist in polluted areas. Some interviewees believe that the quality growing environment of Kachemak Bay produces a higher quality oyster than other areas, like the Pacific Northwest. Two interviewees discussed this sense of community pride associated with local oysters:

Interviewee 2: *Do you eat oysters? Are you a regular oyster eater?*

Interviewee 1: *Well, you should have some while you're here because they are the best in the world.*

Interviewee 2: *They are the best in the world for a couple of simple reasons. Our water,*

our water temperature, and the cleanliness of the water. Anywhere you can think of where oysters are: Northeast, Northwest... all that's been logged, it's all industrial, all that waste goes down to the bottom, and that's where the oysters live. And you know how they work, so, they're filtering all this garbage in their filtration system. Whereas ours, especially out of Peterson, there's never been any logging in there, so there's no tannins. Because when they used to log, they'd float the logs so the bark all comes off and goes to the bottom, and it's, you know, you get 10-12 feet of bark over a square mile, there's a lot of nasty flavor there. That's what your Northwestern oyster tastes like, and that's an acquired taste, that's just what they are, but here we don't get that.

Salmon Aquaculture

Some interviewees also discussed the social and economic benefits provided by salmon aquaculture operations in the Kachemak Bay watershed. For some, aquaculture is a significant economic asset as it provides support for commercial and sport/recreational fishing industries that were otherwise suffering from substantial fish population declines:

Halibut stocks are down... natural salmon stocks... really hard to say what'll happen to them. A lot of these big fisheries are relying on hatcheries.

Aquaculture was also described as an important social asset as it increases community access to recreational fishing that may not otherwise be available. Many interviewees emphasized that lack of access to a boat significantly limits access to the Bay and its resources. One interviewee described how salmon aquaculture enables those without access to a boat to still have the ability to fish, and pass the knowledge, skill, and love of fishing down to their children:

Interviewee: *[Aquaculture is] huge because that's allowed locals who don't have boats to go out and fish. It allows a lot of visitors who might have one person go out on a charter, but then the family is here and they can fish. We have a lot of people from here who just go down to fish.*

Interviewer: *So, do you see that aquaculture as a generally positive thing?*

Interviewee: *Oh definitely! People just can't wait until that opens, and I see it as an economically positive thing, because people don't have to spend an arm and a leg to go have the experience to fish. And, they're restricted by the number of fish until it comes to snagging or something, but it's healthy and it's a giant plus... So, it's great if you want to teach your kids how to fish, or if you want to go out and fish yourself.*

Signs of Health

To identify what members of the Kachemak Bay area perceive to be signs of ecosystem health, and to understand how people register changes in ecosystem service health/availability, interviewees were asked several questions, including:

What are the signs that indicate whether this service is healthy/successful?

Can you describe a time that this this place/service was particularly pristine/abundant/healthy/prevalent?

Can you describe a time that this place/service seemed degraded or threatened?

While we use the term “Signs of Health” in this study, the literature refers to the same concept as, “Benefit Relevant Indicators.” The terminology was simplified for this study in order for it to be more easily communicated and explained across diverse audiences.

Benefit Relevant Indicators (BRIs), a concept developed by Olander et al. (2018), can be useful in understanding what ecosystem services are valued within a community and how these services are impacted by social, ecological, and management changes. At the most basic level, a BRI is a community-identified indicator of what social, economic, or other human benefits are being received from the area’s ecosystem, and how the health or availability of these benefits is monitored by community members. Identifying BRIs is especially useful for tracking whether the amount, quality, or health of community-valued ecosystem services change over time, and doing so in terms that are relevant to the broader community. Examples of BRI’s presented by Olander et al. (2018) include number of fish caught commercially, or the amount of undisturbed habitat for a valued species.

Community-Identified Signs of Ecosystem Health

Interviewees identified many ways in which they track the health and availability of the ecosystem services of importance to them. The most commonly discussed indicators of ecosystem health included: the quantity of a resource available; management decisions concerning valued resources; the level of biodiversity observed in fish and wildlife populations; the physical size of a resource (this primarily applies to fish and shellfish); the “quality” of the resource; and, the presence or absence of various threats.

Table 3.3: Perceived signs of ecosystem health (% of Interviews = total percentage of interviews that contained the associated sign of health) (n = 31).

<i>Perceived Sign of Health</i>	<i>% of Interviews</i>
Presence and Quantity of Valued Species	81
Management Decisions	58
Biodiversity	45
Physical Size of Fish and Wildlife	20
Quality of Resources	16
Presence or Absence of Various Threats	16

Presence and Quantity of Valued Species

The most prevalent sign of ecosystem health discussed by interviewees (81%) was the presence and quantity of a diverse array of valued fish and wildlife species. Some of the most frequently discussed ecosystem changes seen in the Kachemak Bay watershed include population declines in marine species like salmon, halibut, clams, crab, and other shellfish; various intertidal species; and sea birds. As such, many interviewees perceived that higher population numbers indicated the watershed was healthy and functioning, while population crashes indicated degradation of the Bay.

Interviewees observed changes in the presence and quantity of valued marine species in several ways: the amount of fish and shellfish caught in commercial, recreational, or subsistence fishing or clamming activities; the diversity and quantity of intertidal species observed when tide pooling or spending time at the beach; and, the observance of dead animals (e.g. the murre mortality event) on the coastline. Perceptions of fish population changes and what they mean for the health of the resource and the Kachemak Bay watershed overall were expressed in comments such as these:

And people talk about being able to go to the end of the Spit, putting a pot out there, coming back an hour later and it was full of king crab. We don't have that anymore, there is a small, personal use fishery that is open for Tanner Crab sometimes just in the fall and sometimes it's just been open twice.

Hard shell clam population has plummeted too. You go to lots of beaches around Kachemak Bay and see butter clams or steamer clams and wonder whether that decline has been from environmental factors or sea otter predation, it's unclear.

We don't have crab anymore! We don't have the crab, the king. Of course, a lot of... Well, I don't want to go there. I think crab and the fishery is what we can look at and that has certainly changed. I hear the stories. I wasn't here when everybody and their uncle was fishing out of here, but I think that's one of the big indicators.

The clams stocks here in the bay are almost, not disappeared, but it's very hard to find a little neck clam anymore and the butter clams, those stocks are way down. It's really hard to find a little neck and I find that very worrisome.

Certainly, since when I was little, you know, when I was little there were a lot more natural resources in the bay. But, in the last 10 years, I mean, the halibut has been a big issue and declining signs of halibut, the volatility of salmon, fisheries have been a big issue.

My stepson, when he got out of high school, which would have been in the mid to late 60s, well he worked in the commercial fishery. It would take them 10 skates, which a skate is 3,000 feet or something like that, of the ground line that they would put out with their hooks on it, hooks and bait, and take 10 skates of gear to catch 1,000 pounds of halibut. Well in the 80s, you'd catch 1,000 pounds on 1 skate. The halibut population was really on the uptick

Some interviewees believe that high population numbers, particularly of salmon, do not necessarily indicate ecosystem health if the populations are supplemented by farmed fish. They worried about the ecological impacts of large-scale salmon aquaculture operations in the Bay, and some noted that a substantial salmon population is not necessarily a sign of health if it is not a natural stock:

Well with regard to species, if you focus on the fisheries, yeah the absence of some of those species means there's a degradation. But, you suddenly introduced more fish in

an economically subsidized predatory system into that. So, if the idea is healthy in terms of the old model of maximum sustained yield, that's bankrupt. You can't do that.

However, one interviewee provided insights on how management agencies control the risk of overpopulation from farmed fish through an “escapement goal.” An escapement goal refers to the number of farmed fish (in this case salmon) allowed to leave a hatchery and enter the broader ecosystem. This interviewee discussed using the set “escapement goal” as a means of tracking the health of the salmon fishery and the impact of farmed fish on the ecosystem:

It speaks to your thing about, ‘How do you measure a healthy resource?’ Well one of the ways that we do it, we manage commercial salmon fisheries... And if we're going to target a stock for a commercial harvest, then we have an escapement goal for that stream and we monitor that escapement goal throughout the summer run and we adjust in-season management accordingly.

Some interviewees commented on other observed wildlife population changes resulting from disease and mortality events, and what these changes indicate about ecosystem health:

Even in the few years I've lived here, some of what you find has changed. And just from how people talk about the tide pooling, and how tide pooling used to be, it sounds like there's a lot less animals out on our side of the Bay. A lot less of those animals that you would find in the tide pools. We had a big wipeout of sea stars in general with the wasting disease which happened just within the few years I've been here. So, I've noticed some big changes in that sense, with animals.

I guess one of the biggest things changes-wise would be the sea stars. The sea star die-off last year really wiped out a ton of seas stars and that really changes the tide pool life and the atmosphere when you're over there tide pooling.

Management Decisions

Many interviewees (58%) described using local resource management decisions to gauge the health of valued resources. Individuals look to the Department of Fish and Game's fish population estimates, or whether the department chooses to open or close certain areas for fishing or clamming. In recent years, Fish and Game has declared “emergency orders” to stop recreational/sport fishing in certain areas within the watershed due to low salmon runs. This alarmed several interviewees and indicated a change in the health of natural salmon stocks:

Yeah, well last year there was an emergency order declared by Fish and Game. As of May 29th, ninety individuals [salmon] were observed going up the south fork of the Anchor, which is crazy low.

We just go on Fish and Game [information on the state of the area's fisheries], because they have most of the resources on the fish... And just like Fish and Game you really can't tell until [salmon] start coming back.

But the fact is, we're just getting super erratic [salmon] runs. They're not running at the same time that people are used to them running and so, on the big commercial scale,

that means that you're [waiting] around for a long time ...with nothing or maybe a whole bunch of running at the end of it when you're all ready to go home...As the fishing regulations are kind of designed around those time periods -- those conditional run times -- [if] they close the fisheries and the run comes after that, then they have to have an emergency opening or something like that. It is, to me, it's just going to be interesting with climate change and the erratic nature of it and how humans are very good about regulating when it comes to erratic behavior.

Additionally, warnings from management agencies and public health organizations concerning diseases like Paralytic Shellfish Poisoning (PSP) were often cited as indicators of warming water temperatures and ecological degradation:

I think those closures of the... just warnings for oysters and mussels and those types of things. I've noticed those more recently. So, that's been an indication.

The number of permits granted by management agencies to aquaculture or industrial activities was also seen as an indicator of ecosystem health by some interviewees. Some saw tighter restrictions on industry as a positive indicator that ecosystem health will be maintained in the future.

The state has limited the number of aquaculture permits, and that's probably not a bad thing either because I'm sure there may or may not be some... if it became a dense harvest... you wouldn't be able to get around in a small sports boat. And I don't know what the output would do to the quality of the water in the Bay.

Biodiversity

The level of wildlife diversity present in the Kachemak Bay watershed was also cited by interviewees (45%) as an indicator of ecosystem health. Some interviewees also discussed loss of other wildlife, particularly various intertidal species and murre. Interviewees described noticing a loss of individuals in the intertidal areas, as well as a loss of diversity over time. The murre die-off was much more apparent, and interviewees described seeing significant numbers of dead birds on the beaches. Both changes disrupted how these interviewees thought about the health of the Kachemak Bay ecosystem.

...there was an employee that worked at the Pratt Museum and she had a piece of paper that I wish I had saved, but it was a large piece where school kids had drawn all the different invertebrate creatures that they found on Bishop's Beach right out here and it was very rich, and the diversity was high. You won't find that now.

Our intertidal communities I think have been hammered by a variety of things and just in the 25 years I've been here the diversity of those systems has plummeted.

The sea star die-off last year really wiped out a ton of seas stars and that really changes the tide pool life and the atmosphere when you're over there tide pooling... the tide pools really feel like there is an echo of something wrong... there are not very many sea stars anymore. They used to just be piled on top of each other.

Physical Size of Fish and Wildlife

In addition to the quantity of fish and wildlife present in the Bay, some interviewees (20%) also looked to the physical size of individuals to indicate whether the population was healthy, particularly fish and shellfish. Several interviewees who are long-time Kachemak Bay area residents discussed the substantial decrease in the size of species like salmon, halibut, and clams over the past few decades. They perceive that these decreases in physical size are the result of some ecosystem stress such as: overfishing, the impact of hatchery raised fish, and climate change. Representative comments include:

So, there's those ups and downs, but then the halibut have gotten smaller! You know when I first got here, and I'm coming from the East Coast, you wouldn't keep a fifteen-pound halibut. They would say, 'Put it back, let it grow up a little bit,' and I would just say, 'What are you talking about?! That's pretty big!' But no that was a little chicken halibut and you didn't want that. Now you would keep it. Now what used to be pretty small is pretty decent and you'll keep it.

So, we've been looking at a growing body of literature that shows that hatchery raised pink salmon can outcompete wild fish, and also can compete in open oceans in the same niche as king salmon. So, we've been seeing a decrease in king salmon size across our entire state, and there's probably several causative factors, but I think hatcheries are probably at the top along with bycatch from trough fisherman and other fisheries.

Interviewee 1: *It used to be you could go to Clam Gulch...*

Interviewee 2: *It was over harvested!*

Interviewee 1: *... and you could get 60 a day and it would take 2 buckets to get 60, because they were that big. Now, well we haven't gone for years, but people were saying you could do 120 in one bucket because they're not getting big enough.*

Interviewee 2: *Yeah, you went from this [shows with his hands how big a clam was] to a tiny little thing.*

Quality of Resources

Some interviewees (16%) used the quality of the fish, shellfish, and other resources harvested from the Kachemak Bay watershed as an indicator of ecosystem health. The high quality of the oysters grown in Kachemak Bay is a particularly relevant indicator for some interviewees. Because oysters are “filter feeders,” some interviewees believed that oysters grown in more degraded or polluted environments do not taste as good as Kachemak Bay oysters, thereby indicating that the Kachemak Bay has a high water quality.

Another interviewee pointed to the degraded quality of the timber products from the Kachemak Bay region following the Spruce Bark Beetle infestation in the 1990s. This individual described how the beetle ruined the quality of the timber that had once been exported and used to manufacture paper:

The spruce bark beetle infestation about 20 years ago that killed off about three quarters of the spruce population from Ninilchik, or even a little farther up there to the whole southern half of the Kenai peninsula, probably three quarters of the spruce were killed. Up until that time there had been a fairly robust harvest of the timber, and in several different forms. There was a fairly large company, or at least large enough, that was logging for chips and sending the chips overseas to make paper because the spruce was so white that it was easy for the paper companies to make a really white paper. Well as those trees were killed and this color started changing in that wood, the desirability kind of went away. So, along with that the quality of the wood even to use for lumber has been degraded.

Presence and Absence of Outside Threats

Some interviewees (16%) perceive that the lack of outside threats like invasive species and pollution/litter are signs that the Kachemak Bay ecosystem is healthy. They discussed the clean appearance of the Bay, and how this appearance indicates the area is pristine.

We don't see invasive plants and trash and those kinds of things so it's a pretty healthy natural system. Clean, I guess that's part of that too...you know, the clean air and water.

I'm not seeing trash, and [the Bay] still feels wild and clean. There are some things...I just remember when I was a kid, my dad saying, if there's life in there then the air's clean. And I have no idea if that's actually true, but just noticing that everything still seems to be thriving and that there's not invasive species and things like that.

Conclusion

Interviewee perceptions of the threats and assets impacting the health and availability of valued ecosystem services in the Kachemak Bay area and perceived signs of health can be useful for KBNERR in understanding public attitudes and perceptions of ecosystem change. These perceived threats, assets, and signs of health also provide community-relevant indicators of the drivers of ecosystem change as well as the current state of the ecosystem, which could help in developing communication and public education strategies. Further, perceived assets can be useful sources for KBNERR to utilize as resources in their research, outreach, and educational work. Each of these factors will be useful in developing an ongoing coastal management plan that links human and social well-being to the management of natural systems.

While this study did not attempt to verify or quantify these signs of health or the ecosystem changes that interviewees noted, doing so in the future may be a useful method for continuing ecosystem service research. Additionally, Chapter Six connects these drivers and signs of health with current ecosystem service literature to bridge the gap between community relevant and scientifically supported measurements of ecosystem services.

Chapter Four

Perceptions of Natural Resource Management, Policy, and Practices





Perceptions of Natural Resource Management, Policy, and Practices

Introduction

Resource management can refer to fisheries management, land use management, hunting and harvesting regulations, and other environmental policies. To understand perceptions of how natural resource management in the Kachemak Bay impacts valued ecosystem services, interviewees were asked the following question:

In what ways do management decisions of federal, state, or local organizations positively or negatively affect valued places or resources?

Interviewees discussed several different aspects of resource management in response to this question, including: their perceptions of current management strategies and policies and how they impact the Kachemak Bay watershed; perceptions of resource management decision-making processes; and the perceived role of economic interests, politics, and scientific research in local management decisions and policy development.

Interviewees expressed an array of opinions about what an appropriate level of regulation looks like, particularly regarding fishing, hunting, motorized vehicle use, and land use. Some expressed a desire for strict regulations from state and local agencies and consider regulations to be necessary for protecting and sustaining the area's resources:

I think we will always have the problem of overharvest and overuse because if there is a resource out there, then we like using it. How do you manage that? And I think Alaska has always been less restrictive in its regulations, which is fine up until you do too much, then you're behind.

A few, however, felt that current policies are too cumbersome, restrictive, confusing, or unnecessary:

There are so many different regulations at so many different levels that I can understand why people get frustrated. It's hard for people to know when they need a federal, state, or local permit to do something. And the Borough, a number of years ago, consolidated a lot of that, a lot of agencies at the Kenai River and kind of created a one-stop shop which is great for the Kenai River, and it extends beyond the Kenai River. But there are still people who don't even know that they need a permit to put in a driveway and they just do that, and it's really highly unenforceable.

Interviewees also expressed a range of opinions on the quality and effectiveness of current local natural resource management strategies, policies, and decision-making processes. Some interviewees considered current resource management practices to be an outright threat to the health and future of the Kachemak Bay watershed and ecosystem. Others, however, considered

current management to be an asset. They viewed management as effective, well-informed, and significantly more robust than it was in the past.

The diversity of opinion represented in interviews illustrates the complex and dynamic nature of natural resources management in the Kachemak Bay watershed. The following sections unpack the decision-making context as described in interviews as well as the positive and negative perceptions of natural resource management and decision-making expressed by interviewees. It should be noted that individual interviewees often expressed both negative and positive perceptions of resource management.

Table 4.1 Breakdown of negative and positive perceptions of resource management in the Kachemak Bay watershed. (% of Interviews = total percentage of interviews that contained the associated threat) (n = 31).

Perception of Management	% of Interviews
Negative Perceptions	81
Positive Perceptions	68

Decision-making Context

Most interviewees emphasized that responsibility for local resource management largely falls to state and local agencies. The most frequently mentioned management and regulatory agencies include: Alaska Department of Fish and Game, City of Homer Planning Commission, and Kenai Peninsula Borough. The Department of Fish and Game was most often discussed in the context of fishery and wildlife management, while the Homer Planning Commission and Kenai Peninsula Borough were largely tied to land use and development decision-making.

Many interviewees considered federal influence over the Kachemak Bay area's resource management to be fairly nonexistent. Some saw federal agencies as being "far removed" and thus absent from local decision-making. Others noted that the state of Alaska and the Kenai Peninsula specifically are largely made up of federally owned land (Kenai National Wildlife Refuge and Kenai Fjords National Park), which influences the area's land management. Many of these interviewees expressed an appreciation for the environmental protections this federal ownership provides.

Negative Perceptions of Natural Resource Management and Policy

81% of interviewees expressed negative perceptions of resource management in the Kachemak Bay region. These interviewees largely focused on ways in which science and data gaps, agency budget constraints, and various economic and political influences may be hindering the development and implementation of effective environmental policies and protections. When discussing his perception of resource management, one interviewee stated:

Time and time again you see decisions made on a short-term basis, typically for monetary reasons, power and money. But that's our nature. We are humans and we have difficulty learning from the mistakes of others, but we're trying to do better than that.

The following table outlines the aspects of management that those who expressed negative perceptions tended to focus on.

Table 4.2: Negative perceptions of management (% of Interviews = total percentage of interviews that contained the associated threat) (n = 31).

Management-Related Topic	% of Interviews
Science Gaps	51
Fisheries Management	45
Agency Budget Constraints	35
Political Influence	25
Disjointed or Ineffective Management/Policies	19
Insufficient Enforcement	9

Science Gaps

Many interviewees (51%) discussed the ways in which past and present information and science gaps or lack of current data have hindered effective and sustainable land use and resource management in the Kachemak Bay area. Several discussed how an absence of data has contributed to delayed regulation/policy development, particularly with regard to fisheries management. Some interviewees believe that agencies like the Department of Fish and Game do not have the information necessary to set the level of fishing limits or restrictions that will adequately protect the resource:

It seems like Fish & Game is the big player and it seems like their management style is to try to allow as much activity, harvest, opportunities as possible. And I don't know if there isn't as much science and research and information to be able to limit it and to have something to support that and say, 'Hey, we need to limit this here because we have information that shows this is declining or this is a threshold' or whatever it is. Whether it's a data gap, they don't have enough information to be able to make those decisions or if it's just that they're mandated to provide opportunities for people to harvest and to maximize the yield on certain species.

There has not been enough information to let the folks that do the management here do their jobs the way they would like to.

Some attributed this lack of verified, scientific information on fishery stocks to the significant population declines that became noticeable in the late 1980s/1990s. Prior to the “crash,” interviewees reported that there was some degree of worry in the community that overharvest

could be an issue (and there was some anecdotal evidence), but without harder data this was not enough to influence regulatory changes:

One of the guys that has managed our facilities for a long time commercially crabbed and shrimped and all that back in the eighties. And he and a bunch of other people that did that at the time say, 'Oh, boats would just be piled high with crab and we would just keep bringing them in! And we told Fish and Game that it was too much! We told them there was going to be a problem!' But of course, no one stopped fishing.

Others discussed the ways in which information gaps have prevented the development and implementation of important land use restrictions in vital habitat areas. Before KBNERR completed their ecological assessment of the Kachemak Bay watershed, it was relatively unknown that the area's many anadromous streams were vital habitat for spawning and juvenile salmon. This lack of data prevented the establishment of any policies that would regulate surrounding land use and protect these areas, and precipitated poor land use decisions on the personal, individual, or residential level:

A lot of people don't even know—this tiny rivulet that crosses their property... It just looks like a little ditch to them and they don't even know that that's important salmon habitat. People put driveways across them, there's material sites even in or next to salmon streams, subdivisions and development projects that siltation is increasing in the streams.

When [KBNERR] came no one knew what was here, and no one knew what was in Kachemak Bay. People talk, 'Oh yeah, there's some fish out there,' but what kind of fish? How many fish? What kind of trees? What kind of wetlands? ... there's a lot of streams around here and many people didn't think there were fish in them or anything to do with fish. But, [KBNERR] found out that most of these streams that feeds into not only Kachemak Bay, but also Cook Inlet, all have different types of fish... red salmon or pink... all the different species. But, in the olden days, a lot of people and these homesteaders would take their four wheelers and just drive across these areas and wipe them out, so the fish couldn't get up them.

Fisheries Management

45% of interviewees expressed negative perceptions of fisheries management. Kachemak Bay area residents, as previously discussed, care deeply about and depend on healthy, thriving, and sustained fish and wildlife populations, so they have high stakes in how these resources are managed. This connection fosters passionate, and often divergent, thoughts and opinions about management, particularly fishery management. The Department of Fish and Game was frequently discussed, and many of these interviewees expressed distrust of Fish and Game's current management practices:

So just in Kachemak Bay, you've seen ample evidence of a lack of sustainability in our management, but because of the way our systems are, because of the way our systems function, we don't have an adequate response to deal with it.

Political Influence in Fisheries Management

Some of these interviewees discussed the role of economic and political interests in fishery management and decision making. Some discussed the perceived political power of fishing interests, particularly commercial and sport/charter fishing, in management decisions. Several explained that while many commercial and charter fishing interests have felt slighted by catch limits and other restrictions, they feel that the allowable catch is still too high to maintain a sustainable population. They believe the Department of Fish and Game allows higher yields due to local political pressures and the significant economic role fishing plays in the Kachemak Bay region.

Well, it seems like Fish and Game is more an extraction agency. They try to maximize the yield while keeping it sustainable, and I think they might be flirting on a line that incorporates more of that economic yield more than the sustainability sometimes.

Reactive vs. Proactive Fisheries Management

Another theme among these interviewees was that economic interests have often caused Fish and Game's management to be reactive, rather than proactive, and that this management style has contributed to significant population declines – specifically in the salmon and halibut fisheries. Many of these interviewees expressed the opinion that commercial and sport fishing regulations like catch limits, fishing schedule limitations, and other policies from Fish and Game have often come too late, and are typically developed in response to significant existing problems of overharvest and population decline, rather than proactively to avoid these issues before they arise.

A common example provided by interviewees was the significant fish and shellfish population decline following the 1980s. Many attributed this crash to overharvest due to a lack of regulation on commercial fishing. Some interviewees do feel that fisheries management has drastically improved since that time, but others worry that Fish and Game policies are still not as rigorous as they should be:

I'd hope to see more proactive management instead of reactive when it comes to the resources. I'd like people to stay strong with realizing that this area is special. I mean that's why it's a critical habitat area, that's why the research reserve is here. It is a special area. And it's okay to restrict some things in order to keep that.

You could grab crab and go cook it on the beach in your salt water and there are no crab fisheries like that anymore. Those numbers have dropped, so seeing those changes in the resource and the fact that I don't know if management and policy has kept up – it seems like there is more reaction than proactive actions there.

So, I'd like to see... more proactive management. And I don't know if that's feasible. Or more data, more research done so that we can be more proactive.

I think some of the marine resources, I think the state has been slow on putting restrictions on.

Agency Budget Constraints

Some interviewees (35%) discussed budgetary issues that impact resource management in the Kachemak Bay area. They discussed environmental risks posed by financial constraints on state and local regulatory agencies, research organizations, and environmental non-profits.

Several of the perceived shortcomings in the Kachemak Bay area's resource management (i.e. "reactive" management and lack of enforcement of environmental regulations) were attributed to budget limitations at the state agency level (particularly the Department of Fish and Game). Some interviewees considered these limitations to be a true lack of funds, but others felt that the resources were available, and the apparent absence of funds was really due to politics and divergent agency priorities.

There was also a range of opinions on whether state/local regulators are appropriately utilizing the resources they do have to adequately protect, preserve, and manage the Kachemak Bay area. Some interviewees expressed a distrust of local natural resource management decisions:

I don't trust the state management always. I think they try to do a good job, but there's still a lot of politicians that try to tell them how to allocate their resources.

When I worked for the state, they didn't spend the kind of money they should... not on the right things.

Some interviewees also discussed their hope that local research will continue to receive necessary funding to continue into the future as it provides vital information for decision makers and community members. The presence of local research is seen as a significant asset to area ecosystem health, and some interviewees considered the chance of this research being impaired due to funding constraints to be a threat:

It's my hope that the Research Reserve continues to get the federal funding that they need to stay in business, because people like Steve Baird and some of the other scientists... they've done such practical things.

Political Influence

Some interviewees (25%) expressed concerns about the influence of oil/gas, extraction, and other industries on state and local politics and how this impacts Alaska's natural resource and land management decisions. Because these industry groups have such significant economic power, they also have substantial political clout throughout the state. Many of these interviewees felt that this influence creates a lack of "political will" from the state to implement and enforce environmental policies and protections. Several interviewees reported noticing this influence in various policy decisions:

Well I think it's more of a problem of omission than commission. The laws and rules are largely there if you had the political will to enforce them, but we don't have that. So, what you see time and time again are our bureaucrats and our agencies bowing to pressures that invariably come back to money. So, a great example is the hatchery permit in Tutka

Bay. The area representative for the DNR denied the permit. Well the guys that invested millions of dollars into their fisheries went above him, went to the director of the agency and they got that decision overturned. The first decision was based on science and facts and law, the second decision was based on politics.

We got rid of our Coastal Zone Management Program. Which, under the federal Coastal Zone Management Act, every state, including Michigan, has a Coastal Zone Management Program. Alaska has more coastline than all the lower 48 states combined, and we're the only state that doesn't have a Coastal Zone Management Program, and that's because the industries didn't like it.

Disjointed or Ineffective Management and Policies

19% of interviewees discussed concerns that fall into the category of “disjointed management.” This phrase encompasses issues like: lack of communication or coordination between different agencies, levels of government, or stakeholder groups; discrepancies or redundancies between federal, state, and local policies; and/or policies that do not appear to respond effectively to the treat they were designed to address.

One example provided by an interviewee was a state program that funds the construction of bat boxes throughout Alaska. This interviewee felt that while this program may have noble intents, it is somewhat stand-alone, and not tied to a more broad and comprehensive wildlife management or protection policy:

We joke about [funding for bat boxes] and call it a random act of wildlife conservation. I feel like there are a lot of random acts that are being done... And some of them are useful and some of them are not. And some of them actually counteract some of the other ones that are being done. So, it is interesting. I am a big proponent of collaboration and cooperation.

One interviewee described how a lack of communication and coordination between the many stakeholders involved in the fisheries has lead to confusion and ineffective implementation of fisheries management:

I've tried to understand the fishing world, and it's next to impossible because the stakeholders just don't work together at all. You know, you have commercial, private, land based, ocean based, you have processors, you have the people that live in this part of the world, you have the Susitna drainage people, and they want their fish, and nobody knows which ones are theirs, and they get all mixed up.

Another interviewee described a lack of coordination in state offices when developing ongoing management plans for different areas in the Kachemak Bay region:

The State Park went through their planning process and the Critical Habitat area is going through theirs, and we aren't necessarily coordinating and collaborating as much as we could. And I think that we could do that better.

Insufficient Enforcement

A few interviewees (9%) felt that existing fish, wildlife, and land use regulations may not be entirely effective due to insufficient enforcement. This absence of necessary enforcement was largely attributed to monetary limitations, which are discussed later:

I think we only have two Brown Shirts? In the whole lower peninsula? And there's a lot of things going on down here. I could be wrong, but I believe it's just two for the lower peninsula and sometimes they get called elsewhere. My point is just that there isn't—it's impossible to be everywhere you need to be to address all these things so, yeah, a lot probably slips below the radar.

Positive Perceptions of Resource Management and Policy

Many interviewees (68%) also discussed positive perceptions of current resource management and decision making. For some, there was a sense of local pride and belief that the Kachemak Bay community and Alaskans as a whole have managed resources more carefully than the rest of the country. Several discussed the connection to and respect for Alaska's ecosystems and natural resources that is felt by so many Alaskans and has fostered more thoughtful and considerate resource management:

For me, I still believe that we, in Alaska, are proud of the fact of how well we manage our resources. And we're not perfect by any means. But I think we do a good job of managing our resources.

We have a reputation of being a very well-managed fisheries and scientifically based... I'm sure people question that reputation, but I think that is our reputation, at least, and I would like to be able to continue to have that as a cultural value as Alaskans. It's not about who gets the most... it's about really good management. I mean, I do think we value that as a state.

Several interviewees expressed that while state and local resource management in the Kachemak Bay area has not always been perfect, it has greatly improved since the 1980s. Many also discussed how increased regulation of resource and land use in recent decades has provided important and effective protections to ensure viable populations.

When we first arrived [in the 1980s], commercial fishing was the primary industry, and during that time we had a number of vibrant fisheries out in the Bay. We had commercial shrimp fishery, commercial crab fishery, commercial halibut fishery, commercial salmon fishery right in the Bay. Now, within probably ten years or more, those fisheries all but disappeared because they weren't as carefully managed as they are today with Fish and Game.

A lot of stuff was overharvested or overfished before there were a lot of regulations.

While financial constraints and resource allocation can impact resource management and decision-making, some interviewees perceive the resource management decisions to be thoughtful and effective:

There are a lot of areas in Alaska where the management is somewhat haphazard just due to lack of resources. There's not the money to do the monitoring that should be done or come up with harvest estimates and abundance, so there is a lot of thought that goes into the management resources in Kachemak Bay.

The following table outlines the aspects of management that those who expressed positive perceptions tended to focus on.

Table 4.3: Positive perceptions of management (% of Interviews = total percentage of interviews that contained the associated threat) (n = 31).

Management-Related Topic	% of Interviews
Federal and State Policies and Protections	58
Local Policies and Protections	29
Scientific Research and its Role in Resource Management	26

Federal and State Policies and Protections

Many interviewees (58%) discussed federal and state policies that they believe are effective in managing and protecting the Kachemak Bay region and its resources. Some interviewees cited state limits on allowable catch or allowed number of fishing days for commercial and charter fishers, and how these restrictions are necessary for ensuring sustainable populations:

Again, like I say, as the user population increases, there has to be more restrictions. You know, I've got friends that are charter operators and they're lost 2 days out of the week not that they can't charter for halibut. Well, during that same period of time that's happened, the commercial halibut fishermen, the long liners, they've seen probably a 25 or 30 percent decrease in the allowable catch that they can get. So, both sides of the user group have seen a reduction in their allowable catch....

Federal and state protected areas in the Kenai Peninsula are another key aspect of management that interviewees perceived to be beneficial for the health of the Kachemak Bay watershed. Southcentral Alaska is home to a large number of publicly and privately designated conservation lands and marine areas. These include the Kachemak Bay Critical Habitat Area, Fox River Flat Critical Habitat Protected Area, Kachemak Bay State Park. It is important to note, the State Critical Habitat Area designation banned oil leases in Kachemak Bay.

Many consider these protected areas to be important assets for protecting the structure and function of the Bay's ecosystem:

You know one thing I'll say about Homer is because we have the Kachemak Bay State Park, but most of the park is across the Bay. It's a little harder to get to than a lot of other places with natural areas. I think having the protected lands, the state parks and the federal lands that we do around the Kachemak Bay and the southern Kenai Peninsula is incredibly important to the resiliency of the area.

I think, this is critical habitat here, and I think that has been one of the best things that we have ever done.

Local Policies and Protections

Some interviewees (29%) also highlighted local policies and management strategies that they believe are important in managing development and protecting the Kachemak Bay watershed's ecological function and processes. Several discussed the City of Homer's planning and zoning ordinances that they believe have helped Homer to develop and succeed economically, while working to maintain the area's pristine ecosystem:

It seems to me that balanced decision-making is critical, and I'm not afraid of some regulations... zoning in fact to me is very important... Generally development has been handled pretty well.

While some specific resources may not be as abundant as they have been in the past, I'd say overall, Homer is doing pretty good at paying attention to the kinds of development that might conflict with resource health—for the most part.

Additionally, while the 50-foot stream buffer policy (discussed in Chapter 3) is controversial, many see this Kenai Peninsula Borough policy as a necessary protection for wild salmon populations:

The Kenai Peninsula Borough several years ago passed a setback, fifty foot buffer for salmon streams which was pretty limited and hugely controversial. Big fight around it. But it's still in place... A lot of people didn't understand, and I didn't understand, the degree to which salmon use those little streams... Then all these streams have these little creeks that they use, especially over the winter... that's a pretty obvious [positive aspect of management].

Others noted that easements and preserves designated by the Kachemak Heritage Land Trust have provided valuable protections for wildlife habitat and valuable headwater streams.

Scientific Research and its Role in Resource Management

Some interviewees (26%) expressed the belief that improvements seen in local resource management over time can be largely attributed to the expansion of local scientific research, and the integration of ongoing research in fishery and land management decision making. Most research discussed by interviewees was completed by KBNERR or the Department of Fish and Game's scientists. One interviewee described the important relationship between researchers

and decision makers that exists in the Kachemak Bay area, and the value created through collaboration between scientists, local decision-makers, and managers:

One of the things that the Reserve does is they host a lot of forums for connecting across [researchers and decision makers]. So the people generating the scientific information, the people that need it, and the community members that are wondering, 'Will I get to do this or not? Or what should I look out for?' Those conversations are able to happen, and I think that's one of the really valuable opportunities that the Reserve provides is it provides the opportunity for those conversations and for the sharing of information and for the figuring out where we need to go.

Several interviewees discussed the responsiveness of local and state management agencies to new information, and the willingness of management agencies to adapt their strategies to incorporate local data. In discussing the role of scientific research in natural resources management, one interviewee said:

People are really in touch with the environment and the Bay and so there is also that appreciation of local knowledge and traditional knowledge and communities across the Bay. The scientists listen to what they have to say and respect that integration of knowledge—so I think in some ways, it's kind of unique too because we do have all these government and non-government agencies, but there's no ivory towers here with information and I think that's pretty unique and important.

A commonly provided example of the role of local scientific research in decision making was the 50-foot stream buffer policy mentioned earlier. This policy limits certain land uses and development within fifty feet of an anadromous stream, as these streams have been found to be vital juvenile and spawning habitat for salmon. This policy was born largely from the integration of research completed by KBNERR and local land use planning processes. One interviewee provided a decision maker's perspective on this policy and the role of science and education in policy development and implementation/enforcement:

Well, I've been on the planning commission. Both the city's and the Borough's, so I know we try to make good decisions. Since I've been there we have put a 50-foot buffer on both sides of the Kenai, any anadromous stream and pond. That is trying to educate people that, 'Yeah, you may not want to throw your grass clipping into the pond that you're on. You know, maybe you can help them understand something about nitrification. And most people are buying into that, so when they want to build within the 50-foot setback they have to come to the planning commission with their request and argue why it's necessary to put this in. Mostly they're fishing stations and they have to be light penetrating to a certain height and they're buying into that. So, we are seeing something positive.

Conclusion

Interviewees expressed a wide range of thoughts and emotions related to their perception of natural resource management in the Kachemak Bay watershed. Commonly discussed management areas included the fisheries, wildlife, and land use/development. Most often management was discussed in the context of state and local decision-making. Like the perceived threats, assets, and signs of health discussed in Chapter Three, the perceptions of resource management are useful in understanding public opinion and attitudes, as well as in improving communication between organizations and the community. As one interviewee commented, there is always room for, and value in, improved communication:

[Fish & Game doesn't] tell [KBNERR] everything [they're] doing and sometimes I hear something [KBNERR is] doing and I'm like, 'What? You are? You should have told me, I have to do these samples from over there' or whatever...I'm sure it goes both ways. So yeah, communication is good. We can always do better at that.

Chapter Five

Kachemak Bay-Specific Ecosystem Services Framework





Kachemak Bay-Specific Ecosystem Services Framework

Introduction

To organize the results presented in Chapters Two-Four in an ecosystem services framework, we looked to social value typologies (SVT) as they apply to ecosystem service research – particularly the social value typology presented by Zachary Cole (2012). However, in doing so, several discrepancies emerged between data collected in Kachemak Bay and the pre-existing framework from Cole (2012). To respond to these gaps and more accurately capture the ecosystem services present and valued in the Kachemak Bay watershed, a social value typology specific to Kachemak Bay was developed. The following chapter outlines the use of social value typologies in ecosystem service research, the Cole (2012) social value typology, and the development of the Kachemak Bay SVT. Finally, the resulting Kachemak Bay SVT is presented and detailed.

Social Value Typologies in Ecosystem Service Research

There are several areas of research that seek to capture social-cultural dynamics of ecosystem service valuation. Interview questions and analysis followed two frameworks of social valuation: (1) social value analysis as established by Brown & Reed (2000) and Cole (2012); and (2) place-based, socio-cultural ecosystem service valuation proposed by Potschin & Haines-Young (2013) and Scholte et al. (2015). As defined by Cole (2012), “social values are the perceived attributes of a given ecosystem that are thought to result from a transactional concept of human-landscape relationship” (pg. 57). As human populations interact with the ecosystem, they develop perceptions of the utility and value associated with a particular place. These transactional values are often categorized according to various social value typologies (SVT). The social value types that make up these frameworks represent the many different social benefits derived from natural systems (Brown, 2005; Brown & Reed, 2000; Cole, 2012).

Brown & Reed (2000) argue that a range of value types can provide a detailed approach to unpacking and organizing the benefits and interactions between humans and natural landscapes. Several detailed social value typologies serve this purpose. This study employs the SVT established by Cole (2012) for coastal communities. Cole’s social value typology is one of the most recent applications of ecosystem value research and is designed specifically for a coastal setting. It was developed using an e-Delphi survey technique with 30 expert respondents working on coastal management issues across geographic regions in both public and private sectors. The e-Delphi survey technique promotes consensus through multiple iterations and expert engagement. Cole asked experts to critique and add to existing value typologies. Their responses modified existing social value typologies to include both access and natural value types that are particularly relevant to coastal ecosystems. The resulting SVT from

Cole (2012) is shown in Figure 5.1, and contains sixteen value types ranging from a value of biodiversity, to a value of recreational or subsistence opportunities, to a value of economic benefits derived from an ecosystem. Many of these value types also relate to places with therapeutic, spiritual, or cultural value.

This study tested these typologies qualitatively to assess whether or not they capture the place attachment expressed by interviewees in the Kachemak Bay region. This place-based lens for ecosystem service valuation, as described by Potschin and Haines-Young (2013), is a bundled analysis of the ecosystem services with particular attention given to current and future states. A place-based framework provides a holistic view of the ecosystem services and the personal significance that these services have on individuals and community groups.

Value	Definition
Access	Places of common property free from access restrictions or exclusive ownership/control.
Aesthetic	Enjoyable scenery, sights, sounds, smells, etc.
Biodiversity	Provision of a variety and abundance of fish, wildlife, and plant life.
Cultural	Place for passing down wisdom, knowledge, and traditions.
Economic	Provision of fishery (commercial/recreational), minerals, and tourism industry that support livelihoods.
Future	Allowance for future generation to know and experience healthy, productive, and sustainable coastal ecosystems.
Historic	Place of natural and human history that matter to individuals, communities, societies, and nations.
Identity/symbolic	Places that engender a sense of place, community, and belonging; represent a distinctive “culture of the sea.”
Intrinsic	Right to exist regardless of presence; value based on existence (being rather than place).
Learning	Place of educational value through scientific exploration, observation, discovery, and experimentation.
Life sustaining	Provision of macro-environmental processes (i.e., climate regulation, hydrologic cycle, etc.) that support life, human and nonhuman.
Recreation	Place for favorite/enjoyable outdoor recreation activities.
Spiritual/novel experience	Places of sacred, religious, unique, deep, and/or profound experience where reverence/respect for nature is felt.
Subsistence	Provision of basic human needs, emphasis on reliable, regular food/protein source from seafood.
Therapeutic	Place that enhances feelings of well-being (e.g., “an escape,” “stress relief,” “comfort and calm”).
Natural	Place of minimal human impact and/or intrusion into the natural environment.

Figure 5.1: Cole (2012) Social Values Typologies for coastal ecosystems.

Kachemak Bay Social Value Typology Framework

The social value typology framework that resulted from Cole's (2012) coastal area study was the most applicable pre-existing framework for organizing findings from interviews completed within the Kachemak Bay watershed. Other NERRs, including the Mission-Aransas NERR and Sapelo Island NERR have utilized the Cole (2012) framework to administer survey-based social value analysis, thereby supporting its potential suitability for KBNERR. As such, Cole's sixteen value types were used as a starting point for deductive interview coding in this study. The goal of this coding process was to (1) identify which value types were most salient in throughout interviews; and (2) test the applicability of the SVT framework for future KBNERR research. Overall, findings from this study indicate that there is significant overlap between Cole's framework and this research, with Economic, Pristine/Natural, Cultural, and Access being the most frequently expressed value types.

However, while the Cole framework is fairly comprehensive, there were significant details and nuances that emerged throughout the Kachemak Bay study that were not adequately captured or described by Cole's framework.

To respond to the observed discrepancies between Cole's framework and the results of the Kachemak Bay study, Cole's framework was modified to better represent the types of ecosystem services and values described by interviewees. The result is a similarly detailed, but more place-based social value typology framework that is specific to the Kachemak Bay watershed. Certain value types introduced in Cole's framework were representative of the social value types expressed throughout this study and remain consistent in the Kachemak Bay SVT framework, but some definitions put forward by Cole were altered to better describe what that value type means in the context of Kachemak Bay. Additionally, there were several SVTs expressed in the Kachemak Bay region that were not present in the Cole framework and were added to the Kachemak Bay SVT framework.

The definition of "ecosystem service" can be elusive, and is represented differently throughout the literature. The term can be used to describe tangible and quantifiable benefits provided by an ecosystem such as number of fish caught, or value of coastal land per acre. It can also be used to describe intangible benefits like therapeutic or spiritual experiences that are provided by a natural system, but are not as readily quantified or measured over time. The definition of ecosystem service used for this study was presented by Daily (1997): "Ecosystem services are the conditions and processes through which natural ecosystems and the species that make them up, help sustain and fulfill human life."

It should be noted that within the context of this study, ecosystem services can also be understood as the ways in which people *perceive* the Kachemak Bay's ecological "conditions and processes" benefitting and enriching their lives and community. Cole (2012) also emphasizes that social-valuation of ecosystem services are a method of understanding human "perceptions" of benefits received from an ecosystem.

Interviewees expressed diverse perceptions of the types of benefits they receive from living and working in the Kachemak Bay watershed. Some of these benefits could be quantified or

measured in future studies, but others cannot. However, all were prevalent through conversations with interviewees, and individual interviewees often expressed receiving both quantifiable and non-quantifiable benefits from the watershed. The following SVT framework is, at its core, a representation of the types of benefits interviewees perceived as being provided by the Kachemak Bay ecosystem.

A table outlining the complete SVT designed for the Kachemak Bay watershed is shown in Table 5.1, and the following chapter provides further insights into each value type. The framework is broken into three sections: values consistent with the Cole framework, values modified from the Cole framework, and values unique to the Kachemak Bay framework. Table 5.1 provides a description of each value type, the frequency in which that value type was expressed in interviews.

Table 5.1: Social Value Typology for Kachemak Bay (% of Interviews = total percentage of interviews that contained the associated typology) (n = 31). Relation to Cole Framework indicates which SVTs and/or Descriptions have been modified from Cole (2012), remained the same, or are unique to KB.

Values	Description	% of Interviews	Relation to Cole Framework
Pristine/Natural	<i>Minimal human impact and/or intrusion into the natural environment</i>	97%	Same
Recreation	<i>A place for favorite/enjoyable outdoor recreation activities</i>	90%	Same
Life-sustaining Ecological Processes	<i>Provision of macro-environmental processes (i.e., climate regulation, hydrologic cycle, etc.) that support life, human and nonhuman.</i>	71%	Same
Therapeutic	<i>A place that enhances feelings of well-being (e.g. ‘an escape’, ‘stress relief’, ‘comfort and calm’)</i>	65%	Same
Spiritual	<i>Places of sacred, religious, unique, deep and/or profound experience where reverence/respect for nature is felt</i>	45%	Same
Economic	<i>The provision of fisheries (commercial/recreational), minerals, ecotourism, agriculture, and research and education that support livelihoods</i>	97%	Modified
Access	<i>A place to enjoy recreational activities and natural beauty while maintaining sustainable management of human activity</i>	94%	Modified
Cultural	<i>Defining community characteristics of Homer and the Kachemak Bay area that are tied to the natural environment</i>	94%	Modified

Future	<i>The ability for future generations to enjoy and benefit from the Kachemak Bay watershed’s ecosystem services</i>	90%	Modified
Aesthetic	<i>Appreciation of “sights, sounds,” and the overall striking beauty of the Kachemak Bay area.</i>	87%	Modified
Learning	<i>Opportunities to learn or share scientific information, values, and traditions as they relate to the Kachemak Bay ecosystem</i>	87%	Modified
Subsistence	<i>The provision of basic human needs, emphasis on reliable food sources from nature</i>	74%	Modified
Biodiversity	<i>A high variety of fish and wildlife species, as well as genetic diversity within populations</i>	45%	Modified
<hr/>			
Connection to Community	<i>The “sense of place, community, belonging... and distinctive ‘culture of the sea’” associated with the Kachemak Bay region. Additionally, the sense of pride of place tied to living and/or working in the area.</i>	77%	Unique to Kachemak Bay
Connection to Self/Personal Identity	<i>Individual experiences/beliefs that a place is essential to one’s self and/or informs a personal sense of identity</i>	71%	Unique to Kachemak Bay
Connection to Nature	<i>Experiences of being completely present in nature; recognition that humans are a part of the ecosystem/natural environment</i>	71%	Unique to Kachemak Bay
Connection to Family	<i>Familial connections or closeness fostered by shared time spent outdoors; cherished family memories outdoor activities; or other experiences/opportunities in which the ecosystem has provided a sense of place or identity within a family or household</i>	65%	Unique to Kachemak Bay

Value Types Consistent with the Cole Framework

The first portion of the KBNERR Framework consists of value types that were present in the Cole (2012) framework and were represented in interviews as they were described by Cole. The description of these values is consistent with the Cole article (shown in Table 5.2), and are further described in the following section.

Table 5.2: Value Types Consistent with the Cole Framework (% of Interviews = total percentage of interviews that contained the associated typology) (n = 31).

Values	Description	% of Interviews
Pristine/Natural	<i>Minimal human impact and/or intrusion into the natural environment</i>	97%
Recreation	<i>A place for favorite/enjoyable outdoor recreation activities</i>	90%
Life-sustaining Ecological Processes	<i>Provision of macro-environmental processes (i.e., climate regulation, hydrologic cycle, etc.) that support life, human and nonhuman.</i>	71%
Therapeutic	<i>A place that enhances feelings of well-being (e.g. ‘an escape’, ‘stress relief’, ‘comfort and calm’)</i>	65%
Spiritual	<i>Places of sacred, religious, unique, deep and/or profound experience where reverence/respect for nature is felt</i>	45%

Pristine/Natural

Thirty interviewees (97%) valued the “Pristine/Natural” state of the landscape and ecosystem services of Kachemak Bay. The “natural areas” value was added by Cole to the landscape value literature, indicating a recent recognition of the importance of untouched areas to describe social landscape values. Cole’s definition of a place that is valued because of “minimal human impact and/or intrusion into the natural environment,” accurately describes the responses expressed in interviews. Interviewee comments also validate the addition of a “pristine” value type to Cole’s “natural” value.

Notably, many interviewees described the untouched landscape that still exists on some parts of Diamond Ridge, while others highlighted the pristine quality of Kachemak Bay State Park as a draw for residents and visitors alike:

Interviewee 1: *And, what across the Bay has forever, unless we screw it up, is the renewable resource or ecotourism going over to kayak and hike. We’ve forever been proponents of, ‘Let’s not mess this up, because this is more money,’ and you can’t replace this, you can’t get this...*

Interviewee 2: *You can’t build it, you can’t recreate it.*

Interviewee 1: *And it’s unique that there’s no roads to it, it is a little bit of a pain sometimes because you have to take a boat to it.*

Interviewee 2: *But that keeps the impact way down.*

Interviewee 1: *Yeah, it makes it special for people that come to Homer and go across the Bay... and you can’t do that other places.*

Others expressed motivation to protect the pristine quality of the natural spaces. They support policies such as the critical habitat area, the establishment of the state park, the Kachemak Heritage Land Trust, and/or the reduction in aquaculture and other drivers of ecosystem change:

My heart has always been with preservation of land and conservation. So it's a natural progression from what I've done in the past to this. I very much feel like it's important to ensure that some of the landscape is protected forever, both for people to use and for conservation of fish and wildlife resources.

What are the ecosystem impacts? You know, if you put ten million pink salmon out there what is it going to do to everything else? But you also have the aesthetic. You put the fish pens up for a couple months then you have the people that want to go kayaking in a pristine place and that's not exactly what they want to see. So is that a big deal or not? Depends on who you ask.

Recreation

Twenty-eight interviewees (90%) valued "Recreation," which is described by Cole as a "place for favorite/enjoyable outdoor recreation activities." This definition holds true for Kachemak Bay. Recreational activities include favorite activities for community members and visitors alike. Some interviewees described "Recreation" on both an individual and a community-wide level:

Well, I'm a fairly avid snowmachiner. I have got an off-road vehicle that could be used in the summer. I don't do that much summer use, I do more winter use. As far as the water, I have a boat and we have what you might call a summer home across in Tutke Bay, so we do spend a fair amount of time on the water. I enjoy fishing, both salmon and halibut... and even hunting. I enjoy moose hunting.

I like the outdoors too, I really enjoy the sea kayaking aspect and the hiking and the hunting and fishing and everything too.

...in the winter, it's a lot of snow related stuff and cross country skiing, downhill skiing, we've got ice hockey rinks, so hockey. In the summertime, it's the biking and the kayaking, and the hiking.

Well, Homer has a lot of different user groups. So, I mean you have to just pick your neighbor and say, 'Oh what does he do?' So, interacting... A lot of seasonal work with ecotourism, kayak guides, people working on the Spit, then you've got a lot of fishermen... a lot of hunters, a lot of recreational sport fishing. I like to fly-fish a lot, so I kind of roll in that circle a bit.

Life-Sustaining Ecological Processes

Twenty-two interviewees (71%) valued the "Life-Sustaining Ecological Processes" provided by the Kachemak Bay watershed. This value, called "Life Supporting" in the Cole framework, is defined as, "Provision of macro-environmental processes (i.e., climate regulation, hydrologic cycle, etc.) that support life, human and nonhuman." This definition is reflective of the values

expressed by interviewees when discussing topics such as: nutrient cycling, hydrological cycling, wildlife habitat maintenance, ocean chemistry, and climate regulation. Representative comments include:

First and foremost, the healthy nature of the ecosystem has been integral to our physical health and the health of our business. We can only do what we do because we have clean air and clean water and intact systems that we can live and co-evolve with. Nutrients and natural inputs from fish and other organisms living in the Bay and the forests, even though they aren't natural as this is a prairie landscape, are also a core part of supporting [our] work.

Therapeutic

Twenty interviewees (65%) discussed “Therapeutic” values associated with the Kachemak Bay ecosystem. Interviewee perspectives aligned closely with Cole’s therapeutic definition: “Place that enhances feelings of well-being (e.g. ‘an escape’, ‘stress relief’, ‘comfort and calm’).” The access to coastal and marine areas with abundant wildlife viewing and general recreation provided people a chance to escape and find time for personal reflection:

Getting out and biking is kind of a no-cost activity, and so the beaches and all the snow-bike trails, and wherever I go to bike or hike, I'm getting—the services I get are great exercise in a healthy environment, but also the entertainment value, often social entertainment, and meditative if I'm by myself. Which you can pay for a massage or any kind of self-care thing, and this is something that the environment provides me...

These values also related to the increased use of technology. Many saw the everyday necessity of cellular phones and other devices but appreciated the opportunity for escape, self-reflection, and restoration provided by the natural places. Some also credited moving to Homer or surrounding areas as a way to live in a place that was restorative for mental and physical health:

I think a lot of [value] is in just letting the kids play on the beach. And just being out in the natural environment away from the stimulation of the city, away from the stimulation of having electronic devices all the time. And just letting them have fun and explore. It's the same reason we take our kids into the woods any time, is to get away from that.

I really like to be over [on the south side of the Bay] because it is quiet and it's beautiful and it's just an opportunity to just kind of find a lot of peace and grounding from being over there and being around the natural environment and it's great tide pooling. So just being able to go out and look at all the amazing diversity we have over there. And it's simple....it's just a good grounding place for me. And I like my kids to go over there because then they just learn how to just be—entertain themselves and be outside and find a lot of joy in walking and seeing things and drawing, that sort of thing, so you remove technology and that's really good.

Spiritual

Fourteen interviewees (45%) expressed “Spiritual” values when discussing the ecosystem services in the Kachemak Bay area. Cole’s SVT defines spiritual values broadly as, “Places of

sacred, religious, unique, deep and/or profound experience where reverence/respect for nature is felt.” Although not explicitly religious, many interviewees described deeply emotional and spiritual relationships to the Kachemak Bay region. Others used religious language to describe the views and felt inspired by living in the area.

There’s an area there that when I stand on it, I call it the ‘Fist of God.’ And it’s a series of ridges that are kind of like knuckles, and where the mountain drives down there’s a lake and then it comes back up to kind of a foothill. I stand there and it’s like the fist of God is driving into the earth and has created this pocket of water and rising land on the other side. I think it’s tough for us to use the term ‘sacred’, but that skyline, for me—and I think for others too—there’s places there that fit that category of ‘sacred places’.

And, we’re also a deeply religious community with 13, 15 churches, but we’re also a deeply spiritual community with a lot of people that consider our glacial cathedrals as their morning mass.

In addition to the individuals we interviewed, there are other groups around Kachemak Bay with a religious or spiritual connection to the region. Native communities in Seldovia and Port Graham have religious ties to the landscape. Additionally, Russian Old Believer communities have significant spiritual values that influence their perceptions and interactions with the landscape. These groups are underrepresented in this project sample, and would provide further examples of religious values that should be considered in KBNERR’s outreach and management efforts, as well as future ecosystem service assessments.

Value Types Modified from the Cole Framework

The second portion of the KBNERR Framework consists of value types that were present in the Cole (2012) framework and were expressed in interviews, but were represented differently by interviewees than how they were described by Cole. For these value types, the value name was maintained, but the definition provided by Cole was modified to more accurately capture responses provided by interviewees. Table 5.3 details the value types included in the KBNERR framework that were modified from values presented in Cole (2012).

Table 5.3: Value Types Modified from the Cole Framework (% of Interviews = total percentage of interviews that contained the associated typology) (n = 31).

Values	Description	% of Interviews
Economic	<i>The provision of fisheries (commercial/recreational), minerals, ecotourism, agriculture, and research and education that support livelihoods</i>	97%
Access	<i>A place to enjoy recreational activities and natural beauty while maintaining sustainable management of human activity</i>	94%
Cultural	<i>Defining community characteristics of the Homer and Kachemak Bay area that are tied to the natural environment</i>	94%
Future	<i>The ability for future generations to enjoy and benefit from the Kachemak Bay watershed’s ecosystem services</i>	90%

Table 5.3: Continued.

Aesthetic	<i>Appreciation of “sights, sounds,” and the overall striking beauty of the Kachemak Bay area.</i>	87%
Learning	<i>Opportunities to learn or share scientific information, values, and traditions as they relate to the Kachemak Bay ecosystem</i>	87%
Subsistence	<i>The provision of basic human needs, emphasis on reliable food sources from nature</i>	74%
Biodiversity	<i>A high variety of fish and wildlife species, as well as genetic diversity within populations</i>	45%

Economic

Thirty interviewees (97%) valued the Bay from an “Economic” perspective. Cole describes this social values type for a coastal community as the “provision of fishery (commercial/recreational), minerals, and tourism that support livelihoods.” Many interviewees who discussed the community’s livelihoods and economic health, connected it to the fisheries, extractive industries, and ecotourism that supports the Bay:

It’s just so cool to be living in a community where so much depends on the ocean in one way or another. I’ve got friends that are fisheries managers at Fish & Game, sea bird managers at FWS, sport fish charter operators, commercial fishermen, that run ecotourism like our kayak guides and whale watching and all that kind of stuff. You know, those aren’t the only things that make up the economy, that collection of things, but Homer is really based in that.

Everything is tied in one way or another to our port and harbor, whether it’s commercial fishing, whether it’s the marine pilots that bring those big tankers up the inland, and the cruise ships docking, whether it’s tourism and people like water taxis and charter boats, accessing the bay, or whether it’s people who choose to live here and, you know, be teachers or doctors but they want to have access to the water and have access to the parks. So, you know, our whole economy really is centered on our port and harbor which wouldn’t be here without, you know, being in the middle of Kachemak Bay.

However, some mentioned that while the economic focus may be on fisheries and ecotourism, there are other components, like local agriculture, that contribute to the economic landscape in Kachemak Bay and make it unique from other coastal communities. These economic attributes are not captured in Cole’s definition. As one interviewee described:

The Kenai Peninsula is probably the most diverse Borough in the entire State because not only do we have the gas and oil side, we have the fishing side, we have the tourism side, we have the agriculture side, we have the research... there’s so many different pieces of the puzzle.

Interviewees also mentioned the importance of scientific research and education as part of the economy. Kachemak Bay has a very large scientific and nonprofit community, and these sectors contribute to the Bay's economy in a unique way. A better-tailored, Kachemak Bay-specific SVT definition for "Economic" is "The provision of fisheries (commercial/recreational), minerals, ecotourism, agriculture, and research and education that support livelihoods."

So, it's my hope that the Research Reserve continues to get the federal funding that they need to stay in business... they've done such practical things. They've done soil erosion, beach erosion studies that help us as realtors talking about waterfront properties.

So you've got well-qualified individuals that are able to find, perhaps, grant funding or run a nonprofit organization or a business but it's all that collectively working together to provide a pretty vibrant local economy.

Kachemak Bay's modified "Economic" definition also makes a simple but profound change in modifying *tourism* to *ecotourism*. (See Chapter Six, "'Tourism' in an ES Framework"). The community is clearly aware of the cultural and economic impacts tourism and ecotourism distinctly have on the health and well-being of Kachemak Bay by recognizing the difference between "cruise tourists" (tourism) and "recreational tourists" (ecotourism). See Chapter Three for more information on this distinction.

Access

Twenty-nine interviewees (94%) described an "Access" value which Cole defines as, "places of common property free from access restrictions or exclusive ownership/control." Access was valued in several different ways by interviewees. Generally, access was mentioned in terms of recreation, aesthetics, or the community. Interviewees were either supportive of increasing access or restricting access.

Those who appreciated access to recreation and aesthetics described how Kachemak Bay is a place where recreational activities like hiking, biking, kayaking, fishing, and hunting were all easily accessible. There are many opportunities to engage in these activities and experience the beauty of Alaska:

Like one of the best things about Alaska and one of the great things about Kachemak Bay is there's so many different ways you can access nature's beauty.

Well, I recreate I would say. Sailing, and canoeing, and skiing, and hiking around, and swimming. I definitely chose my house based on the whole... it's on the Bay, and it has access to the Bay and that was very important to me. I believe you're pretty hard pressed to find a place here that doesn't have a view. I spent a lot of time just looking at the place and feeling that connection.

Others appreciated access in terms of the community. Homer is a diverse and dynamic community largely because of the suite of ecosystem services that are present. It is also uniquely located within the Kenai Peninsula. It is on the road system, making it easy to travel in

and out of the city, and its temperate climate makes it an attractive home and ecotourism destination, ultimately resulting in services that create a higher quality of living:

[I value] the ability to get services and food, infrastructure but still living on the edge of the wilderness where we can access that.

Some feel that increasing access would be beneficial not just for individual interests, but for the overall health of the community. Increasing access to places like the State Park could increase the ecotourism industry and help with Homer's economic health, but it could also provide more educational experiences for students and residents:

I'm all for opening up access... I really appreciate having that access opened up and introducing more people to the wilderness areas, but at the same time I want that to be done smart... You've got a whole lot of cool nonprofits in town that are opening up access to interact with a lot of the environment. The Center for Alaskan Coastal Studies... They cater to a lot of visitors and they do a lot of camp for youth and get people across to Peterson Bay and stuff. I think that's a great interaction. I think the outreach that the Reserve does is pretty awesome. I think Coowe going up to Ninilchik and talking about groundwater recharge and salmon habitat and nutrient transport in the salmon streams... I think that was awesome. So, any interaction that has to do with the school system is pretty awesome, because something happens.

Some interviewees would appreciate increasing access to places for recreation, such as allowing motor vehicles on the beaches or creating bike trails in the Kachemak State Park where they currently are not allowed:

I feel like a lot of what I do is important, not just because of the activity, but because of the place it's in. Like I mentioned I went mountain biking yesterday, and we have the opportunity to work for the state and create our own mountain bike trails. We've been working on that the last 4 or 5 years, so we've got an actual – it's tiny—but public mountain bike system that's beginning to grow.

On the other hand, many interviewees recognized and valued the importance of limiting access through restrictions on fishing, hunting, recreation, or industry in the Bay. They felt that by restricting access to these activities, there can be sustainable management of the ecosystem:

But I also know too that, in order to continue to go moose hunting, as the population grows and the hunting population grows, there's going to have to be some restrictions put in on the harvest levels. And I see that same thing in the marine environment.

I just hope that we don't ruin and degrade further the natural resources that we have [through ORV use]... The off-road winter stuff, you're floating above the ground so you're doing minimal, if any, damage to the ground. You can see where the winter trails are and where the summer trails are, and they are just being hammered with the off-road vehicles, and ... there's going to have to be a handle on that, and I don't know what it is. As there's more and more people coming, everybody has to get the bigger tires and the more aggressive machines... They can go deeper and drill in the mud farther. So, as the

population increases there's got to be restrictions. End of story. Or the land is going to end up totally destroyed.

Because of all the ways in which access was mentioned and valued across interviews, a Kachemak Bay-tailored definition of “Access” should be quite different from Cole’s. It does not necessarily mean “common property” and it does not have to mean free of restrictions or exclusive control. A Kachemak Bay specific “Access” value definition is, “a place to enjoy recreational activities and natural beauty while maintaining sustainable management of human activity.”

Culture

Twenty-nine interviewees (94%) valued Homer’s unique culture and sense of community that is inspired by the area’s landscape, water, wildlife, and other natural resources. This community culture was manifested in multiple ways during interviews and can refer to Homer’s reputation as the “cosmic hamlet by the sea;” the many community groups, clubs, and non-profit organizations; the vibrant arts community; the mix of political leanings, religious beliefs, and world-views; and, overall, the diverse and dynamic population of people that live in the Homer community.

The common thread in this eclectic and dynamic community structure was the belief that Homer’s culture is intrinsically tied to the Kachemak Bay’s ecosystem:

We are known for being the cosmic hamlet. Where just things happen here but, you know, what makes that happen is all of the networking and connections... I think Homer, because of the natural beauty, we draw a unique group of people that are citizens and so all of us [are] helping each other.

The definition of culture embodied in interviewee comments varies from that described in the Cole framework: “Place for passing down wisdom, knowledge, and traditions.” This element of passing down values and traditions is present within the Kachemak Bay area’s community culture, but this definition alone does not fully capture the vibrant and diverse community described by interviewees. This definition was modified for the Kachemak Bay SVT to: “Defining community characteristics of the Homer and Kachemak Bay area that are tied to the natural environment.”

Future

Twenty-eight interviewees (90%) expressed a value that Cole identified as “Future,” which is defined as, “Allowance for future generation to know and experience healthy, productive, and sustainable coastal ecosystems.” Many interviewees who expressed this value described a sense of responsibility for ensuring the Kachemak Bay ecosystem persists well into the future. Many interviewees incorporated this value into their lives through involvement in Homer’s numerous non-profit and environmental organizations. Others expressed this value when discussing the need for regulation of resource use and development in the Kachemak Bay region:

Things like the Water Trail, the Kachemak Bay Water Trail, you can go to the website, but a variety of groups tap into that to get the word out that, 'Hey, we have this amazing resource for ecotourism...' and it's kind of a focus in that side of things, but also with the intent of promoting conservation as well. Part of it is, if you don't know what you have then what is your motivation to take care of it? But, if you know what you have and you're enjoying it, you're going to be more motivated to take care of it in the long run!

If you look at the fundamental hope that I have, and I share with my son, it's what kind of a system could we set up... Culturally, economically, and of course ecologically... that maximizes the potential for long-term, healthy, co-evolution with the rest of the life here. Not just people, but people as knowledgeable partners in a natural system that can continue to evolve to face all kinds of shocks. And, that core value is the fact that we believe we are part of a living planet, and we would like to play a responsible and healthy part in that as a core meaning of our lives.

Therefore, the definition of "Future" was modified for the Kachemak Bay SVT to: "The ability for future generations to enjoy and benefit from the Kachemak Bay watershed's ecosystem services."

Aesthetic

Twenty-seven interviewees (87%) valued the aesthetic aspects of the Kachemak Bay area. Cole describes the "Aesthetic" value as, "Enjoyable scenery, sights, sounds, smells, etc." This is fairly representative of perceptions expressed in interviewees.

However, interviewees also repeatedly emphasized the awe-inspiring beauty of the Kachemak Bay region, and the deep impact this has on their lives. Long-time residents described still being taken aback by the natural beauty of the area, even after living there for decades. To better capture these sentiments, a more appropriate definition of the "Aesthetic" value as it applies to the Kachemak Bay area is, "Appreciation of sights, sounds, and the overall striking beauty of the Kachemak Bay area." Representative comments include:

In terms of resources [that are of particular value] I would say open space, beautiful landscape and that type of aesthetic is missing from most people's lives and we are lucky to have that here.

Learning

Twenty-seven interviewees (87%) valued the educational and learning opportunities that are present in the Kachemak Bay region. Cole describes this "Learning" value as, "Place of educational value through scientific exploration, observation, discovery, and experimentation." This definition is largely appropriate in the context of Kachemak Bay; however, many interviewees also valued the opportunity to teach others about the special nature of the Kachemak Bay area, and that visitors and residents have a shared responsibility to care for the place. This sharing of both scientific knowledge as well as deeper values, culture, and respect for the environment was important to many interviewees:

I'm a Girl Scout leader and it's in our adventures with the Girl Scouts when we're out in nature and just working to instill that appreciation and respect for the natural world. And, at the same time, empowering the children to understand that they have a role to play in protecting and maintaining it.

It's just exposing them to something new and helping them experience something that is in their backyard and they maybe haven't experienced yet. So, really just broadening their horizon and showing them how rich and beautiful the world we live in is.

And then along the way we do berry picking... We do a lot of berry picking. And that is kind of more of a focusing we do when the berries are in. Mostly, it's just a really good time. There is so much you see along the way. Like moose sheds, which we like to go find. And things like that. You just find really neat bones and ... It's kind of educational and entertaining at the same time. Especially for the kiddos.

I never take it for granted, living here. It's something I try to instill in my children too... I think for a lot of people, this is a once-in-a-lifetime place to visit and experience, and we get to experience it every day. I'm pleased to see that my kids seem to have absorbed that, and they have the opportunity to leave here often enough that they know that this is a pretty special place.

Therefore, a more appropriate definition of “Learning” in the context of the Kachemak Bay region is “The opportunity to learn or share scientific information, values, and traditions as they relate to the Kachemak Bay ecosystem.”

Subsistence

Twenty-three interviews (74%) raised a “Subsistence” value type. Cole defines the “Subsistence” value as, “provision of basic human needs, emphasis on reliable, regular food protein source from seafood.” This definition partially holds true for Kachemak Bay. For example, salmon is often mentioned in connection with subsistence fishing:

Subsistence fishing. We don't do it so much anymore because it's become such a circus. For years we subsistence fished on the Spit, and it was a family thing, we'd camp out the night before, get up and set the net.

Within the Kachemak Bay region, there are different sources of subsistence that seem to hold great importance to the community. Bear, moose, and gathering plants were all related to subsistence:

We live very seasonally, so with the arrival of spring we are outside foraging for nettles and with the arrival of fall we're out duck hunting. So, we are a very... I say we live land-to-mouth.

However, interviewees also discussed varying levels of subsistence. Many interviewees note that there are some sections of the community, especially indigenous communities, that rely on subsistence more than those living closer to Homer:

I think the oil spill devastated this area and is the biggest devastation that has happened since the earthquake. People's way of life was changed, there was oil in Nanwalek or Port Graham, and they couldn't do shellfish for years... And they live off subsistence. Well, all the shellfish is wiped out, all the fishing is wiped out.

Other members of the community have a “fill the freezer” attitude where they subsistence hunt or gather when they can:

...underneath that kind of fickle resource-based economy is a human subsistence... it's like whether or not you make a lot of money, you can still live in Alaska if you have a largely subsistence life. I actually have a hugely subsistence life now, I still get my fish and berries and I still like to forage more than I like to garden, but I don't have that same kind of time commitment to those occupations as some people because of the work that I do here....

Well I'm not a sport fisherman. I like to go out and fish for personal use, not sport. It's a little bit of recreational. I love fishing but it's for personal use.

Interviewees recognized that the hunter-gatherer lifestyle that dominated Homer and the Bay region in the past is not as common in the present. One interviewee said it best:

I think as a community it's evolved from a real hunter-gatherer community. Most people, when we came here, the first ten years or so, everybody built their own houses, they went and got their own fish, they fixed their own stuff, they got a moose... At least one person in the household wasn't a full-time worker. So, they had more flexibility to do these things, but it was also really important to do these things. We live by the tides, everybody 20-40 years ago, if you asked somebody when low tide was they would pretty much tell you. Now, I've even got to check my tide book. I'm not aware of it, and that's a big change in the community. It comes from a different type of income. More people have steady jobs. There's government jobs, Fish & Game, the Research Reserve, the hospital, the schools, and that kind of gets you out of the rhythm of doing seasonal things.

Because of the varying levels of subsistence hunting and gathering and the many different sources of food, Cole's definition could be changed to more broadly reflect the Kachemak Bay. “Subsistence” could instead be defined as “provision of basic human needs, emphasis on reliable food sources from nature.”

Biodiversity

Fourteen interviewees (45%) valued “Biodiversity” of fish, wildlife, and plants that is present in the Kachemak Bay region. Cole defines the “Biodiversity” value as, “Provision of a variety and abundance of fish, wildlife, and plant life.” While interviewees did value biodiversity in this manner, several also discussed valuing genetic diversity - primarily in natural salmon populations. As such, Cole's definition was modified to, “A high variety of fish and wildlife species, as well as genetic diversity within populations.”

I think it's important to maintain wild genetic diversity. There's a guy named Schindler who's a scientist out of the University of Washington and he talks about wild salmon and the "portfolio effect." And the portfolio effect basically looks at things through the lens of a financial portfolio where you have to have diversification to weather the ups and downs. In his example, the markets, in the wild example the vagaries of our natural systems.

Value Types Unique to Kachemak Bay

Connections

A value type that recurred throughout interviews and focus groups, but is relatively unidentified or underrepresented in previously established ES frameworks is a value we identified as "Connections." Generally, this value refers to intangible and often deeply personal experiences that are intrinsically tied to benefits provided by the Kachemak Bay watershed and ecosystem. There are several subsets of the Connection value, including: Connection to Community, Connection to Family, Connection to Self or Personal Identity, and Connection to Nature (see Table 5.4).

This value would most appropriately fall within the "Culture" category in the Millennium Ecosystem Assessment, and shares close similarities with the "Identity/Symbolic" value in the Cole framework. However, as previously discussed, the MEA framework is quite broad and fails to capture important details and characteristics of this value. While the Cole framework accurately describes some aspects of this value type (further explained in the following subsections), there were some Connection values expressed by interviewees that Cole's "Identity/Symbolic" value does not capture. Table 5.4 outlines these "Connections" values.

Table 5.4: "Connections" values – Unique to the KBNERR Framework (% of Interviews = total percentage of interviews that contained the associated typology) (n = 31).

Values	Description	% of Interviews
Connection to Community	<i>The "sense of place, community, belonging... and distinctive 'culture of the sea'" associated with the Kachemak Bay region. Additionally, the sense of pride of place tied to living and/or working in the area.</i>	77%
Connection to Self/Personal Identity	<i>Individual experiences/beliefs that a place is essential to one's self and/or informs a personal sense of identity</i>	71%
Connection to Nature	<i>Experiences of being completely present in nature; recognition that humans are a part of the ecosystem/natural environment</i>	71%
Connection to Family	<i>Familial connections or closeness fostered by shared time spent outdoors; cherished family memories outdoor activities; or other experiences/opportunities in which the ecosystem has provided a sense of place or identity within a family or household</i>	65%

Connection to Community

Twenty-four interviewees (77%) discussed ways in which the Kachemak Bay area's natural places, resources, or ecosystem help to foster a sense of place, a shared community identity, and/or a sense of pride in living and working in the area. Some interviewees discussed how a reliance on the area's natural resources, and the subsistence lifestyle that is enjoyed by so many residents promotes a connection to community.

This facet of the "Connections" value is most like the "Identity/Symbolic" value typology introduced in the Cole framework which is defined as, "Places that engender a sense of place, community, and belonging; represent a distinctive 'culture of the sea.'" This definition captures some extent of the Connection to Community expressed by interviewees, but not wholly. This "Connection to Community" was quite distinct, and also describes the ways in which Homer's "community" and "distinctive culture of the sea" fosters a shared community identity and pride of place. For some interviewees, Homer's distinctive culture elevates it above other Alaskan communities. Comments that describe this value type include:

I think the main thing is that this is a coastal community, and a coastal Alaskan community that depends on marine resources in a variety of different ways. So, it's very cool to live in a place where people really care about what we do because it either matters for their work or their recreation.

I heard an interview on the TED hour of KBBI the other day driving home. [The show's guest] said that people who are fortunate enough to live in a beautiful natural environment, they find a oneness of their own, they find their own place... but it also gives you a sense of community. I was just so moved, and it really just dawned on me how moved I was.... But that's what we get from here.

Some interviewees expressed the belief that residents of Homer and the Kachemak Bay area most often make the conscious choice to live and work in the community, and this, at least in part, is because of this connection to the place and the community. Representative comments include:

The geography is great, and Homer and the community itself is awesome, I mean it's a tiny town, and being here for just a couple years you kind of feel pretty well engrained. You go anywhere, and you see familiar faces pretty quickly. It's easy to start to get pretty well-meshed into this community.

Because of the uniqueness of Kachemak Bay of not only the natural habitat of having the mountains and the ocean and the bluff and just all of that in one place, but just the community and I don't think you can find that. I haven't found that anywhere else.

Therefore, "Connection to Community" is defined as "The "sense of place, community, belonging... and distinctive 'culture of the sea'" associated with the Kachemak Bay region. Additionally, the sense of pride of place tied to living and/or working in the area."

Connection to Self or Personal Identity

Twenty-two interviewees (71%) discussed ways in which a connection with the Kachemak Bay ecosystem has informed their own sense of personal identity. Many of these interviewees discussed ways in which this identity that is connected to the natural world informs their lives; their personal and professional choices; their worldview; and their interactions with others.

While this “Connection to Self or Personal Identity” shares some similarities with the “Community” and “Family” connections, this value type captures a specific nuance that was conveyed in the way interviewees discussed their personal relationship with the natural world. This value dives a bit deeper into individual experiences than does the “Community” or “Family” connections and is defined as, “Individual experiences/beliefs that a place is essential to one’s self and/or informs a personal sense of identity.”

I’ve just got in my soul, the gardener, gatherer... for berries and other things like that... and a fisherman... so, I love to do that myself.

Connection to Nature

Twenty-two interviewees (71%) discussed valuing the connection to the natural world that they receive from living and working in the Kachemak Bay area. These interviewees described a connection to nature that allows for a richer, more meaningful living experience. Interviewees described fun, exciting, and relaxing experiences within the Kachemak Bay watershed and ecosystem that have allowed them to connect with the natural world in unique ways, such as the reminder that humans are natural beings themselves, and often disconnect from everyday life in the process. Some examples of these types of experiences include:

Being out in [nature] in the variety of ways that you can whether it’s cross country skiing, you know a few weeks ago we were still cross-country skiing, barely but you could; and you’re up out by the Russian villages and it’s just spectacular mountains and just the whole thing. You’re just in the middle of it. Or if you’re kayaking and going up into China Poot or if you’re leaving [work] and going over to Jackalof you’re looking at not only the incredible scenery but also there’s a whole rack of sea otters! The birds are back and flying back and forth to Gull Island, the puffins are going by which always make you laugh. Then when the murrets are flying and they’ve eaten so much that when they try to take off they keep bouncing their bellies on the water.

In September we were on a trip in Halibut Cove Lagoon, and at a weird time during the tides where you kind of have to cut it to get out and fight against it. And so, I kind of wanted to get out and thought, ‘Okay, good workout, fight against it,’ and all of a sudden, these sea otters were coming in the other way and they were just kind of riding the current like ‘Whee!’ and obviously just totally playing, and two things happened. One we were like, ‘Wow, look at them that looks like fun!’ and two, ‘Wow, we should really do that!’ still knowing of course that we would have to paddle back out. But we just thought, ‘We are going to ride the current with the otters!’ And there is just a joy that comes from those moments, you just feel touched or you get connected in a way that I think informs

my whole life. It informs my work, but it also just informs how I live, and that's why I would have a really hard time living anywhere else.

Once you're out in the open country [on Grace Ridge Trail], you really have almost a 360-degree view and it's breathtaking, spectacular, beautiful, and awe inspiring, and it's a place where, I guess you could take your cellphone with you, that's not against the law... but you can turn it off too. It's a great place to be away from town, sit and reflect, it's a great place to sit and eat the blueberries or the salmon berries. It's just a quiet respite away from your harried way of life.

Some interviewees described the ability to experience this connection to nature and the area's natural resources from the comfort of their homes and gardens:

I definitely chose my house based on the whole... it's on the Bay, and it has access to the Bay and that was very important to me. I believe you're pretty hard pressed to find a place here that doesn't have a view, and so, yeah, I spent a lot of time just looking at the place and feeling that connection.

We take nettles and dry them, the leaves, then we have a mint garden in the backyard, and dry the mint, and it's just all kinds of mint so I think there's a lot of variety. We dry the mint leaves and then mix the mint and nettles leaves for tea, and it's kind of the house tea at our home.

Many expressed the belief that this ability to connect and interact with the natural world and the area's wildlife sets the Kachemak Bay area apart from other areas of Alaska. They attributed this connection to the natural world to the absence of heavy industry and oil/gas development, or the overall pristine nature of the region.

I really like to be over [on the shore of the Bay] because it is quiet and it's beautiful and it's just an opportunity to just kind of find a lot of peace and grounding from being over there and being around the natural environment and its great tide pooling. So, just being able to go out and look at all the amazing diversity we have over there.

This Connection to Nature is defined as, "Experiences of being completely present in nature; recognition that humans are a part of the ecosystem/natural environment."

Connection to Family

Twenty interviewees (64%) valued ways in which the Kachemak Bay's resources and ecosystems have provided a connection to their family members. This facet of "Connections" includes: familial connections or closeness fostered by shared time spent outdoors; cherished family memories of doing outdoor activities like hiking, camping, and recreation/subsistence hunting or fishing; or other experiences or opportunities in which the ecosystem has provided a sense of place or identity within a family or household. It is defined as, "Familial connections or closeness fostered by shared time spent outdoors; cherished family memories outdoor activities; or other experiences/opportunities in which the ecosystem has provided a sense of place or identity within a family or household."

These connections between family members that are provided by natural resources and the environment are not currently well-represented in ES literature or frameworks. However, within the Kachemak Bay context, this was a widely-recognized and valued ecosystem service:

And for our family history, we would go down once or twice in the fall to get enough coal, and our son every time would complain and didn't want to go. We stuck him in the car anyhow. We would get down there and as soon as we were on the beach he wanted to get out and as soon as he was down on the beach it was the greatest time in the world. I'm sure if you talked to him, he would say that going to get coal was the best thing in the world. It was more fun getting the coal than using the coal, because it got you down on the beach and it was good exercise, and it's one of those things that I always want to happen.

We have an annual trip that we take every Memorial Day weekend where we spend three or four days on a beach in Kachemak Bay, take the kids.... It's just a wonderful place.

Conclusions

This qualitative ground truthing of Cole's Social Value Typology reveals that people in the Kachemak Bay value a suite of ecosystem services provided by the watershed in a diverse and complex manner. While existing social value typologies, like that presented in Cole (2012), capture many of these values, this study's analysis indicates that there is a type of value beyond Cole's framework, including connections to personal identity, community, and family. These intricate and deeply personal connections illuminate the strong ties that new and old residents both feel for Kachemak Bay and the sense of place that is fostered by the social and natural setting. This finding is quite fascinating as it indicates that unless ecosystem service frameworks are developed in a place-based manner, there may be valued services (like these Connections) that fall by the wayside in analysis because they are not present in a pre-existing framework.

The social value typology developed specifically for the Kachemak Bay watershed is useful in understanding the human-environment interactions in the region, public attitudes, and community perceptions of benefits provided from the ecosystem. These insights will be useful for KBNERR in developing ongoing management plans, as well as education, communication, and outreach strategies that are centered around both biophysical and social systems. The values demonstrated by interviewees also demonstrate potential themes that KBNERR could highlight in research and outreach efforts. Using Cole's typology for future geospatial analysis or surveys could yield useful results, as discussed in Chapter Six.

It should be noted that the small sample size and semi-structured interview approach is only a starting point for ecosystem service research. There are important community perspectives that could not be captured in the scope of this study. Additional methods that KBNERR could employ to continue and further ecosystem service valuation research are outlined in Chapter Six.

Chapter Six

Ecosystem Service Research Applications for KBNERR





Ecosystem Service Research Applications for KBNERR

Introduction

Given the multidisciplinary nature of ecosystem service research, a range of frameworks and methods exist to monitor and report on ecosystem goods and services. Chapter Five demonstrated the application of a socio-cultural framework to analyze the sense of place and landscape values associated with ecosystem services around Kachemak Bay. This chapter highlights several other major frameworks and methodologies in ecosystem service literature. These include monetary valuations, coastal applications, and additional socio-cultural applications. The goal of this chapter is to provide KBNERR with a guide to ES literature as well as case studies of research applications. Limitations and challenges of ecosystem service research are also discussed.

The primary goals of ecosystem service research are to define, monitor, and measure the benefits that natural ecosystems provide for human populations. Additionally, much of the literature focuses on the application of ecosystem service analysis and frameworks to inform resource management and land use decision making. Initially, these concepts were applied monetarily to assign a dollar value to the marginal good or service provided by an ecosystem. Costanza et al.'s (1998) initial valuation of the earth's ecosystem goods and services at over 1 trillion USD is highly debated in monetary valuation. Moving beyond this coarse monetization, researchers began to holistically assess the ecological, socio-cultural, and economic values of various ecosystem services (de Groot et al., 2002). This shift has promoted a wide range of methods and applications to advance effective research and outreach (see Harrison et al., 2018 for extensive list of ecosystem service methods).

The socio-ecological systems of coastal and marine areas, like those of Kachemak Bay, have presented unique challenges and opportunities in ecosystem service research. Increased pressures of population growth, development, and resource extraction have contributed to the decline in major habitat and fishing resources throughout the globe (MEA, 2005). Additionally, the complex ecological dynamics between coastal zones and marine environments make it challenging to directly model biophysical qualities with human benefit (Liquete et al., 2013). However, starting with Beaumont et al. (2007), many researchers continue to classify and measure the benefits of marine and coastal environments in order to promote informed ecosystem management and sound decision making.

Major Frameworks

Millennium Ecosystem Assessment

A major milestone of ES research was the 2005 publication of the Millennium Ecosystem Assessment (MEA). The MEA was supported by the United Nations and conducted from 2001 to 2005. It resulted in a widely-used framework that links ecosystem services with human well-being at local, regional, watershed, or global scales. It describes the full range of ecosystems throughout the world (both human-impacted and relatively undisturbed) and categorizes ecosystem services into four types: provisioning, cultural, supporting, and regulating. This framework recognizes that people are an essential and integral part of the ecosystem and that changes in the human condition drive, “both directly and indirectly, changes in ecosystems,” that can result in changes to human well-being (Millennium Ecosystem Assessment, 2005). Figure 6.1 depicts the basic model of human-ecosystem interaction presented by MEA.

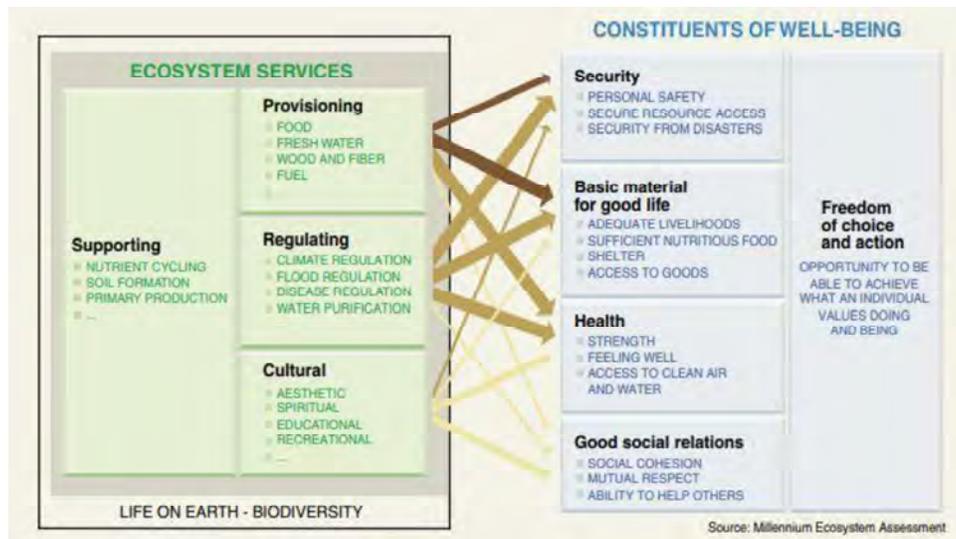


Figure 6.1: Ecosystem service categories and impacts on human-well-being (MEA, 2005)

There are several goals of the MEA framework as described in the 2005 MEA Synthesis report:

1. Identify priorities for action;
2. Use as a benchmark for future assessments;
3. Use as a framework and source of tools for assessment, planning, and management;
4. Gain foresight concerning the consequences of decisions affecting ecosystems;
5. Identify response options to achieve human development and sustainability goals;
6. Build individual and institutional capacity to undertake integrated ecosystem assessments and act on the findings; and
7. Guide future research.

Many scientists and decision makers continue to utilize this framework for analysis and communication. Given its common use, the MEA provides KBNERR with a standard language and set of indicators for future ES research. We organized the major ecosystem services identified by this project under the four major MEA categories:

Provisioning: Products obtained from the ecosystem.

Supporting: Necessary for the production of all other ecosystem services. They differ from provisioning, regulating, and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people.

Regulating: Benefits obtained from the regulation of ecosystem processes.

Cultural: Nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences.

As a whole, this framework could provide KBNERR with a way to design future research and outreach. Tables 6.1 - 6.4 outline some of the major ecosystem services that are included by the MEA or follow-up studies. They include common definitions from MEA or Barbier et al. (2011) as well as indicators to track their quantities and impact on well-being. These services are derived from the results in Chapter Two as potentially important to individual and community well-being. Some indicators come directly from academic literature (Bohnke-Henrichs et al., 2013; Liqueste et al., 2013). The case studies below also highlight specific applications and methodologies. Other indicators (noted by *) emerged from our analysis as metrics that could be used for ongoing monitoring. This list is not exhaustive but rather a starting point to monitor and report on the benefits that Kachemak Bay residents derive from the natural landscapes.

Specifically, regulating and supporting services are important types of ecosystem services to capture and communicate. Although these services were not discussed as explicitly as others, they provide critical benefits to human well-being. Studies indicate that communicating these services to the public can help improve awareness and the desire to protect ecosystem structure and functions (Barbier et al., 2011). KBNERR could seek to monitor and communicate the benefits of supporting and regulating services to the public.

Table 6.1: Provision Services and Potential Indicators Barbier et al. (2011), Bohnke-Henrichs et al. (2013), Liqueste et al. (2013), Millennium Ecosystem Assessment (2005).

Provisioning Services	Definition	Potential Indicators
Seafood	All available marine fauna and flora extracted from coastal/marine environments for the specific purpose of human consumption as food	Amount of fish landed Amount of Sea Food harvested/year
Agriculture	Growth and harvest of food	Acres of agriculture* Total weight of farmer's market sales*
Fuel	The use of timber or coal for heat	Net present value of fuelwood and timber under different management scenarios (USD/ha)

Table 6.2: Supporting Services and Potential Indicators Barbier et al. (2011), Bohnke-Henrichs et al. (2013), Liqueste et al. (2013), Millennium Ecosystem Assessment (2005).

Supporting Services	Definition	Potential Indicators
Nutrient cycling	The storage, cycling, and maintenance of nutrients by living organisms (both marine and terrestrial)	Mineral nitrogen C:N ratio Microbial biomass
Primary Production	Synthesis of organic compounds from atmospheric carbon dioxide	Oxygen emitted by primary kelp production
Habitat formation	Biological productivity, and diversity of habitat for wild cultivated animals	Willingness to pay for the habitat of marine or terrestrial species (USD)
Erosion protection	Presence of vegetation or shoreline that prevents major sedimentation loss or property destruction	Avoided costs of home repair during major storm event

Table 6.3: Regulating Services and Potential Indicators Barbier et al. (2011), Bohnke-Henrichs et al. (2013), Liqueste et al. (2013), Millennium Ecosystem Assessment (2005).

Regulating Services	Definition	Potential Indicators
Climate regulation	The storage, cycling, and maintenance of nutrients by living organisms (both marine and terrestrial)	Amount of CO ₂ sequestered
Air and water quality	Purification of air and water through ecological cycles	Amount of fine dust/NO _x or SO ₂ captured

Table 6.4: Cultural Services and Potential Indicators Barbier et al. (2011), Bohnke-Henrichs et al. (2013), Liqueste et al. (2013), Millennium Ecosystem Assessment (2005).

Cultural Services	Definition	Potential Indicators
Educational values and inspiration	Contribution of marine/coastal environment to education or research	Amount of time (# person days) dedicated to creation of culture, art, and design
Recreation, Ecotourism	Opportunities for recreation in the natural landscape	Amount of time (# of person days) spent in education or research that involve coastal/marine environments
Aesthetic inspiration	Contribution of the coastal/marine environmental to inspire elements of art, culture, or design	Local art shows attendance* Presence of artistic community through businesses, museums*

*Indicator not raised in academic literature

The Economics of Ecosystems and Biodiversity (TEEB)

The Economics of Ecosystem and Biodiversity (TEEB) framework aims to create a global, structured approach that aids decision-makers at all levels. It seeks to “bridge the multi-disciplinary science of biodiversity and the arena of international and national policy as well as local government and business practices.” (TEEB, 2010) The TEEB Synthesis Report (TEEB, 2010) defines ecosystem services as “flows of value to human societies as a result of the state and quantity of natural capital...the flows of ecosystem services can be seen as the ‘dividend’ that society receives from natural capital.” TEEB is structured by a three-tiered approach: 1) Identifying and assessing ecosystem services, 2) Estimating and demonstrating the value of these ecosystem services, and 3) Capturing the value of ecosystem services and seeking solutions.

The TEEB framework is based on the MEA classifications, but it provides an updated classification that is used in the on-going national TEEB studies across Europe. It is intentionally broad to be used on a country-wide and biome scale, and it focuses primarily on the economic applications that allow for better management. The third tier, “Capturing Value and Seeking Solutions,” is perhaps the most important for TEEB. It stresses the use of tools such as subsidizing, fiscal incentives, creating and strengthening property rights, or eco-labeling and certification as ways to strengthen the value of ecosystem services.

The Common International Classification of Ecosystem Services

The Common International Classification of Ecosystem Services (CICES) framework aims to enable people to easily compare frameworks and understand more clearly how people are

measuring and analyzing information. It is another international classification system, but the goal “is not to replace other classifications of ecosystem services.” In fact, CICES holds similar classifications to the MEA and TEEB frameworks. However, instead of categorizing ecosystem services into four broad categories, the CICES breaks the three main categories (provisioning, regulating, and cultural) into a “five-level hierarchical structure”:

1. Section (e.g. Provisioning)
2. Division (e.g. Biomass)
3. Group (e.g. Cultivated terrestrial plants for nutrition, energy, material)
4. Class (e.g. Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes)
5. Class Type (e.g. Cereals: The ecological contribution to the growth of cultivated, land-based crops that can be harvested and used as raw material for the production of food).

“Supporting” is not included in the CICES framework because they are indirectly used and considered to be part of the underlying processes and functions of ecosystems. This hierarchical structure is intended to be applicable at all scales and allow for cross-comparisons within different regions.

Case Examples

The following section outlines seven “case examples” of other applications of ecosystem service research that could be employed by KBNERR in future studies. Three categories of ecosystem service research are presented in the case examples: monetary valuation of ecosystem services, ecosystem service valuation in marine and coastal areas, and other methods of socio-cultural ecosystem service valuation. Table 6.5 lists the studies used for the case examples, and the following section provides a cursory summary of the methods used in each study with insights on how they may be useful for KBNERR. Additionally, the case examples highlight ways in which the Kachemak Bay SVT framework may be used as a starting point to inform similar ecosystem service studies.

Table 6.5: Case Examples

Case Example (#) and Authors	Method/Description	Case Example Type
(1) Hjerpe & Hussain (2016)	Primary Valuation of stream and forest restoration in Tongass National Forest	Monetary Valuation
(2) Bradley et al. (2018)	Primary valuation master's project of greenbelt millage in Ann Arbor, MI	Monetary Valuation
(3) Lui et al. (2008)	Meta-analysis value transfer	Monetary Valuation
(4) Barbier et al. (2011)	Literature review of coastal and marine valuations	Marine and Coastal Valuation
(5) Knowler et al. (2003)	Bioeconomic valuation of salmon habitat	Marine and Coastal Valuation
(6) Loerzel et al. (2017)	Survey application of social value typology framework as used by Aransas NERR	Socio-Cultural Valuation
(7) Klain & Chan (2012)	Participatory mapping of socio-cultural ecosystem service values in coastal context	Socio-Cultural Valuation

Monetary Valuation Case Examples

The field of ecosystem services often utilizes monetary/economic valuation methods to quantify the economic utility of ecosystem goods or services. Within the ecosystem service valuation literature, there is a range of viewpoints and methodologies used to estimate the total economic value of a particular ecosystem. Some ecosystem services, such as lumber or fish catch, can be considered market goods and their price is determined by market factors of supply and demand (Brander, 2013). However, many ecosystem goods and services, such as biodiversity and nutrient filtration, are not traded on markets and their value is calculated using other, non-market, valuation methods. The following case examples demonstrate monetary valuation techniques and applications. While this report aims to determine the qualitative ES values of community members within the Kachemak Bay, KBNERR may look for an economic valuation of these specific estuarine services in the future.

Case Example 1- Primary Valuation

Hjerpe, E. E., & Hussain, A. (2016). Willingness to pay for ecosystem conservation in Alaska's Tongass National Forest: A choice modeling study. *Ecology and Society*, 21(2). <https://doi.org/10.5751/ES-08122-210208>

The most localized approach to economic valuation is a primary valuation that tests value in a specific service area. These primary valuations can take two major forms: stated preference and revealed preference. A stated preference valuation typically relies on survey responses. Surveys use hypothetical scenarios which ask respondents to state their willingness to pay (WTP) for a particular ecosystem service (i.e. improved water quality, culturally important space, improved air quality, etc). There have been a range of primary valuations in Alaska and in other coastal communities. Hjerpe & Hussain (2016), sought to assess the WTP for forest conservation in Tongass National Forest. Respondents were given three separate scenarios: 1) increased forest conservation efforts, 2) increased stream restoration, and 3) the status quo of continued logging rates. Respondents were asked how much they would be willing to pay for scenarios 1 and 2 in a lump sum. Their responses indicate a WTP of \$154 to restore 100% of old growth and \$130 to restore all salmon streams.

Case Example 2 - Primary Valuation/Master's Project

Bradley, P., Hu, S., Kinney, D., & Tanner, D. (2018). Measuring Impact: Evaluating the Economic, Social, and Ecological Services of the City of Ann Arbor Greenbelt Program. Master's Project. University of Michigan School for Environment and Sustainability. <http://hdl.handle.net/2027.42/143208>

Previous University of Michigan SEAS Master's projects have conducted monetary valuation of ecosystem services. Using a stated preference methodology, Bradley et al. (2018) analyzed the WTP of residents in Washtenaw County, Michigan for the Greenbelt Easement program. Their findings indicate that residents' WTP (\$127.19 per household) is much higher than the actual annual cost per resident, supporting the program premise that local residents support land conservation. KBNERR could use a similar project approach to measure the community's WTP for habitat protection or the regulating and supporting services provided by coastal and riparian vegetation. These methods do require survey responses which present challenges, particularly in rural areas where response rates are typically low. However, economic valuation provides a useful heuristic to communicate conservation efforts. Policy makers and citizens can recognize and respond to a dollar value of ecosystem services when considering trade-offs inherent in policy decisions.

Case Example 3 - Value Transfer

Liu, S., Costanza, R., Troy, A., & D'agostino, J. (2008). Valuing New Jersey's Ecosystem Services and Natural Capital: A Spatially Explicit Benefit Transfer Approach. *Environmental Management*, 45, 1271-1285.

While the primary valuation methods mentioned above are the most accurate and localized form of monetary analysis, they require significant time, knowledge, and resources to conduct.

Alternatively, a benefit transfer methodology can help produce faster results at a lower cost. Benefit transfers (also known as value transfer) apply the value from a previous 'study site' to the site of choice, also known as the 'policy site' (Brander, 2013). KBNERR could use geospatial, ecological, or socioeconomic data to apply the monetary values from other studies to Kachemak Bay.

Liu et al. (2008) used a meta-analysis benefit transfer to estimate the values of land cover classes. First, they reviewed primary valuation literature to develop a mean value for the non-market benefits (supporting, regulating, cultural ecosystem services) associated with different land cover classes (wetlands, coasts, forests, etc.). The values of each land cover were summed for the entirety of New Jersey. KBNERR could use a similar methodology, including finding existing literature that gives values to various land cover types or activities (WTP for forests or salmon habitat) and then transfer these values to a local context (Kachemak Bay or nearby areas). Geospatial data such as land cover data and vegetation indices can be used as proxies for ecosystem services. Troy & Wilson (2006) is a highly referenced study that also provides three distinct applications of value transfer. Although value transfer can be a low-cost application of ES research, there are limitations. The availability of geospatial data and accurate values from previous literature can make these geospatial applications challenging and over/undervalue the ecosystem service of interest.

As an alternative to stated preference methods and value transfer, economists sometimes use revealed preference to determine the value of an ES. Revealed preference methods utilize actual purchasing behavior to estimate value. For example, hedonic pricing studies use regression models on bundled goods (most often houses) to extrapolate the effects that local environmental factors have on price. Another form of revealed preference is an avoided cost methodology. For example, the avoided costs of home repairs following extreme weather has been used to measure the benefits of stormwater protection from coastal vegetation or beaches (Barbier, 2017). Although these methods can be useful, they are often applied in high density areas with significant real estate and tax reporting. A revealed preference study would be challenging for KBNERR to undertake.

Marine and Coastal Valuation Case Examples

Marine and coastal ecosystems present unique challenges and opportunities in ecosystem services research. This section describes the marine and coastal ecosystem services literature and includes a case example that could be a starting point for KBNERR. The following studies are examples of economic and biophysical valuations for estuarine or marine ecosystems. Economic valuations are challenging in marine and coastal ecosystems due to their complicated aquatic/terrestrial relationships and the many overlapping ecosystem services tied to both.

Case Example 4 - Value of Estuarine and Coastal Ecosystems

Barbier, E.B., Hacker, S.D., Kennedy, C., Koch, E.W., Stier, A.C., & Silliman, B.R. (2011). The value of estuarine and coastal ecosystem services. *Ecological Monographs*, 81: 169-193.

Barbier et al. (2011) provide a review of ecosystem service monitoring and valuation in major estuarine and coastal ecosystems (ECEs). The ECEs examined were:

1. Coral Reefs
2. Seagrass Beds
3. Salt Marshes
4. Mangroves
5. Sand Beaches and Dunes

This study isolated the ES, ecosystem processes and functions associated with each ES, and the main drivers of ecosystem change for each ES. The authors also determined an economic valuation indicator whenever possible. The authors note the difficulties in evaluating and valuing ES for ECEs. According to Barbier et al. (2011), the most significant problem is that few ecosystem services are marketed (e.g. carbon sequestration, erosion control, or nutrient cycling). There are three difficult steps required for valuing these services:

1. Determine how to best characterize the change in ecosystem structure, function, and processes that give rise to the change in the ES.
2. Trace how the changes in ecosystem structure, function, and processes influence quantity and quality of ES flow to people.
3. Use existing economic valuation methods to assess the changes in human well-being that result from the change in ES.

Making linkages between ecosystem function and economic valuation is poorly understood. As seen in Figure 6.2, seagrass beds have still not been assessed properly, so the valuation methods are lacking. Estimates are unavailable for a majority of the ecosystem services identified by the authors. The current approach of economic valuation for ECE ecosystem services is to value each service as if it is independent, but it is well-known that ecological processes and functions may influence multiple services. Ecological interactions are bound to affect the value of multiple services within a single habitat. The authors note that because ECEs occur at the interface of coast, land, and watersheds, this makes them especially valuable. Due to a high degree of connectivity, this leads to linked provisions of one or multiple services by more than one ECE biologically and physically.

Barbier et al. (2011) notes that the global decrease of ECEs is known to affect three different ecosystem services: viable fisheries (33% decline), nursery habitats such as oyster reefs, seagrass beds, and wetlands (69% decline), and filtering and detoxification services through wetlands, submerged vegetation, and suspension feeders (63% decline). The Kachemak Bay is an important hub for all of these services. For example, Kachemak Bay has seagrass communities and salt marshes. KBNERR could look to Barbier's Seagrass Bed and Salt Marsh

valuation to determine which services need further research (Figure 6.2). The value of salt marsh services such as raw materials, coastal protection, erosion control, water purification, carbon sequestration, and cultural benefits have been studied extensively. While salt marshes have been studied more frequently for economic valuations, little to no economic valuation research exists for almost all of the ecosystem services identified for seagrass coastal ecosystems, such as food, coastal protection, erosion control, water purification, carbon sequestration, and tourism. Figure 6.2 outlines the common definitions of services provided by seagrasses and highlights the major gaps in valuation.

Ecosystem services	Ecosystem processes and functions	Important controlling components	Ecosystem service value examples	Human drivers of ecosystem change
Raw materials and food	generates biological productivity and diversity	vegetation type and density, habitat quality	estimates unavailable	eutrophication, overharvesting, coastal development, vegetation disturbance, dredging, aquaculture, climate change, sea level rise
Coastal protection	attenuates and/or dissipates waves	wave height and length, water depth above canopy, seagrass bed size and distance from shore, wind climate, beach slope, seagrass species and density, reproductive stage	estimates unavailable	
Erosion control	provides sediment stabilization and soil retention in vegetation root structure	sea level rise, subsidence, tidal stage, wave climate, coastal geomorphology, seagrass species and density	estimates unavailable	
Water purification	provides nutrient and pollution uptake, as well as retention, particle deposition	seagrass species and density, nutrient load, water residence time, hydrodynamic conditions, light availability	estimates unavailable	
Maintenance of fisheries	provides suitable reproductive habitat and nursery grounds, sheltered living space	seagrass species and density, habitat quality, food sources, hydrodynamic conditions	loss of 12 700 ha of seagrasses in Australia; associated with lost fishery production of AUS235 000 (McArthur and Boland 2006)	
Carbon sequestration	generates biogeochemical activity, sedimentation, biological productivity	seagrass species and density, water depth, light availability, burial rates, biomass export	estimates unavailable	
Tourism, recreation, education, and research	provides unique and aesthetic submerged vegetated landscape, suitable habitat for	biological productivity, storm events, habitat quality, seagrass species and density,	estimates unavailable	

Figure 6.2: Ecosystem services, processes and functions, important controlling components, examples of values, and human drivers of ecosystem change for seagrasses (Barbier et al., 2011)

Case Example 5 - Valuing Freshwater Salmon Habitat

Knowler, D.J., MacGregor, B.W., Bradford, M.J., Peterman, R.M. (2003). Valuing freshwater salmon habitat on the west coast of Canada. *Journal of Environmental Management*, 69: 261-273.

Knowler et al. (2003) developed a valuation approach for freshwater spawning and rearing habitat of coho salmon (*Oncorhynchus kisutch*) on the Thompson River in British Columbia, Canada. Portions of the Thompson River had declining salmon populations of 90%, which led to reduction in catches and eventually the closure of a commercial fishery in 1998. The authors used a production function model to examine how changes in land use affect the productivity of salmon populations and the economic impact of such land use changes. This paper demonstrates a connection between biophysical measurements and economic valuation using a bioeconomic model.

The abundance of coho salmon adult recruits was estimated based on exploitation rates and spawner abundance data. The researchers developed a model where the net social benefit from the coho stock is dependent on the gross benefits of the coho catch minus the costs incurred by the commercial troll fishery. Coho recruitment is a function of habitat quality and spawner escapement, which also includes productivity, capacity, and survival rate parameters based on previous research of coho salmon survival. Habitat capacity and habitat quality values were estimated by the annual rate of change in the abundance of adult coho recruits. These numbers were also determined with a habitat concerns index (HCI) that considered the opinions of community experts in determining which human activities (forestry, agriculture, mining, roads, etc.) might be impacting 16 different streams the most or the least.

From several models and scenarios of the habitat quality of the Thompson River, the researchers were able to determine an optimal stock of over 1 million fish and an optimal catch of 560,308 fish for an optimal annual exploitation rate of 52.3%. With a degraded system, the optimal exploitation rate decreased to 19.5% with an optimal stock of only 474,628 fish. Overall, a reduction in river quality showed a loss of \$2.63/ha of watershed area or \$3,731/km of coho stream.

The authors describe a detailed economic and biological method to determining monetary valuations for critical salmon habitat. They were able to estimate stock-recruitment relationship at the population level (not local or stream level like other studies) and incorporate habitat quality into this relationship by comparing coho salmon abundance with land use degradation. The Kachemak Bay community, with its strong economic and cultural reliance on salmon, may benefit from a true monetary valuation that examines monetary value of the salmon and the value of maintaining salmon habitat. As shown in Chapter Three, many may feel that development is impacting salmon habitat. A valuation like the one done by Knowler et al. (2003) could show a cost-benefit analysis of certain management strategies that may be placed on Kachemak Bay, such as the 50-foot stream buffer that prevents development within 50 feet of a salmon stream.

Ecosystem service research for coastal or estuarine ecosystems is incredibly difficult to evaluate in monetary terms, especially when considering whole-system ecology. There simply have not been enough studies evaluating and valuing the diverse ecosystems included in a marine environment. Incorporating research like the study done by Knowler et al. (2003) would show the importance of ecosystem connections and attempt to evaluate the importance of a larger cascade of effects. Additionally, a valuation like this could aid the KBNERR in developing more support from other members of the community for protecting salmon habitat by viewing the habitat degradation as a function of monetary loss through the Bay's fisheries.

Socio-cultural Valuation Case Examples

In addition to economic and ecological methods of ecosystem service analysis, there are other socio-cultural methodologies. The following case examples of socio-cultural techniques could be employed by KBNERR to continue monitoring community perceptions of valued ecosystem services and the drivers that impact them. The first study relies on a survey-based approach using the SVT framework, while the second uses a semi-structured interview and in-person mapping technique.

Case Example 6 - Social Values of ES

Loerzel, J., Knapp, L., & Gorstein, M. (2017). Gauging the Social Values of Ecosystem Services in the Mission-Aransas National Estuarine Research Reserve. NOAA Technical Memorandum NOS NCCOS 243. Silver Spring, MD. 79 pp.

Loerzel et al. (2017) used a survey-based method to understand community perceptions of: ecosystem changes, the social benefits derived from the Reserve-area ecosystem, the places within the watershed they associated most closely with these benefits, their level of personal/emotional attachment to the ecosystem, and critical resource management issues. The research team sought to capture the perspectives of the multiple user-groups present in the Aransas Bay, Texas area, including: "commercial entities, non-profit institutions, local residents, (summer) visitors, students, and teachers." The "local residents" group was also further divided into "seasonal residents" and "permanent residents."

To conduct surveys, three methods of sampling were used: Intercept surveys (used with seasonal residents and summer visitors), mail-back surveys (used for full-time residents), and snowball sampling (similar to the method employed in this KBNERR ES study). In this context, snowball sampling consisted of "contacting members of the Reserve Volunteer Coordinator's mailing list as well as meeting with members of the Coastal Bend Guide Association (CBGA)."

The complete survey is provided in the Loerzel et al. (2017) report. Research design and questions were based on the Cole (2012) social value typology. We applied and modified this typology for Kachemak Bay (see Chapter Five). Hence, this survey design could yield useful quantitative results. Questions that are most applicable to the KBNERR study, and insights on how they could be useful to KBNERR in future studies are described below:

1. “Attributes” (Ecosystem Change)

The first question posed in the survey asked respondents to indicate their perceptions of ecosystem changes within the watershed. These potential changes were referred to as ecosystem “attributes” in the survey. The survey listed multiple potential indicators of ecosystem change that were relevant to the watershed, including: abundance of various fish and wildlife species, shoreline erosion, and frequency of red tide events. Respondents were asked to rank their perception of potential ecosystem changes as: Large increase, Increase, No Change, Decrease, Large decrease, or Unsure/Don’t know.

Posing a similar question could be useful for KBNERR in monitoring the state of the “Signs of Health” over time. These “signs of health” are community-identified and community-relevant indicators. Therefore, it may be useful to use them as the basis for this form of question. A potential survey design that is similar one used in Loerzel et al. (2017) as adapted to Kachemak-Bay-specific signs of health is shown below in Table 6.6. This table includes signs of health as the attribute column with a Likert scale for measurement.

Table 6.6: Sample survey question on perceptions of ecosystem changes. Adapted from Loerzel et al. (2017) for KBNERR application.

“Attribute”	Large Increase	Increase	No Change	Decrease	Large Decrease	Unsure
Abundance of salmon/halibut						
Abundance of crabs and shellfish						
Physical size of fish						
Physical size of shellfish						
Number of different intertidal species						
Number of different species of wildlife						
Fish and shellfish disease/mortality events						
Access to subsistence and recreational fishing						
Presence of aquaculture						
Presence of invasive species						
Presence of pollution and/or litter						

2. Connection to place

The second set of survey questions asked respondents to indicate their level of attachment to the Reserve-area ecosystem. The survey provided a statement such as, “The Bay represents a way of life in my community,” or “The Bay is the best place to satisfy my outdoor recreation needs.” Respondents were then asked to indicate the level to which they agreed with each statement by selecting: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, or Unsure/Don’t Know.

A question like this could be an effective means of tracking community perceptions of the benefits derived from the Kachemak Bay ecosystem. Tailoring the statements to the value types described in the Kachemak Bay Social Value Typology Framework (Chapter Five) could enable KBNERR to monitor community perceptions of the benefits received from the Kachemak Bay ecosystem (and how they may change) over time. See Table 6.7 for some sample questions that could be useful for KBNERR to pose in a similar study.

Table 6.7: Sample survey question on perceptions of social benefits received from the Kachemak Bay Ecosystem. Adapted from Loerzel et al. (2017) for KBNERR application.

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unsure
The Kachemak Bay and surrounding landscape contribute to the culture of my community						
My community’s economy relies on the Kachemak Bay						
The Kachemak Bay and surrounding areas provide all my outdoor recreation needs						
My closeness or connection to the Kachemak Bay and surrounding area influences my sense of identity and how I live my life						
I believe I have a personal responsibility for caring for the Kachemak Bay and its resources						
I believe the Kachemak Bay and surrounding areas provide opportunities for learning and exploration						

3. Ranking

The next portion of the Loerzel et al. (2017) survey asked respondents to rank the importance/value of different benefits provided by the watershed. This ranking was done by listing the various types of values/benefits provided by the ecosystem, and then asking interviewees to imagine they had 100 pennies and could allocate these pennies among the list of benefits. Benefits perceived to be of a higher value should be allocated greater pennies, and less valuable benefits should be allocated fewer pennies.

An exercise like this one could be useful for KBNERR in determining the varying levels of importance community members may associate with the values identified in the Kachemak Bay social value typology framework. Currently, the frequency with which the different values were expressed in interviews is used to establish hierarchy. However, if completed with a larger sampling group, this ranking exercise, could produce more robust rankings and comparisons between sectors.

4. Mapping

Respondents were next asked to use the same list of values provided in the ranking exercise and place these values on a map of the watershed in the places respondents believe “best represents” each value. An exercise like this one could be useful for KBNERR in identifying valued places in the Kachemak Bay watershed as well as the types of values associated with these places. This technique can also be useful in grounding the more abstract concept of ecosystem services/values and can help interviewees think about these concepts specifically as they apply to Kachemak Bay. The report utilized the Social Value for Ecosystem Services (SoVES) model to analyze the locations and magnitude of values.

5. Management

The final primary question presented in this survey that is directly applicable to continuing social-value based ecosystem service in the Kachemak Bay watershed attempts to understand what respondents perceive to be pressing management issues within the watershed. The survey lists many potential resource management initiatives or concerns, including: “Improve freshwater flow into the Bay,” or “Restore and sustain fish stocks and other living marine resources in the Bay.” Respondents were then asked to rank each management issues as: High Priority, Priority, Neutral, Low Priority, Not a Priority, or Unsure/Don’t Know.

A question like this one could be useful for KBNERR to track community perceptions of resource management in the Kachemak Bay watershed as well as the drivers the community perceives to be impacting valued services over time. The selection of management issues presented to respondents could be based on the perceptions of management or the “threats” and “assets” described in the Kachemak Bay ES study (Chapters Three and Four) or KBNERR’s management priorities. This method would likely be useful in determining the perception of management priorities and needs among a broader pool of community members.

Case Example 7 - Participatory Mapping

S. Klain & Chan, K. (2012). Navigating coastal values: Participatory mapping of ecosystem services for spatial planning. *Ecological Economics*, 82: 104–113. doi:10.1016/j.ecolecon.2012.07.008

Klain & Chan (2012) employed in-person semi-structured interviews with mapping exercises to understand both monetary and socio-cultural valuation of ecosystem services within the Regional District of Mount Waddington area of Vancouver Island, British Columbia. The authors emphasized that in-person interview methods were chosen over a survey method as they believed in-person conversations would better capture the non-monetary, socio-cultural ecosystem service values, and that important details or nuances may not be as well represented in a paper or electronic survey format.

The sampling method employed in this study was similar to that of this KBNERR project in that the authors purposively selected interviewees who would be particularly knowledgeable about, or have a significant stake in local marine issues. Overall, Klain & Chan (2012) posed similar questions to interviewees as the KBNERR ES study, including: what ecosystem services are valued, how they are valued (economically or otherwise), and what threats do interviewees perceive impact these valued services.

This study also introduced a mapping and ranking/valuation component that was not present in the KBNERR ES study but may provide interesting insights for KBNERR in future studies. In one portion of the exercise, interviewees were presented with a map of the study area and asked to draw green polygons around areas of monetary or economic importance. Later, interviewees were asked to look at the same map and draw blue circles around areas that represent some non-monetary importance (cultural or otherwise). When discussing threats to ecosystem services and valued places, interviewees were also asked to draw red boundaries around areas perceived to be threatened or pose a potential threat.

This geographic component may be useful for: clarifying the concept of monetary versus non-monetary ecosystem services for interviewees, grounding interviewee ideas to specific regions or places within Kachemak Bay, distinguishing areas that provide monetary versus non-monetary services, and understanding where various values, threats and assets overlap.

Some limitations of this study were that some interviewees were hesitant or unsure when identifying valued places on a map and when asked to “rank” monetary value through assigning tokens based on perceived relative value. However, the majority of interviewees were able and willing to do so. Overall, adding a geographic component to KBNERR’s future ecosystem services research could provide nuance in analysis as well as helpful visual aids for planning and outreach.

Additional Methods and Tools

In addition to the case examples presented above, the methodology from this master’s project provides opportunities for KBNERR to continue to monitor the qualitative dynamics of place attachment and ecosystem services. Focus groups and interviews are deliberative and

engaging. Many benefits come from the process as well as the result. Outreach and communication can make residents from various areas and sectors feel heard and valued, thereby promoting KBNERR's reputation as a public research and outreach organization. This section provides reflection on our focus group and interview protocols including updates for future use.

Focus Groups

As described in Chapter One, this project designed and facilitated three focus groups to engage the community with the concepts of ecosystem services. This section details the process and outcomes of the focus groups including the potential for future application.

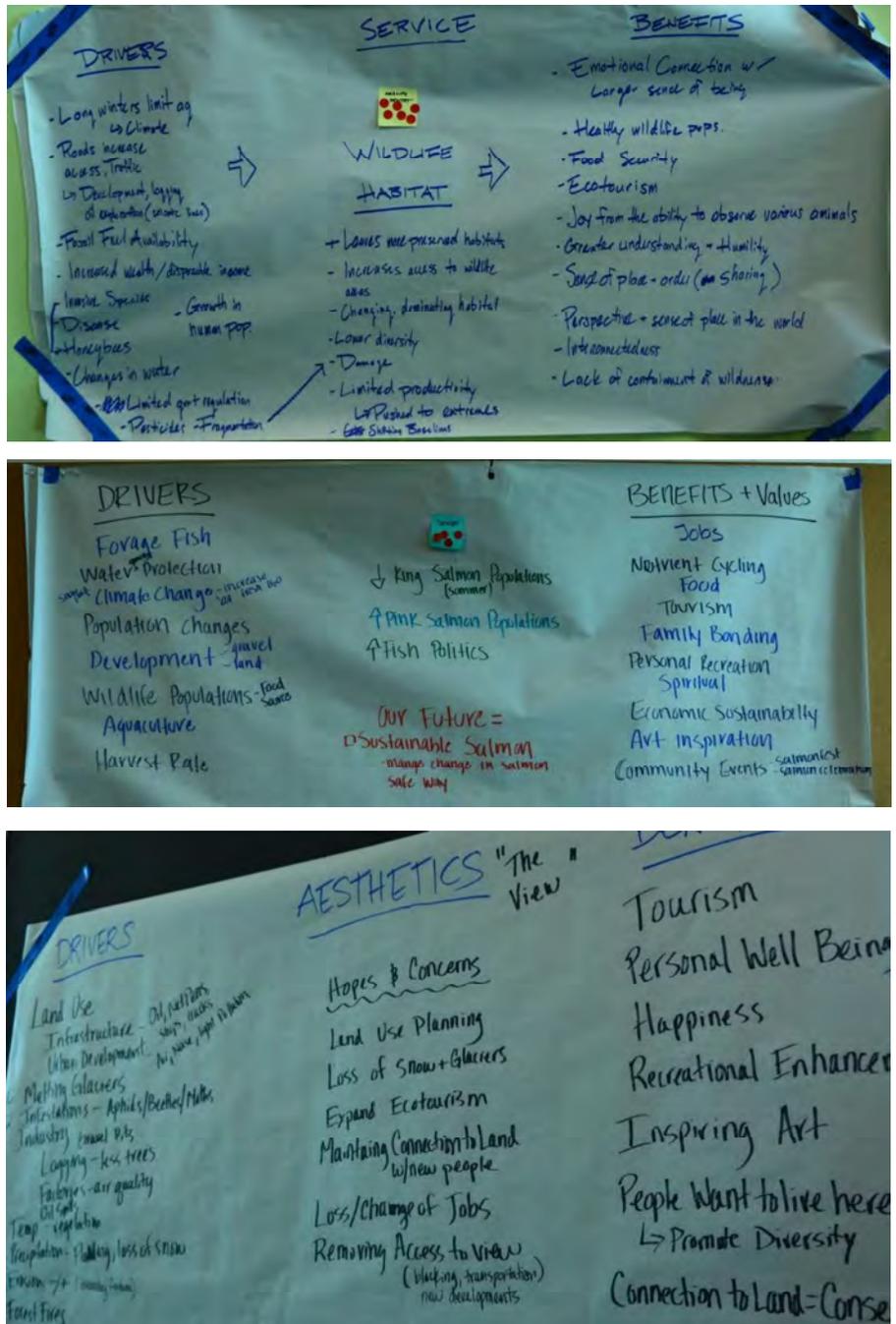
Process:

The focus groups had four major activities:

1. **Brainstorming ecosystem services:** participants were asked to call out ecosystem services that they viewed as important to their well-being. These responses were organized using the MEA categories of provision, supporting, cultural, and regulating. Figure 6.3 contains the visual charts produced by this exercise. The services listed overlapped among focus groups and the interviews. Common services included: food resources (fish, moose, agriculture), various recreation opportunities (skiing, hiking, water sports), and ecological processes (nutrient cycling, water cycling).
2. **Ranking ecosystem services:** participants were asked to use ten color tabs to rank ecosystem services that they think are most important to their individual and community well-being. This exercise provided participants an opportunity to get out of their seat, interact with each other and with the facilitator to ask questions. Ranking results across groups showed a wide range of value for various ecosystem services and categories. Top ranked services in each group were: Aesthetics ("The View"), Salmon, and Wildlife habitat. See Figure 6.3 for outcomes of ranking exercise.

3. Mapping drivers and outcomes: the highest ranked services from each group were discussed including brainstorming benefits from the service and drivers impacting the health of the service. This type of diagram, referred to as a “causal chain,” was used in the Olander (2018) study to identify services valued by community members and identify measures by which to track the state of these services over time. This activity produced drivers similar to those discussed in Chapter Three. The causal chains from focus groups are presented in Figure 6.4. As shown in the figure, major threats such as population changes, development (fragmentation), and invasive species are all perceived to impact the health of wildlife habitat via degradation or limited productivity.

Figure 6.4: Causal chain showing top-valued ecosystem service including drivers and benefits



4. Reflection: participants were asked reflection questions in their groups on the activities and discussion. All participants were brought together to compare visuals and reflections. This final portion prompted insights into the similarities between group outcomes. Although each group had a different ecosystem services of focus, many of the benefits and drivers overlapped between groups. Social values such as access, economic, and connections were prevalent among all groups. Drivers such as population changes, invasive species, and management decisions were similar between groups.

Lessons Learned from Focus Groups

Overall, the focus groups sparked rich conversation and engagement from most participants. The format of brainstorming, ranking exercises, and model building provided a balance of active participation and reflection. The concepts of ecosystem services provided a common language to organize the conversation in visual aids. Many themes overlapped with interviews including major ecosystem services, value types, and drivers.

Other takeaways from the design and outcomes of the focus groups could be used to improve future focus groups. First, although the ecosystem service lens is designed to promote conversation with the public about ecological issues, the language can be confusing. Clear definitions and handouts with examples of various services could help improve understanding and engagement. Second, the hour time frame provided enough time for the activities but limited discussion. We recommend including more time for reflection or splitting activities and reflections into two sessions with a break in between. This modification could provide valuable insight and promote collaboration between stakeholder groups. Lastly, the participants' background in environmental issues and research could have skewed the efficacy of the design. KBNERR could continue to pilot similar workshops with other major sectors to foster communication between people with different backgrounds.

Interview Protocol Revisions

Many socio-cultural ecosystem service studies have utilized semi-structured interviews (Scholte et al., 2015). In reflection, our interviews were effective to engage conversation that covered ecosystem services of value to interviewees. However, there are a number of ways that KBNERR could apply our interview guide (see **Appendix B**) for follow up studies. First, we suggest targeting a broader range of stakeholders including native groups and fishermen as significant stakeholder groups. Second, there were several questions that did not garner effective responses. Early questions in the interview, such as, "How would you describe your community" and concluding questions on the perceptions of management decisions prompted confusion and "question fatigue" from some interviewees.

Limitations

This chapter outlines major frameworks and methods that KBNERR could consider for future research. Studies could use the indicators in Tables 6.1-6.4 as well as methods from listed case examples to capture other ecological, economic, and social values associated with these services. Overall, there are a range of approaches to studying ecosystem services and this chapter has provided a frame of reference for future research. However, there are some limitations to our project, and ecosystem service frameworks in general, that should be considered for ongoing research.

Project Limitations

Inclusion is critical for future research. Our project included a small sample size which could exclude perspectives in the area. Specifically, fishermen, other marine trades, and native communities are all valuable sectors to reach out to. While we had some interviewees with past experience in the marine trades, we were unable to interview current fishermen due to the timing of our on-site interviews (late spring) which coincided with the start of fishing season. Similarly, we were constrained by time and budget to Homer, so we were unable to travel to other communities for native perspectives. Future qualitative studies should reach out to these groups and surveys should seek to include a wide range of respondents.

Second, this project did not evaluate all available literature for a comprehensive list of ecosystem services for the Kachemak Bay. We chose to inductively construct a list of ecosystem services through interviews with residents of the Kachemak Bay region. This list should help KBNERR identify which services are highly valued by the community because they either a) have knowledge of them, b) recognize specific ways their lives are impacted by these services, and/or c) explicitly state that these services are highly valued. Further research could be undertaken to extensively inventory services in Kachemak Bay.

Framework Limitations

Trade-offs

The socio-ecological systems in marine and coastal environments are highly complex. Measuring the interconnections between services and human benefits within a simple valuation metric can promote errors and critiques. For example, the notion of trade-offs in this project's interviews with the Kachemak Bay community highlighted the difficulties in comprehensively identifying these interconnections. Many interviewees discussed the balance between land uses and value types. While some valued an untouched landscape, they also recognized the economic benefits that come from human-landscape interactions. The concept of trade-offs between ecosystem services is an ongoing debate in ES research (Harrison et al., 2018). How can one rank and prioritize certain ecosystem goods and services with economic development and growth? Trade-offs were most prevalent between economic values (ecotourism, fish) and other conservation values (pristine/natural, intrinsic).

Trade-offs were also mentioned in the context of challenges associated with access. Places like the Kachemak Bay State Park were valued for their pristine element. However, individuals also recognized the positive influence that increased access can have in promoting a conservation ethic in the public. How can one balance values of access with conservation? KBNERR should be cognizant of these trade-offs and seek to account for them in future studies.

Issues in Defining Ecosystem Services

Many ecosystem service researchers broadly define ecosystem services as "benefits people obtain from services" (Daily, 1997). However, there are a range of perspectives on the various definitions of services and their relationships to human well-being. For example, Bohnke-

Henricks et al. (2013) critique the common definition and claims that ‘benefits’ and ‘services’ need to be independently distinguished. Different marine-based management initiatives likely use different ES definitions, which the authors see as problematic and potentially undermining ecosystem-based management (EBM) strategies. This discrepancy would make it difficult to compare EBM initiatives using different ES definitions. Additionally, if KBNERR performs an economic valuation of ecosystem services in the future, the supporting category in MEA’s framework is problematic and could lead to “double-counting” services when looking at total system value (Bohnke-Henricks et al., 2013).

“Tourism” in an ES Framework

Ecotourism in Kachemak Bay was largely considered in economic terms by interviewees. However, Pueyo-Ros (2018) argues that tourism/ecotourism has a somewhat “schizophrenic approach” in many ecosystem service frameworks. Many studies first define tourism as either a cultural (non-material) or an economic (consumptive) ecosystem service, but then include conflicting reasoning behind these definitions. For example, the TEEB framework explicitly identifies tourism as a cultural ES. However, it notes that “Nature tourism provides considerable economic benefits and is a vital source of income for many countries,” which implies that tourism is, in part, an economic ES (TEEB, 2010). Pueyo-Ros calls this “intellectual laziness” when studies do not consider tourism more deeply. Pueyo-Ros concludes that since the well-being of tourists is provided by other services, such as recreation, aesthetic appreciation, or some provisioning services, and also since the well-being of local communities that host tourists is provided by money from tourists rather than tourism itself, “tourism cannot be considered an ecosystem service, but an industry that converts tourists’ well-being into money.”

Pueyo-Ros also considers the difference between *nature-based tourism*, defined as “tourism within natural environments,” and *ecotourism*, defined as “responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education.” Our interviews display clear evidence of this distinction when interviewees discussed “cruise tourists” and “recreational tourists.” Cruise tourism was largely considered negatively by the community (see Chapter Three) while recreational tourism (ecotourism) was seen as sustainable and beneficial to the well-being of the community (Chapter Two).

Nevertheless, this project examined the community perceptions of ecosystem services, one of those being “tourism.” Using Daily’s (1997) definition of ecosystem services (“*the conditions and processes through which natural ecosystems and the species that make them up, help sustain and fulfill human life*”), and acknowledging that a majority of interviewees perceive tourism through an economic lens, we consider *ecotourism* an economic ecosystem service. Acknowledging Pueyo-Ros (2018), we agree it is important to maintain a distinction between tourism and ecotourism, and we recommend that KBNERR does the same in their future research. The community is clearly aware of the cultural and economic impacts tourism and ecotourism distinctly have on the health and well-being of Kachemak Bay.

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Appendices





Appendix A

Kachemak Bay Community Network

The Kachemak Bay is home to a diverse community of small businesses, non-profit and educational organizations, government agencies, researchers, volunteers, recreators, hunters, and fishers. The network described below provides a snapshot of the communities present in the Kachemak Bay region, but this list is not comprehensive or completely representative. This list was compiled following completion of interviews, and represents the makeup of interviewees that comprise the final sampling group represented in this study, as well as organizations that were noted by interviewees. The purpose of this Appendix is to provide context to the results of this study and the resulting Kachemak Bay-specific social value typology through outlining the involved user groups.

Kachemak Bay National Estuarine Research Reserve (KBNERR)

The KBNERR is part of a larger NERRS network that consists of 29 coastal sites designated for long-term research, monitoring, community outreach, education, training, and stewardship. These NERRS were established under the Coastal Zone Management Act, and they foster a collaborative connection between the National Oceanic and Atmospheric Administration (NOAA) and coastal states.

KBNERR is a local-state-federal partnership, gathering input and resources from community members and the Alaska Center for Conservation Science at the University of Alaska, Anchorage. It is a “living laboratory” designated in 1999 and located in Homer on the north side of the Bay, east of the Homer Spit. The reserve is the largest in the entire NERR system, encompassing 372,000 acres of land across the western coast of the Kenai Peninsula.

The staff at KBNERR develop and conduct research on the Bay’s ecological systems and diverse wildlife community, including salmon life cycles, ocean acidification, and stream productivity. Results of these studies and regular monitoring are shared with the community to promote well-informed decision making and strategy development for the well-being of Kachemak Bay. KBNERR staff also provide community outreach and education through the Coastal Training Program and various workshops.

NERR System : <https://coast.noaa.gov/nerrs/>

KBNERR : <http://accs.uaa.alaska.edu/kbnerr/>

The KBNERR Community Council

The Community Council was established by KBNERR to strengthen collaboration by fostering “dialogue and recommendations between agencies, local governments, Research Reserve staff, researchers, environmental educators, conservation groups, and others interested in natural science research and education.” The Council is comprised of volunteers from the local community (residents and agency representatives). The Council does not have more than 9

voting community members, who are chosen to represent the vibrant and diverse community of the Bay. These voting members are to encompass a wide range of perspectives relating to education, research, residential location within the Bay, and economic interests. Non-voting members represent the following agencies:

- Kenai Peninsula Borough
- Alaska Department of Fish and Game
- Alaska Department of Natural Resources
- Alaska Department of Environmental Conservation
- US Coast Guard
- US Environmental Protection Agency
- US Fish and Wildlife Service
- University of Alaska Anchorage
- National Park Service
- NOAA

KBNER Community Council: <https://kbaycouncil.wordpress.com/council/>

Government Organizations

Homer was established as a first class general law city in 1964. It has a city manager/city council style of government where six City Council members and the mayor are elected by citizens of Homer. It is part of the Kenai Peninsula Borough.

Local

Mayor, City Council & City Manager:

The City Council consists of 6 elected officials given power through the State Statute and Homer City Code. Two members are elected every year with a three-year term. They are chosen to represent the citizens of Homer in decisions regarding the well-being of Homer. Members of the council can introduce ordinances, which can then be set for a hearing by majority vote. The Mayor, who governs over the City Council, can only vote in case of a tie.

The Mayor serves a two-year term, and acts as the ceremonial head of the City Council with powers to veto an ordinance and act as City Manager should one not be appointed.

City Council appoints a City Manager. Duties of the City Manager include preparing an annual budget, enforcing ordinances of the City, appointing heads of any department of the city, and acting as purchasing manager for all departments.

Commissions and Boards also exist within Homer to advise the Manager and Council on any issues brought forth by the Council. The City of Homer has 5 different advisory commissions:

- Economic Development
- Library
- Port & Harbor
- Homer Planning
- Parks, Art, Recreation & Culture

In 2018, Homer revised the 2008 Comprehensive Plan, which was developed to serve as a guide for future city development, land use, and policy until the next comprehensive plan is formed in 2028. The City of Homer Mayor, City Manager, City Council, all five commissions, and planning staff all participated in developing the 2018 Comprehensive Plan. The recent plan examined community values, land use, transportation, public services, economic vitality, and energy as it relates to the overall goals of a growing, changing community.

Commissions & Boards: <https://www.cityofhomer-ak.gov/bc/commissions-boards>

Homer City Code: <https://www.codepublishing.com/AK/Homer/>

Homer Comprehensive Plan: https://www.cityofhomer-ak.gov/sites/default/files/fileattachments/planning/page/30781/final_public_draft_reduced.pdf

Homer Advisory Planning Commission:

The Homer Advisory Planning Commission was created by the City Council to “maximize local involvement in planning and to implement and recommend modifications to the Homer Zoning Ordinance.” The Commission consists of 7 members appointed by the Mayor for three-year terms, 6 of which must reside within Homer city limits. Regular public meetings are scheduled to discuss current or upcoming development projects, zoning issues, comments and questions from the public, etc. The Advisory Commission has the authority to accept or deny permit applications for conditional use, zoning, lighting standards, wetland alteration, and more within the Homer city limits.

Kenai Peninsula Borough:

The Kenai Peninsula Borough was formed in 1964 as a county-level governmental authority. Its seat is located in Soldotna and it consists of a mayor and board of directors (known as the “assembly”) that act to advise the mayor. The assembly of the Borough is comprised of nine representatives from each district of the Borough. Cities within the Borough’s management include Homer, Kenai, Seldovia, Seward, and Soldotna. The Borough collects money from property and sales taxes and uses the funds to provide a wide array of services like road maintenance, waste disposal, habitat protection, and floodplain management.

Kenai Peninsula Borough: <https://www.kpb.us/>

Homer Soil and Water Conservation District:

The Homer Soil and Water Conservation District is one of thirteen districts in the entire state of Alaska. It is a unit of government created to “develop, manage, and direct natural resource programs at the local level.” Districts are run by a volunteer board of local “District Supervisors,” who must serve 3-year staggered terms. The Homer District is non-regulatory, but includes approximately 200 private landowners and land managers as “SWCD Cooperators.” through this extensive stakeholder network, the District promotes “the conservation and productive and sustainable use of natural resources.”

The Conservation District provides various programs in education for landowners and schools, as well as conservation projects through mining reclamation monitoring and soil mapping. The

District is also working on the Anchor River restoration, which has heavily eroded streambanks from a flooded gravel pit incident in 2002. Using funding from a DEC Alaska Clean Water Actions grant, the Conservation District is working with other local non-governmental organizations to develop a plan to rehabilitate the Anchor River streambank at degraded sites.

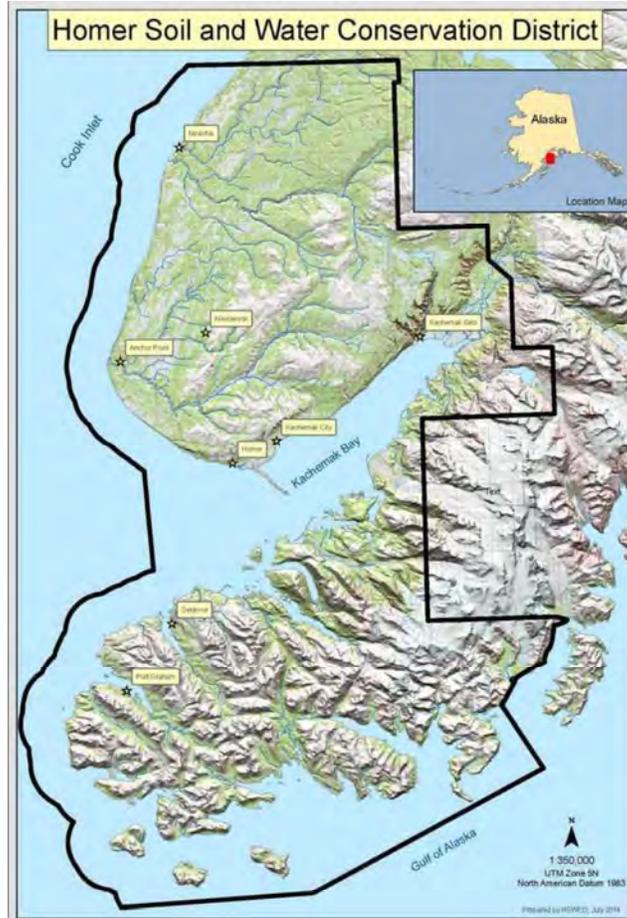


Figure A.1: Map showing the boundary of the Homer Soil & Water Conservation District.

Homer Soil & Water Conservation District: <http://www.homerswcd.org/>

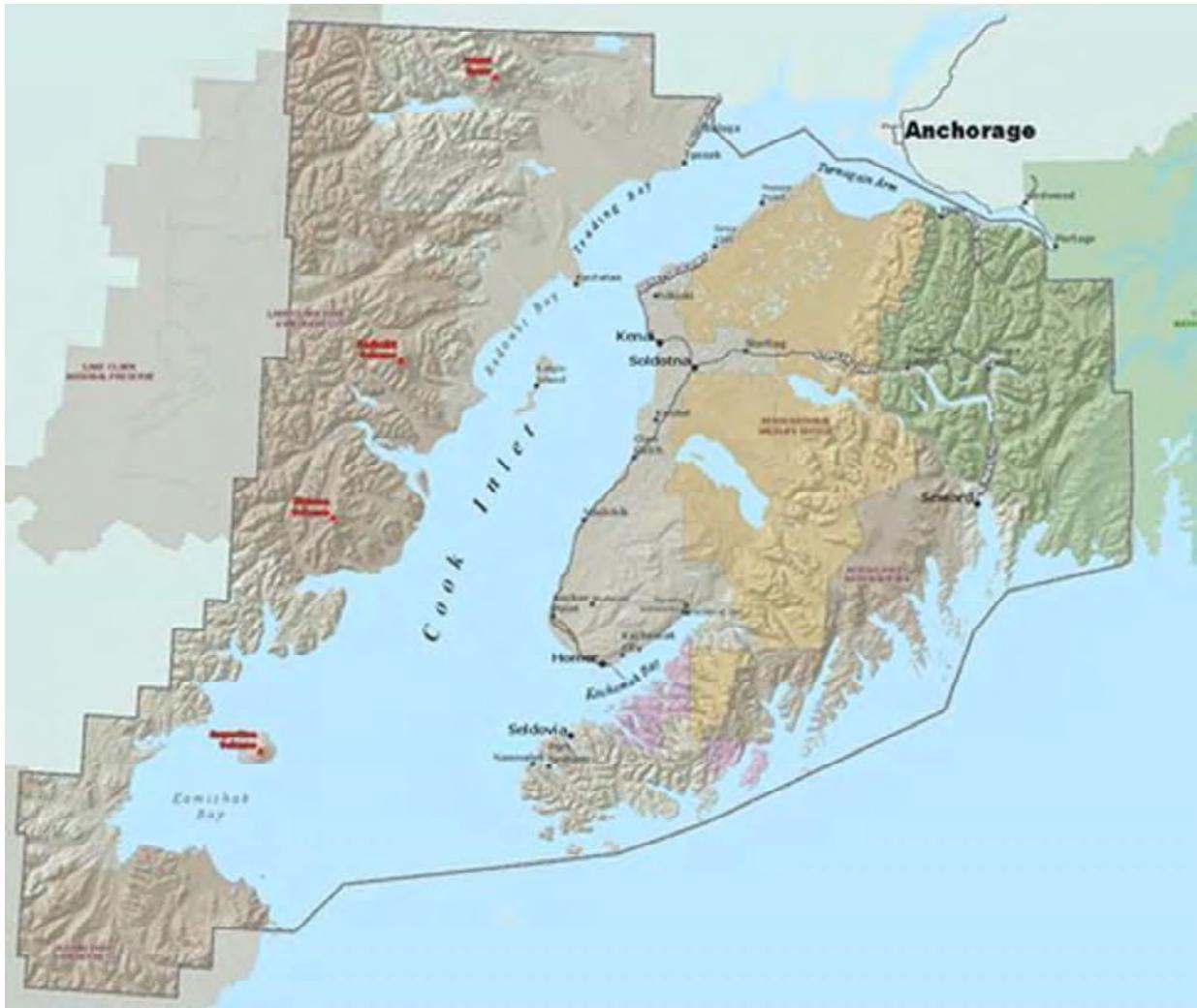


Figure A.2: Map showing Kenai Peninsula Borough boundary.

State

Department of Environmental Conservation:

Alaska's Department of Environmental Conservation (DEC) includes five different divisions all supporting the natural resources and the environment in the state for the well-being of Alaskans:

1. Air Quality
2. Environmental Health
3. Administrative Services
4. Spill Prevention & Response
5. Water

The DEC does not have an office location on the Kenai Peninsula, the nearest location being Anchorage. The most recent DEC project within the Kenai Peninsula was the Anchor River restoration. DEC and other collaborators identified areas for restoration in 2006, and restoration plans are to begin in the summer of 2019.

Department of Natural Resources:

Alaska's Department of Natural Resources (DNR) contains seven different divisions, including:

- Mining, Land & Water
- Oil & Natural Gas
- Parks & Outdoor Recreation
- Forestry

Within the Kenai Peninsula, there is a Forestry Division office located in Soldotna, and a Homer Ranger station and a Soldotna office location for the Parks & Outdoor Recreation division. The DNR Parks and Outdoor Recreation division received funding from the Exxon Valdez Oil Spill Trustee Council to restore portions of the Anchor River downstream from locations identified by the Homer Soil and Water Conservation District and DEC.

Department of Fish & Game:

Alaska Department of Fish & Game is made up of six divisions, the Office of the Commissioner, two associate entities (Exxon Valdez Oil Spill, Commercial Fisheries Entry Commission), and a Boards Support Section. The six divisions include:

1. Commercial Fisheries
2. Sport Fish
3. Wildlife Conservation
4. Habitat
5. Subsistence
6. Administrative Services

Fish & Game offices are located throughout the Kenai Peninsula in Seward, Soldotna and Homer. Fish & Game has advisory committees for Homer, Kenai/Soldotna, Seward, and Seldovia, which meet monthly and actively participate in fisheries and game management.

The Alaska Department of Fish & Game is coordinating with the DEC, DNR, and Homer Conservation District with plans to incorporate the Anchor River site restoration work as part of a community training event.

Local Businesses

Homer and the areas surrounding Kachemak Bay is a thriving, growing economy. Many goods and services are provided in Homer especially. These include services such as accommodations, recreation and ecotourism, restaurants and breweries, retail, the arts, and transportation.

Ecotourism:

Kachemak Bay is a prime location for recreational activities, and as a result is a booming area for ecotourism. Visitors from around the globe can experience Alaska through many activities, such as wildlife viewing, boating, hiking and biking, kayaking, whale watching, horseback riding, and winter activities. Tourism-related activities have been steadily increasing overall since 2009

with a total 8% increase in gross sales from 2013 – 2017 across the entire Kenai Peninsula Borough.

Kachemak Bay Prospects Report: <file:///H:/Research/wetlands/KBNERR/2018-KPEDD-Situations-Prospects-Report.pdf>

Dining & Spirits:

With a growing community and popular spot for tourists, the restaurant and brewery industries in Homer are expanding as well. Homer is currently home to two breweries, one winery, and many more options for bakeries, pubs, restaurants, and fine dining. Over a recent 5-year period (2013 – 2017), gross sales increased by 28%. The Kenai Peninsula Borough as a whole had an increase of 7% in the same 5-year period.

City of Homer Summary Report 2018: https://www.cityofhomer-ak.gov/sites/default/files/fileattachments/economic_development/page/25341/kpedd_aug_28_fin_al_2018_sp_homer_summary.pdf

Chamber of Commerce

The Chamber of Commerce membership base includes individuals of the business community in Homer. Its goal is to “ensure a healthy economic base while improving the quality of life” in Homer by encouraging business development, tourism, and investment. Members can join with a fee, and additional funds are raised for the Chamber by grants and fund-raising events. Members elect a board of directors, who then hire an executive director to carry out the Chamber’s policies.

Private Landowners

Homer had one of the highest numbers for new homes constructed in peninsula cities. 51 homes were built in 2017. Land within and surrounding the Kachemak Bay State Park and the Kachemak Bay State Wilderness Park are nearly 900 acres of privately owned land. Another nearly 200 acres in the area are owned by native communities and the Bureau of Land Management. In 1999, Kachemak Bay held 8% of private lands in all of Alaska (Alaska Department of Fish and Game, 2000). Land ownership has changed hands in the last 20 years from mostly public to many private landowners, which has led to many trespassing issues. As a result, state and local agencies stress for visitors to check property ownership before any excursion.

Native corporations are a major landowner in the Kachemak Bay Watershed. Two native corporations (Cook Inlet Region, Inc. and Seldovia Native Association) owned over 110,000 acres in the watershed in 1999. Currently, the Seldovia Native Association owns over 180,000 acres on both sides of the Cook Inlet, and Cook Inlet Region, Inc. owns over 1.3 million acres of land throughout the Kenai Peninsula.

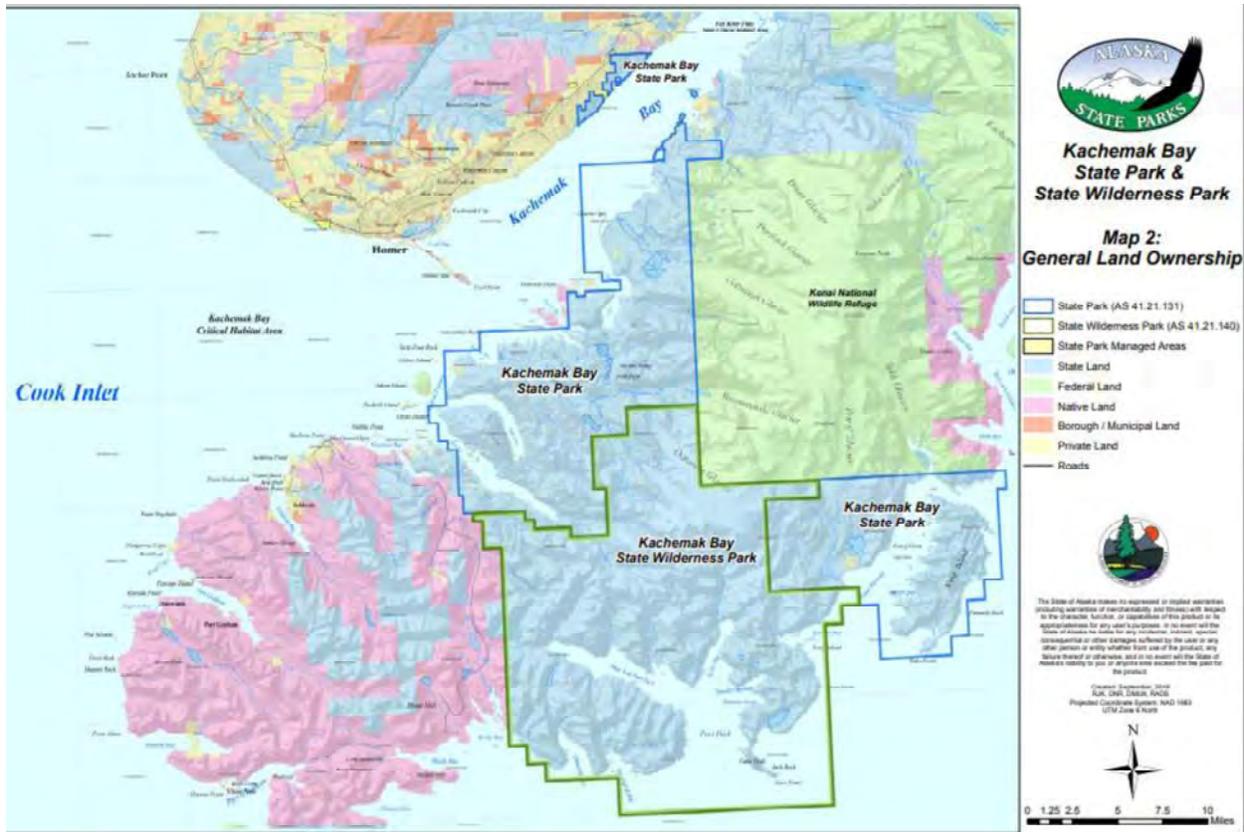


Figure A.3: Kachemak Bay State Park and State Wilderness boundaries.

Kachemak Bay State Park Wilderness Plan 2018:

http://dnr.alaska.gov/parks/plans/kbay/kbay_prd_complete.pdf g

City of Homer Summary Report 2018: [https://www.cityofhomer-](https://www.cityofhomer-ak.gov/sites/default/files/fileattachments/economic_development/page/25341/kpedd_aug_28_fin)

[ak.gov/sites/default/files/fileattachments/economic_development/page/25341/kpedd_aug_28_fin](https://www.cityofhomer-ak.gov/sites/default/files/fileattachments/economic_development/page/25341/kpedd_aug_28_fin)
[al_2018_sp_homer_summary.pdf](https://www.cityofhomer-ak.gov/sites/default/files/fileattachments/economic_development/page/25341/kpedd_aug_28_fin)

Fishing

The Kachemak Bay offers residents and visitors plenty of fishing opportunities through recreational/sport, commercial, and subsistence fishing. The Homer Spit is home to a large boat harbor for vessels of all sizes. The Bay is also home to several species of Pacific salmon and other fish:

- King Salmon
- Pink Salmon
- Coho Salmon
- Red Salmon
- Silver Salmon
- Halibut
- Dolly Varden Char
- Tanner Crab

At one point, there were harvests for King Crab, Dungeness Crab, and shrimp, but these species are now closed year-round due to low populations.

Homer residents (< 0.1% of Alaska's population) harvested 8% of the commercial fish haul for all of Alaska in 2016, earning a total of \$66 million.



Figure A.4: Map of Kachemak Bay salmon, halibut, crab and clam locations.

Source:

<https://www.adfg.alaska.gov/static-sf/Region2/pdfpubs/kachemakbay.pdf>

City of Homer Summary Report 2018: https://www.cityofhomer-ak.gov/sites/default/files/fileattachments/economic_development/page/25341/kpedd_aug_28_fin_al_2018_sp_homer_summary.pdf

NGOs and Nonprofits: Environmental Organizations

Kachemak Heritage Land Trust:

The Land Trust is a non-profit organization founded in 1989 that works to preserve lands essential for wildlife habitat and Alaskan culture. The KHLT owns and focuses on over 3,000 acres of land throughout the Kenai Peninsula. The KHLT is managed by a full-time team and a voluntary board of directors. Volunteers work together to monitor the many green spaces, trails, and other conservation easements that the Trust oversees. Community partners include the City of Homer, U.S. Fish & Wildlife, The Nature Conservancy, and various foundations and funds. The KHLT also offers educational programs to build community and promote good stewardship.

Kachemak Bay Land Trust: <https://www.kachemaklandtrust.org/>

Cook Inletkeeper:

The Cook Inletkeeper combines monitoring and research to work with scientists and managers while also working to increase stewardship and community participation. The organization's first priority is to protect and promote clean water. They have four goals:

1. Grow support for clean water and strong local economies
2. Promote renewable energy
3. Protect healthy habitats
4. Build an effective organization

The Inletkeeper helps the community in many ways, including testing their own drinking water, properly disposing of pharmaceuticals, advocating against harmful projects that could negatively impact habitat, and working with the Harbor to secure spill kits on vessels.

Cook Inletkeeper: <https://inletkeeper.org/our-work/>

Western Hemisphere Shorebird Reserve Network:

The WHSRN is a “science-based, partnership-driven, conservation initiative for protecting the ecological integrity of critical habitats for shorebirds throughout the Americas.” The WHSRN adopts shorebird sites to strengthen compliance, garner community support, and management and monitoring.

Western Hemisphere Shorebird Reserve Network: <https://whsrn.org/about-shorebirds/conservation-action/>

NGOs and Nonprofits: Education and Outreach

Center for Alaskan Coastal Studies:

The CACS is a non-profit organization founded in 1982 that is dedicated to educating students and visitors on the marine ecosystem of Kachemak Bay through science-based learning and stewardship. They provide their students with direct experience in the environment through guided walks, tours, and other programs. Through full-time staff, a board of directors, and volunteers, the CACS is able to host popular annual programs like the Kachemak Bay CoastWalk, which is an opportunity promote citizen science through volunteers engaging in data monitoring and beach cleanup. The CACS headquarters are located in Homer, but it also manages the Wynn Nature Center, the Peterson Bay Field Station, and the Yurt on the Homer Spit.

CACS: <https://www.akcoastalstudies.org/>

Pratt Museum:

The Pratt Museum is specific to the Kachemak Bay. It strengthens the connection of the community to the Bay through interactive story-telling of homesteaders, commercial fishermen, native tribes, and other local residents. The Museum also includes the ecological history of the Bay, art installations, and community outreach.

Pratt Museum: <http://www.prattmuseum.org/mission-vision/>

Project GRAD:

This non-profit organization works with local school districts in the Kenai Peninsula, typically with districts in tribal communities, to supplement natural resources and environmental education, promote an interest and passion for the outdoors, and encourage students to pursue environmental-related careers and/or higher-education.

Art Community

Bunnell Street Arts Center:

Located in historic Homer, the Bunnell Street Art Center's mission is to nurture exceptional and innovative art in all medias through art appreciation, exposure, and education. Many art installations from local artists are on display and sold through the Arts Center.

Bunnell Street Arts Center: <https://www.bunnellarts.org/our-story/>

Homer Council on the Arts:

The Council on the Arts brings art to the community through galleries, performances, classes/workshops, and collaboration. Since its formation in 1972, the Council on the Arts has been providing “a place of deep exploration of the creative process.”

Homer Council on the Arts: <http://www.homerart.org/>

Recreation

Kachemak Bay Water Trail:

The Water Trail group is volunteer-based and made up of members from communities all across the Bay. The water trail is 125 miles stretching from Homer Spit to Seldovia. The Water Trail is managed by a Steering Committee that is devoted to building support, gathering input and data from users, and improving accessibility.

Kachemak Bay Water Trail: <http://www.kachemakbaywatertrail.org/about-association.htm>

Kachemak Nordic Ski Club:

The Nordic Ski Club is dedicated to promoting the nordic ski trails in Kachemak Bay by maintaining/grooming the trails, offering ski lessons, hosting race events, and offering additional support for the skiing community.

Kachemak Nordic Ski Club: <http://kachemaknordicskiclub.org/>

Snomads Snow Machine Club:

Snomads is based in Homer. Their goals include promoting outdoor recreation, the safe use of motorized recreational vehicles, trail access and preservation, and safety/survival education. This organization also provides aid in search and rescue efforts when necessary. Membership fees and grants allow the Snomads to finance trail building and maintenance, educational programs, and the on-call search-and-rescue team. As land use ownership changes hands, the Snomads work to improve communication and continued trail access between different land owners.

Homer Snomads: <http://www.homersnomads.org/>

Agriculture

Homer Farmers Market:

The Homer Farmers Market is the place where the community comes together every Wednesday and Saturday throughout the summer to sell art and craft, fresh-grown produce, and seafood. This community event provides a sense of community, a place for conversation, art, music, and food. The average number of visitors to the Market has been steadily growing. 2018 had a total of 112 members, comprised of producers (42), crafters (36), prepared food (22), non-profits (6), and supporting community members (6).

Homer Farmers Market 2018 Report: <http://www.homerfarmersmarket.org/annual-reports---presentations.html>

Native Communities

A majority of the population in the Kenai Peninsula is white, but nearly 8% are Native Alaskans. Historically, the Kenai Peninsula was predominately the Dena'ina and the Unegkurmiet people (Figure A.5).

Port Graham and Nanwalek:

Villages like Port Graham and Nanwalek, located on the south side of the Bay, are predominantly native. The current Port Graham and Nanwalek residents are a mixture of Alu'utiq (Pacific Eskimo), American Indian, Aleut, Russian, Euro-American, and Asian descent. While there are many modern conveniences, residents are removed from the hustle and bustle of modern American life. Port Graham is not connected to the road system in Alaska. It must rely on air service from Homer as primary transportation. Residents maintain the tradition of subsistence harvests, including marine mammals.

The population of Port Graham is around 178. Commercial fishing provides seasonal employment for residents. Logging, construction, health care and ecotourism are growing segments of the local economy.

Seldovia Village Tribe:

The Seldovia Village Tribe is a tribal government that aims to protect the cultural heritage of its members, as well as support the health and well-being of the community. The Tribe is made up of Aleut, Yupik, Alutiiq, and Athabascan peoples. The Tribe has a semi-open enrollment policy, allowing people of all cultures and races to be a member.

<http://svt.org/>



Figure A.5: Map of Kachemak Bay showing locations of native villages. Nanwalek is located along the coast south of Port Graham.



Figure A.6: Map showing the geographic boundaries of native populations in Southern Alaska.

Source:

<https://www.adfg.alaska.gov/static-sf/Region2/pdfpubs/kachemakbay.pdf>

Appendix B

Interview Guide

1. Could you tell me how long you've been in the Kachemak Bay region and what you do here?
 - a. What attracted you to the region?
 - b. How would you describe your community?
 - i. What is particularly special about it?
 - ii. What types of things do people do here?

2. People interact with the natural environment in many different ways – whether for work or for play. How do you interact with the environment?
 - a. Are there particular places/resources in the Kachemak Bay region that are important to you or your family?
 - i. Can you describe what you do here or how you use this resource?
 - ii. What specifically is valuable about this place/resource to you? What is its relative importance to you or your community?
 1. What services or benefits do you derive from this place/resource?
 2. Take me to the last time you were there
 - iii. What are the signs that indicate whether this service is healthy/successful?
 - iv. Can you describe a time that this this place/service was particularly pristine/abundant/healthy/prevalent?
 - v. How about a time when it seemed degraded or threatened?
 1. Can you describe what your experience was like there 10 years ago?
 2. How have things changed since then?
 - vi. What are your hopes and concerns about the future of this resource?
 1. What would you say are the greatest threats to this resource?
 2. What would you say are the greatest threats to other natural systems in the Kachemak Bay area?
 - vii. How do other community members or groups interact with this place?
 1. What is your perspective on these interactions? Are they positively or negatively affecting this place/resource?
 - b. Are there other places or natural resources that are particularly important to you?
 - i. Do you derive different kinds of values or benefits from these places/resources as compared to those discussed previously?
 - ii. *Use follow-up protocol above*

3. In what ways do management decisions of federal, state, or local organizations positively or negatively affect these places/resources?

- a. If you were in charge of planning and decision making concerning the Kachemak Bay area's natural resources:
 - i. What would you change?
 - ii. What would you keep the same?

Concluding Questions:

1. Just to reiterate, the goal of this interview is to understand what you and the community value about the Kachemak Bay region's natural landscape and resources. Is there anything else that we haven't covered during this interview that you think is important or would like to share?
2. Who else should we try to speak with who might be able to provide a good perspective on these topics?
 - a. Are there community groups/members that we should be speaking to? What is their role/influence in the community?
 - b. What is their influence in the community?

Appendix C

Focus Group Protocol

Presentation and Focus Group Summary and Goals:

1. Identify how ecosystem services are connected to community well-being.
 - What is the relative importance of each service?
2. Foster communication between groups/people of different backgrounds. Find common ground.
 - What are the shared or group values of these services?
3. Connect drivers of change with ecological functions and services:
 - Identify drivers impacting natural systems and ecosystem services
 - Connect drivers to ecosystems structure and function
 - Connect changes in ecosystem services to individual and community well-being

Expected Outputs/Outcomes:

1. A working list of major ecosystem services in the Kachemak Bay region
2. A mental map of connections and relationships among drivers and services

Participants (per focus group session):

5-6 participants from various backgrounds

Process Agenda:

The focus group will begin with an introductory presentation including our basic research goals and an explanation of the ecosystem service framework. From there, we will split into three smaller groups of 5-6 individuals each. Groups to be determined, splitting up community, agency and KBNERR staff members.

Presentation (~15 minutes)

- Provide a project overview (goals, research questions, deliverables, etc)
- Define/explain: ecosystem services (categories of ecosystem services?), drivers, outcomes, and well-being

Break out into groups

Opening Question (~5 minutes)

- “Just to begin, could we go around the room and briefly tell us who you are, what you do, how long you’ve been a member of the community council and why you joined?”

Exercise One - Brainstorming Ecosystem Services (~10 minutes)

In this exercise we will have group members call out ecosystem services that they believe are critical to the well-being of the community. The focus group facilitator or another assistant will write the services on post-it notes as they are called out and place them on the board. This will allow participants to hear other's responses and continue fostering conversation:

"Next, we are going to do a brainstorming exercise. One at a time, call out what major ecosystem services that you feel are critical to the well-being of your community. Well-being can mean different things to different people and could refer to: economics, cultural values, recreation, safety/security, or general happiness."

Exercise Two - Categorization of group-determined Ecosystem Services (~15 minutes)

"Next, we are going to do a ranking exercise. Each group member is ten dots and will add the dots to the ecosystem services that they think are most important to their individual and community well-being. Place them directly on the sticky note, and don't vote more than once for a particular ecosystem service. Multiple people can vote for a service, but an individual can only vote once for a particular service."

Reflection Questions for Sections 1 and 2:

- "What patterns, themes, do you see in the list?"
Potential Probes:
 - "Is there anything that surprises you?"
 - "How has this list changed over the last ten years?"
- "Does the voting reflect what services are most important?"

Exercise Three - Mental Mapping- Identifying Drivers and Outcomes (~15 minutes)

Choose one service and unpack benefits that the community receives from this service as well as drivers that impact the health of the service. The service chosen will be the one that collectively received the highest rating by the group (add the numbers on the dots and find the service with the highest number of "points").

Benefits/Values:

- "How does your community benefit from this service?"
- "Do you think these benefits accurately reflect the values derived from this service?"

Drivers:

- "There are a range of drivers, or factors, that can impact this service in a positive or negative way. These could include environmental factors like climate, vegetation, predators as well as social factors like harvest rates, government policy, or development."
- "Given this description, what are drivers that impact this service?"
- Focusing on a particular driver →

Reflection Questions for Section 3:

- “Collectively, how do you think these drivers are impacting this service?”
 - *Potential Probes*:
 - “How would these impact you or your community?”
 - **“How has this driver specifically impacted a benefit provided by this service?”**
 - “Do you have specific examples?”
 - “If this service were no longer available how would that affect community well-being?”
- “Considering these drivers and benefits, what are your hopes and concerns for this service?”

Wrap-up Questions for Exercise Three: (~10 minutes)

- “Does this diagram describe the circumstances/context of this ecosystem service? Is anything missing?”
- “The purpose of this focus group was to understand the major ecosystem services that are important to the Kachemak Bay community. Taking a step back and thinking about this entire focus group experience, have we missed anything that you think we should talk about?”
- “Would anyone like to give a brief presentation of our focus group process to the rest of the group?”

Exercise Four - Final Questions (for entire group ~5 minutes)

- “We are wrapping up, but does anybody have any last thoughts they want to share?”
- “Lastly, we are passing out note cards and if you have any initial feedback, questions or comments, you can write them. Additionally, if you are interested in participating in a one-on-one interview to go further in depth, please put your name and phone number of the other side of the note card. Thank you all for your participation and perspectives in the focus group and we look forward to sharing our final project findings no later than May of next year.”

Definitions Used for Focus Group:

Ecosystem service:

Ecosystem services is shorthand for all aspects of nature that contribute to our health, wealth, and well-being.

Regulating Services:

Maintaining the quality of air and soil, providing flood and disease control, or pollinating crops are some of the 'regulating services' provided by ecosystems. They are often 'invisible' and therefore mostly taken for granted. When they are damaged, the resulting losses can be substantial and difficult to restore.

Provisioning Services:

Water, food, wood and other goods are some of the material benefits people obtain from ecosystems called 'provisioning services'. Many provisioning services are traded in markets. However, in many regions, rural households also directly depend on provisioning services for their livelihoods. In this case, the services value may be much more important than is reflected in the prices they fetch on local markets.

Supporting Services:

Providing living spaces for plants or animals and maintaining a diversity of plants and animals, are 'supporting services' and the basis of all ecosystems and their services.

Examples: habitat, genetic diversity maintenance.

Cultural Services:

The non-material benefits people obtain from ecosystems are called 'cultural services'. They include aesthetic inspiration, cultural identity, sense of home, and spiritual experience related to the natural environment. Typically, opportunities for tourism and for recreation are also considered within the group. Cultural services are deeply interconnected with each other and often connected to provisioning and regulating services: Small scale fishing is not only about food and income, but also about fishers' way of life. In many situations, cultural services are among the most important values people associate with Nature – it is therefore critical that they are understood.

Drivers:

Any natural or human induced factor that directly or indirectly causes a change in an ecosystem. A direct driver unequivocally influences ecosystem processes. An indirect driver operates more diffusely, by altering one or more direct drivers. The MEA categories of indirect drivers of change are demographic, economic, sociopolitical, scientific and technological, and cultural and religious. Important direct drivers include climate change, plant nutrient use, land conversion leading to habitat change, and invasive species and diseases.

Benefits/Well-being:

Well-being can mean different things to different people and could refer to: economics, cultural values, recreation, safety/security, or general happiness.

*Materials Needed:***Prep:**

Large roll of paper

Tape

Sticky Flip Paper

Recording Equipment

Note-taking supplies

Exercise One:

Sticky Notes

Markers

Exercise Two:

Dots (red)

Exercise Three:

Notecards

Pens/pencils