differences in the movement patterns of these species, and then liquidate the oldest
stock to protect the remaining fish.

One of the primary reasons why ecosystem
services are valued is because they are
impossible to replace once lost. As the
climate changes, so do the species of fish
that migrate through the region; this
creates a challenge for fishermen and
local businesses.

There are also concerns about the
impact of climate change on the
adaptness of salmon to changes in
water temperature. This is critical
because the salmon’s ability to
survive and reproduce is dependent
on these changes. If water temperatures
become too warm, the salmon may
have difficulty finding suitable
habitat to spawn in, which could
reduce their numbers and alter the
ecosystem.

Economists estimate the annual
value of these natural resources to be
$288.8 million. There are roughly 2,700
fishermen in the region who harvest
resources harvested by its fishermen. There
are also concerns about the impact of
climate change on the adaptability of
salmon to changes in water temperature.
This is critical because the salmon’s ability
to survive and reproduce is dependent
on these changes. If water temperatures
become too warm, the salmon may
have difficulty finding suitable
habitat to spawn in, which could
reduce their numbers and alter the
ecosystem.
This work would not have been possible without the support of the Skaggs Foundation, the Leightly Foundation, the Wilburforce Foundation, Edgerton Foundation, Alaska Conservation Foundation and Alaska Community Foundation. We are especially indebted to the following individuals: Sam Skaggs, Richard Nelson, Liz McKenzie, Clay Frick, Bill Leightly, Ken Leghorn, Lety Hopper and Daniel Schindler for their financial support, wisdom and guidance. We would like to thank Dave Albert for sharing his GIS-mapping expertise for this report. We also thank Jessica Menges, an Alaska Conservation Foundation intern, for her sablefish graphics. We are grateful for the support of our partners and colleagues at Alaska Longline Fishermen’s Association, Rivers without Borders.
### III. Key Habitats

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### VII. Conclusion
Executive Summary

Introduction: Southeast Alaska’s Natural Capital - SeaBank

SeaBank is a wealth of natural capital located in southeast Alaska: coastal-temperate rainforests, rich estuaries, megafauna, freshwater aquatic ecosystems fueled by glaciers and precipitation, and the near-shore and off-shore marine waters. This report focuses on the primary goods and services provided by SeaBank ecosystems: (1) the highest quality and most valuable seafood on the planet; (2) 11 million acres of forests that are a global champion in terms of carbon sequestration; (3) scenic and remote recreation experiences for hundreds of thousands of visitors each year who take away fishing stories and memories of pristine scenery ranging from rugged snow-capped mountains to glaciers and estuaries, viewing iconic marine mammals and terrestrial megafauna and (4) abundant wildlife populations utilized for subsistence, sport hunting and wildlife viewing.

This natural capital produces economic outputs from the seafood and visitor products industries worth several billion dollars a year to southeast Alaska residents, non-resident workers, visitors and society as a whole. Ecosystem services provide this stream of income as natural capital – a complex of plant and animal communities and their environment that interact as one functional unit – SeaBank.

SeaBank’s economic value is Alaska’s untold secret. Its annual fish dividend makes southeast Alaska the state’s leading region for commercial salmon production by volume, with commercial fishermen harvesting over 53 million salmon each year—24 million more than Bristol Bay. SeaBank’s scenery, fish and wildlife and remote recreation opportunities are assets that attract over 1.5 million visitors each year—two-thirds of all visitors to Alaska and more than any other region in the state. Both the seafood and visitor products industries rely on SeaBank’s natural capital. Any activities that reduce ecosystem services are likely to adversely impact these industries.
Coastal ecosystems such as SeaBank which combine estuaries, coral reefs, temperate rainforests and other high value natural capital, provide provisioning services such as salmon and other food products and amenity services for tourism and recreation. Coastal areas are the most economically productive ecosystems in the world– not only for coastal communities but also for national economies and global trade. Coastal ecosystems like SeaBank comprise only 8 percent of the planet’s surface but generate 43 percent of the global ecosystem service economic value.

Coastal areas are also vulnerable ecosystems experiencing rapid environmental change through developments that degrade high value habitats-- coastal forests, estuaries and, coral reefs. These changes heighten the need to maintain SeaBank’s natural capital in the face of a declining global capacity to produce ecosystem services due to habitat conversion for industrial uses.

Global biodiversity in particular is declining at unprecedented rate. This loss of biodiversity and habitat degradation will lead to long-term interruptions in the supply of natural capital for present and future generations. Climate change and an increasing human population exacerbate these risks.

In southeast Alaska, decision makers need better information on the full range of economic values provided by coastal ecosystem services. In particular, better accounting of ecosystem services should improve decision making related to conservation and ecosystem management– particularly between competing uses such as timber and mining developments versus maintenance of fishery and recreation resources. Is it better to use estuaries for raw log export transfer facilities or to maintain them intact and preserve their ecological capacity to function as nurseries for high-value fish and recreational uses? Are SeaBank’s old-growth and recovering, second growth forests more important for fishery production, wildlife habitat and recreation, or for near-term degradation by timber companies? Will long-term harm to salmon populations caused by toxic watershed pollutants released by mining companies exceed the value of extracted minerals? These narrow, short-term uses of natural capital are likely to reduce outputs from ecosystem services and harm coastal communities over time.

Coastal ecosystems like SeaBank comprise only 8 percent of the planet’s surface but generate 43 percent of global ecosystem service economic value...

SeaBank’s natural capital: value and sales

Natural capital generates ecosystem services which in turn produce both goods and services
which are major contributors to the economy. Ecosystem services fall in four main categories: provisioning (food, water, raw materials), regulating (air quality, climate, water flow, erosion prevention, etc.), habitat (i.e. juvenile fish nursery service, etc.) and cultural services (recreation, etc.). These services provide substantial benefits for humans. Because these services generate substantial economic value, the belief that habitat conservation is bad for the economy is often wrong. Natural capital yields dividends over an extended period of time, just like any other capital asset such as a fishing permit or commercial vessel. Indeed, natural capital can generate benefits in perpetuity.

Over the past several decades resource economists have worked to quantify economic values produced by natural capital and specific ecosystem services. Their research shows that the degradation of natural capital and ecosystem services caused by converting habitats to industrial uses for agriculture, logging or fish and shellfish farming causes a net economic loss. In other words, the value of long-term, lost economic benefits flowing from natural capital exceeds the value of uses that degrade natural capital. These findings should incentivize conservation of natural capital. However, there is an ongoing failure to adequately value ecosystem services combined with decisionmaking processes and government subsidies that favor habitat conversion for narrow, short-term benefits.

This report emphasizes sales and economic outputs flowing from SeaBank’s natural capital. Capturing the full Net Present Value (NPV) of the natural capital is beyond the scope of this report. However, for illustrative purposes, it is important to describe SeaBank assets using estimated values per biome calculated by

<table>
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<th>SeaBank Net Sales by Community: Top 2017 National Seafood Ports</th>
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<td><strong>Port</strong></td>
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<tr>
<td>Sitka</td>
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<tr>
<td>Ketchikan</td>
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<tr>
<td>Petersburg</td>
</tr>
<tr>
<td>Juneau</td>
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<tr>
<td>Wrangell</td>
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<tr>
<td>Yakutat</td>
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natural resource economists. Estimated global ecosystem service values for all biomes are between $125 and $145 trillion per year.

SeaBank’s largest natural capital asset is the coastal rainforest biome, which provides asset values for multiple ecosystem services valued at $3,000 per hectare. The value of SeaBank’s 11 million acres of forested natural capital may be worth over $13 billion generated by provisioning ecosystem services for wildlife, carbon sequestration, fish habitat and outdoor recreation. Freshwater rivers and lakes biomes also provide multiple ecosystem services with values of $4,257 per hectare. SeaBank’s 201,000 acres are worth nearly $363 million, providing fishery and recreation assets and other regulating services. The region’s three transboundary rivers alone are worth $1.2 billion over the next fifty years. Estuaries are among the most important and highly valuable areas for ecosystem services, supporting large numbers of fish, marine mammals, terrestrial mammals and avian species that depend on estuaries for a portion of their life cycle, particularly as juveniles, and sustain diverse flora and fauna. These services amount to $193,845 per hectare, or $22.3 billion for the 284,727 acres of SeaBank coastal wetlands. Coral reefs are the highest valued ecosystems at $353,000 per hectare; there are 5,693 hectares of coral habitat protected areas in the offshore SeaBank worth nearly $2 billion.

Southeast Alaska’s commercial seafood harvesting and processing industry is one of the region’s two largest private sector economies and depends on ecosystem services provided by all SeaBank biomes. Recent economic studies show that SeaBank’s natural capital can produce over 300 million pounds of seafood a year, generating over 8,000 harvesting and processing jobs with between $380 million and $500 million in earnings, with an

| SeaBank Sales: 2017 Estimated Visitor Products Industry Sales | |
|---------------------------------------------------------------|
| **Asset** | **Visitor Spending** | **Jobs** | **Labor Income** | **# of visitors** |
| SeaBank | $705,000,000 | 11,925 | $445,000,000 | 1,500,000 |
| Wildlife: hunting & viewing | $363,000,000 | 2,460 | $138,000,000 | 1,300,000* |
| Sport fishing | $247,000,000 | 3,063 | $99,000,000 | 500,000 + angler days* |
| Glacier Bay | $113,000,000 | 2,090 | $58,700,000 | 547,000 |
| Transboundary rivers | $21,500,000 | 200 | $10,500,000 | 50,000 |
| *includes residents | | | | |

SeaBank Net Sales by Community: 2017 Commercial Fishery Harvests

<table>
<thead>
<tr>
<th>Product</th>
<th>Sales (millions of pounds)</th>
<th>Ex-vessel Earnings</th>
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<tbody>
<tr>
<td>Halibut &amp; sablefish</td>
<td>13.4 million pounds</td>
<td>$63.8 million</td>
</tr>
<tr>
<td>Dungeness crab (2018)</td>
<td>4.0 million pounds</td>
<td>$12.2 million</td>
</tr>
<tr>
<td>Shellfish</td>
<td>2.6 million pounds</td>
<td>$13.4 million</td>
</tr>
<tr>
<td>Salmon</td>
<td>247 million pounds</td>
<td>169 million</td>
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estimated $700 million total economic impact on the region. Six of the top 100 seafood producing ports in the United States rely on SeaBank’s natural capital.

Southeast Alaska’s other top private sector economy is the visitor products industry, providing a $1 billion economic impact when including indirect and multiplier economic impacts. Coastal tourism is one of fastest growing global economic sectors and relies on ecosystem services provided by scenery and opportunities for outdoor adventure and wildlife viewing. SeaBank’s natural capital provides significant competitive advantages for the visitor products economy which include intact ecosystems, dramatic attractions such as glaciers, salmon streams, scenery, marine mammals and iconic terrestrial megafauna such as bears. A decreasing global supply of high-quality outdoor recreation opportunities is likely to increase the value of these assets, which are stimulating rapid growth in nature-based tourism in southeast Alaska.

The following report seeks to identify and quantify economic outputs from SeaBank’s natural capital in order to inform improved decision making so as to maximize economic outputs for the benefit of coastal residents and the millions of Americans who enjoy its scenery, seafood and wildlife.
A resource hub for southeast Alaska’s natural capital
Southeast Alaska is a single, vast, highly productive ecosystem that extends from mountaintop to open ocean. Everything is tightly interconnected: the land, water, vegetation, wildlife, resources, economies and culture. The Alaska Sustainable Fisheries Trust (ASFT) program, SeaBank, was created to tell the story of the contribution of ecosystem services to the economic and lifestyle needs of southeast Alaska residents.

**...this natural ecosystem functions as a richly endowed bank that provides the natural capital essential to the regional economy.**

For the communities of Alaska’s Panhandle, this natural ecosystem functions as a richly endowed bank that provides the natural capital essential to the regional economy. Unlike ordinary business enterprises, the Southeast ecosystem bank requires no human input, no equipment, and no built infrastructure of any kind, yet it produces over a billion dollars in economic outputs flowing from fishery, wildlife, and recreation resources every year. Southeast Alaska’s ecosystem can continue to provide these long-term annual dividends with responsible management of harvests and ecosystems. The goal of ASFT’s SeaBank program is to make people aware of southeast Alaska’s natural bank, to measure the huge annual capital that it provides, to quantify its value to shareholders, and to empower residents, visitors and policy makers to make sound long-term decisions that promote stewardship and sustainable economics.

This first annual SeaBank report serves as a base-line for:

- Understanding the processes that create the wealth of resources southeast Alaska’s ecosystem provides;
- Identifying habitats or geographic locations that are important to sustained production of these resources;
- Assessing the value of these resources in both monetary and non-monetary terms to the people who live within and outside this island region;
- Identifying risk factors to the sustainability of these resources a the communities that depend on them;
- Highlighting recent work that deepens our understanding of this remarkable ecosystem and its value.

This first annual report captures in economic terms the ecological services and resource wealth of the southeast ecosystem. Subsequent annual reports will strive to capture the cultural richness and the complex contribution of personal use and subsistence hunting, fishing and gathering.

**II. Ecology--SeaBank’s Value Creation Process**

Southeast Alaska’s northernmost boundary is
at Icy Bay, north of Yakutat and the region extends south to Dixon Entrance at the border with British Columbia. Roughly 20,000 years ago, glaciers covered most of southeast Alaska. The receding glaciers carved out all of the straits and inlets in southeast Alaska’s inside passage. Glacial retreat resulted in a terrain of steep mountains and glacial valleys. Today, this 21.6 million-acre terrestrial environment includes hundreds of islands of all sizes (the Alexander Archipelago) and a coastal mainland characterized by steep mountains interspersed with glaciers and ice fields. Admiralty, Baranof, Chichagof and Prince of Wales islands are four of the ten largest islands in the United States.

Forests cover over half of the land area and the remainder is rock, ice, unforested alpine country, and muskeg. Aquatic ecosystems include large transboundary rivers on the mainland and streams of all sizes are scattered throughout the region, including 14,000 miles of anadromous or potentially anadromous salmon habitat. The region has 11,861 square miles of estuarine habitat, making it one of the largest estuarine systems in the world. A highly scenic marine highway consisting of deep fiords, large straits, narrow channels and inlets provides the transportation infrastructure that allows access to 18,000 miles of marine shoreline.
Southeast Alaska’s marine environment has approximately 160,000 square kilometers of continental shelf and a variety of sea bed types, and many banks and reefs. Offshore marine waters include large areas of living substrate, including slow growing, deep water corals, such as gorgonian red tree coral, that are valuable for fish habitat.

The Alaska Coastal Current moderates the region’s climate by providing warmer winter sea temperatures and cooling the area in the winter. A warm, Japanese ocean current and high coastal mountains combine to form a cool, wet environment. Temperatures remain within a narrow range, fluctuating on average by only 24 degrees Fahrenheit between winter and summer. It is cloudy for most of the year, with abundant precipitation that drains into over 40,000 miles of streams and 20,000 lakes and ponds. The precipitation—mostly snowpacks—fills the region’s non-glacial watersheds. Precipitation and discharge patterns that influence temperature, spawning patterns and spawning success positively influence the region’s abundant salmon populations by creating a freshwater nursery and fish factory the comprise southeast Alaska’s most valuable natural capital.

Marine weather patterns are important to productivity. Winter storms mix the water column and distribute nutrients. As the weather calms in the spring and the days get longer, boundary layers form in the water column creating lenses for the plankton blooms that form the basis for overall marine biological productivity. The Pacific Decadal Oscillation, which shifts oceanic circulation patterns, creates extended warm and cold phases that also affect productivity. Other sea surface temperature trends can affect cyclical weather changes. Inter-annual and inter-decadal climate variability and associated ecological fluctuations govern positive and negative changes in the abundance and distribution of marine fishery resources.

III. Key Habitats

The key habitats that comprise southeast Alaska’s SeaBank are coastal-temperate rainforests, rich estuaries, freshwater aquatic ecosystems fueled by glaciers and precipitation, and the near-shore and off-shore marine waters.

Coastal-temperate rainforests are globally significant ecosystems and provide habitat for a large number and diversity of species. Southeast Alaska and coastal British Columbia comprise the largest temperate rainforest in the world and roughly half of the global temperate rainforest on the planet. Southeast Alaska’s remaining old-growth temperate rainforests support fish and wildlife species that are no longer abundant or even extirpated from other forested habitats. In addition to values for fish and wildlife, SeaBank rainforests provide a vital ecosystem service by sequestering carbon and storing it in trees, soils and plants.

Estuaries provide important resource values for nearly all southeast Alaska’s fish and wildlife assets—marine and anadromous fish, invertebrates, plants, avian species and both terrestrial and marine mammals. Estuaries are particularly critical as nursery areas for juvenile salmon. There are 11,861 square miles of estuarine habitat in the Alexander Archipelago, making it one of the largest and most complex estuarine systems in the world. The largest
estuaries are on the mainland, including the 29,180-acre Stikine River Delta. The Yakutat Forelands and the Stikine River Delta in particular are critical natural resource areas that support dozens of species of migratory birds. Estuaries are also crucial shellfish and salmon spawning areas.

The most productive estuarine habitats feature submerged vegetation such as eelgrass and kelp that provide food resources, cover and nursery habitat for more than fifty fish species, including herring, juvenile rockfish and juvenile salmon. Vegetated estuarine areas have higher species richness, diversity and fish abundance than unvegetated areas. Eelgrass grows in soft substrates of sand or mud and is the dominant vegetation in most of southeast Alaska’s estuaries, occupying nearly twenty percent of the southeast Alaska coast. The most dominant kelp species is L. saccharina, a brown kelp that grows as dense, low-lying mats on rocky substrates. Eelgrass is the more common vegetation in inside protected bays and inlets with freshwater influence. Kelp sites are more oceanic and located in exposed locations at the mouths of bays.

Kelp and eelgrass habitats are important rearing and nursery areas for juvenile fish and are vital to the production of fishery resources because they provide habitat for high value commercial and forage fish species. Scientists believe that eelgrass may be essential for rearing and spawning due to use by herring as spawning substrate and the high abundance of salmon fry and juvenile rockfish that exhibit high levels of seasonal use, particularly during spring and summer. Shoreline developments have a significant potential to adversely impact these habitats, making it critical to identify key areas in order to conserve fish habitat.

Major freshwater aquatic ecosystems include three large transboundary watersheds on the southeast Alaska mainland— the Taku, Stikine and Unuk River watersheds flow from British Columbia into southeast Alaska. Glacial watersheds are distinct from watersheds filled by precipitation and account for nearly a third of the freshwater discharge in Alaska. Nearly half the water flowing into the Gulf of Alaska comes from glaciers and ice fields.

**Southeast Alaska has a global reputation for its beauty and wildness...**

Near shore habitat in southern southeast Alaska consists of rocky shores, protected inlets and deep fjords, large kelp beds, and sandy bays. Northern southeast Alaska includes the outer coast of Glacier Bay National Park and miles of exposed rocky shoreline with few accessible coves, glaciers that calve into the ocean, and a backdrop of steep mountains.

The near shore continental shelf is rocky with significant depth relief, but in most areas tapers to a broad flat plain 2-10 miles wide with a depth ranging from 100’ to 600’ before transitioning to a steep, highly convoluted continental slope. The slope region is 2-3 miles wide, and the water depth rapidly transitions from 600’ to 5,000’ feet before the seafloor flattens into the abyssal plain. The proximity of the productive deep-water shelf/slope region to shore is a unique feature of the southeast Gulf of Alaska, and one that makes the Southeast fishing grounds accessible to small-scale fishermen.
Overview

Southeast Alaska has a global reputation for its beauty and wilderness, but its economic value is often overlooked. If reserved for well-managed and sustainable uses, SeaBank capital will provide long term annual dividends—ecosystem services and resources—that enrich residents, visitors, the national economy and the planet as a whole.

The Gulf of Alaska is a highly productive marine ecosystem of global significance, providing habitat for fish, shellfish and marine mammals. Southeast Alaska’s watersheds and coastal temperate rainforests provide valuable natural resource assets for commercial and sport fishing, visitor products, and local recreational use.

Each year, fishermen harvest over 300 million pounds of seafood in southeast Alaska, worth over a billion dollars and supporting more than 10,000 jobs. Over 1.5 million tourists visit Southeast each year, supporting nearly 8,000 jobs and generating another billion dollars to the local economy.

Consumptive and non-consumptive uses of the region’s wildlife are valuable for both quality of life in the region and the economy. Alaska Department of Fish and Game studies show that Alaska residents and visitors spend over $300 million on hunting and wildlife viewing in the region.

The Resources

Southeast Alaska’s marine environment and productive estuaries support numerous salmon, shellfish and finfish species. Fishermen harvest all five species of salmon in southeast Alaska, along with a plethora of finfish, including halibut, sablefish, rockfish and herring. Shellfish, crab, and shrimp are also important for subsistence, sport and commercial purposes. Marine and terrestrial mammals have high value for subsistence, sport and personal use hunting and wildlife viewing.

The Tlingit, Haida and Tsimshian people have inhabited southeast Alaska and coastal British Columbia since time immemorial. Their cultures are diverse, complex and deeply connected to the resources of the ocean, estuaries, rocky shores and forests. Over the next year, SeaBank will work with appropriate tribal partners to provide an overview of these cultures and their relationship, management, and utilization of Southeast resources.
Salmon

Some of the most important annual dividends from the SeaBank include the most productive and highly valued salmon fisheries in the world: commercial salmon fisheries, sport fisheries and subsistence harvests that sustain Alaska native cultures. One of the most productive salmon producing regions in the world, SeaBank assets include nearly 14,000 miles of anadromous or potentially anadromous salmon habitat. Approximately 5,500 individual streams and tributaries support salmon with varying levels of productivity. The mainland transboundary rivers, the Alexander Archipelago island ecosystems, and the Yakutat area from Cape Fairweather to Cape Suckling, are the three broad and distinct areas that produce salmon. The wide range of available habitat buffers against variability in marine, estuarine and freshwater conditions. Numerous Pacific salmon stocks from Canada to California are declining or even facing extinction risks because of habitat loss. In contrast, SeaBank retains numerous watersheds that remain intact, making it a refuge for large proportion of wild salmon stocks remaining in the Pacific Northwest.

Salmon depend on both marine and freshwater environments. Spawning and rearing mostly occur in freshwater streams, and juvenile fish then migrate to the marine environment to feed and mature before returning to natal streams to reproduce. Most watersheds in southeast Alaska provide habit for multiple species of anadromous fish. Each species utilizes available habitat in different ways and at different times—pink and chum salmon spawn first, beginning in early July. Adult coho return to southeast Alaska’s outer coast during the summer and spawn throughout the fall. Sockeye and Chinook return to spawn in late spring/early summer.

Forests are vital to the productivity of aquatic ecosystems by controlling sediment inputs and regulating stream temperatures. Salmon harvests have fluctuated significantly over the past decade, particularly pink salmon catches. The productivity of marine habitat is variable and cyclical, increasing the importance of freshwater habitat and the buffering of forests in order to maintain salmon populations during times of unfavorable ocean conditions.

The three transboundary rivers produce all five salmon species and have historically supported commercial fishery harvests of nearly half a million fish per year. Some of the most economically valuable salmon species—coho and sockeye salmon—comprise the largest numbers of fish spawning in the transboundary rivers. The most productive island ecosystems for salmon are north Prince of Wales Island, Kupreanof/Mitkof Islands, Revilla Island and East Chichagof Island. Prince of Wales Island provides over a thousand miles of pink salmon streams, eastern Chichagof Island has 825 stream miles and Revilla/Cleveland Peninsula and Kupreanof/Mitkof Island each provide over 500 stream miles. Coho utilize a broad range of small stream habitats and Prince of Wales Island has more coho salmon habitat than any other biogeographic province in the region with 1,904 stream miles. The Yakutat Forelands and other large mainland systems also highly productive for coho and sockeye. Southeast wild Chinook rely on major transboundary river systems throughout the region.
**Chinook salmon** (Oncorhynchus tshawytscha) Mainland river systems and their tributaries provide spawning and rearing habitat for most of southeast Alaska’s 85 Chinook salmon stocks. The Taku River and Stikine River support the largest populations overall. Mainland systems near Haines (Chilkat River), Yakutat (Alsek and Situk Rivers) and Ketchikan (Unuk and Chickamin) support other major stocks. Most juvenile Chinook salmon rear in freshwater habitat for at least a year before maturing in the marine environment for three or four years and returning to spawn. Taku, Stikine, Alsek and Situk river stocks are “outside” rearing and spend most of their marine life-cycle in the Gulf of Alaska and Bering Sea. Chilkat River and mainland river stocks near Ketchikan rear in nearshore marine waters in southeast Alaska. Estuaries are likely important rearing areas for “inside” rearing juvenile fish. Chinook salmon are more susceptible to stock declines because of their smaller population size and specific habitat needs.

**Coho salmon** (Oncorhynchus kisutch) inhabit freshwater ecosystems for at least a year before migrating to the marine environment, and most juveniles will remain in freshwater for two years. The availability of rearing habitat—small streams, ponds, lakes and off-channel areas—is a key factor in the viability of coho populations and makes them vulnerable to changes in freshwater habitat. After rearing, coho typically spend 16 months in the marine environment before returning to the southeast Alaska’s outer coast during the summer and spawning in the fall.

Southeast Alaska provides habitat for more than 2,300 coho stocks. There are four thousand streams, large mainland rivers, and thirteen hatcheries that produce coho salmon in southeast Alaska. The majority of the stocks are small populations of less than 1,000 spawners that utilize small to medium stream systems which support 60 percent of the annual return. Larger mainland systems such as the Chilkat River, Taku River, Tsiu-Tsiyat system near Yakutat, and Stikine River support the largest stocks in the region. North Prince of Wales Island provides 1,904 stream miles of coho habitat, making it the most important island ecosystem for cohos. Scientists believe that North Prince of Wales Island karst landscapes are particularly productive for coho.

**Sockeye salmon** (Oncorhynchus nerka) can utilize various freshwater habitat types but most of southeast Alaska’s roughly 200 sockeye stocks spawn in systems that include lakes. Lake-type juveniles often spend 1 to 3 years rearing in lakes. Juvenile sockeye typically leave freshwater systems in the late spring and spend two to three years in the marine environment before returning to spawn. Primary producers of sockeye include the Alsek, and Situk river systems near Yakutat,
Chilkat River, the mainland transboundary rivers (Taku and Stikine), and lake systems near Ketchikan. Prince of Wales Island provides the most sockeye habitat of any island ecosystem.

Chum Salmon (Oncorhynchus keta) also known as dog salmon, are the second largest salmon in Alaska and the most widely distributed of all the Pacific salmon. Like most other Pacific salmon species, chum salmon spend most of their life feeding in saltwater, then return to freshwater when mature to spawn during the summer months. Most chum salmon populations do not travel far upstream to spawn. Since the 1980s, commercial chum salmon harvests in Alaska have more than doubled as a result of the Alaska hatchery program.

Pink salmon (Oncorhynchus gorbuscha) utilize over 2,500 smaller streams in the region for spawning. Stocks have a distinct separation between the northern and southern portions of southeast Alaska. Commercial fishing regulatory districts in southern southeast Alaska – especially Area 2 adjacent to Prince of Wales Island and Area 1 near Ketchikan provide the majority of the pink salmon harvest during the even year cycle and in some years as much as ninety percent of the harvest. Odd year cycles are generally more productive for pink salmon than even year cycles.

Herring

Pacific Herring (Clupea pallasii) are a major schooling forage fish in Southeast Alaska. Herring reach sexually maturity at 3-4 years of age and spawn every year after reaching maturity. Spawning occurs in the spring in shallow, vegetated areas in intertidal and subtidal zones. The eggs are adhesive and attach to vegetation or the bottom substrate. Eggs hatch about two weeks after fertilization and the young larvae drift and swim in the ocean currents. Once the larvae undergo metamorphosis into their juvenile stage, they rear in sheltered bays and inlets. In the fall, the schools of juveniles move to deeper water where they will spend the next 2-3 years.

Alaska’s commercial herring industry began in 1878 with a 30,000-pound harvest for human consumption. By 1882, a reduction plant at Killisnoo in Chatham Strait was producing 30,000 gallons of herring oil. Reduction plants were built throughout the Southeast region. In 1929 herring seiners harvested a record 78,745 tons of herring for all uses, including bait. These intensive harvests continued for three decades, and populations plummeted. By 1967 the fishery crashed. Substantial harvest for sac roe, or herring eggs, began in southeast Alaska in 1971 and expanded up the Alaska coast to Norton Sound. Seiners also harvest herring for use as bait in the halibut,
groundfish, crab, and salmon troll fisheries.

Environmental changes likely drive major fluctuations in herring stocks. A threat to Pacific herring is the loss of spawning grounds. Dredging, construction activities, log storage facilities, oilspills and reduced water quality have degraded or destroyed herring spawning habitat. Global warming may also pose a threat to herring by reducing the availability of their prey: zooplankton and phytoplankton. In addition, the recovery of populations of predator species, such as humpback whales, may impact herring populations.

**Halibut**

**Pacific halibut** (*Hippoglossus stenolepis*) live on or near the continental shelf through much of the northern Pacific Ocean. Halibut typically live near the bottom over a variety of benthic habitats and sometimes swim up in the water column to feed. They usually inhabit waters between 20’ and 1,000’ deep, but will occupy depths up to 3,600’. Halibut are laterally flat, and swim sideways, with one side facing down and the other facing up. The upper side is typically gray to brown, or nearly black, with mottling and numerous spots to blend in with a sandy or muddy bottom. The maximum reported size is over eight feet in length and over 500 pounds.

Halibut are a long-lived species with individuals up to twenty years old caught in the commercial fishery. Female halibut grow faster and reach larger sizes than male halibut. Male halibut rarely reach a length of three feet. Halibut size-at-age has changed over time. For example, the average length and weight of halibut of each age increased from the 1920s to the 1970s and has decreased since then. By the 2000s, 12-year-old halibut were about three-quarters the length and about one-half the weight they were in the 1980s. Reasons for changes in size-at-age are unknown.

Most male halibut are sexually mature by about eight years of age, while half of the females are mature by about age 12. Most halibut spawn during the period November through March, at depths of 300 to 1,500 feet. Larvae initially drift with deep ocean currents. As the larvae mature, they move higher in the water column and ride surface currents to shallower, more nourishing coastal waters. Juvenile and some adult halibut migrate generally eastward and southward, into the Gulf of Alaska coastal current, countering the westward drift of eggs and larvae. Halibut tagged in the Bering Sea have migrated as far south as the coast of Oregon – a trip of over 2,000 miles. Because of the extensive movements of juvenile and adult halibut, fishery managers assess the entire population as a single stock. The proportion of the coastwide halibut stock inhabiting southeast Alaska’s marine environment (IPHC regulatory areas 2C and 3A) has been slowly increasing over the past decade.

**Sablefish**

**Sablefish** (*Anoplopoma fimbria*), also known as blackcod, are a groundfish species with a range that spans the North Pacific coast from Baja Mexico to Alaska, with the highest abundance centered in the Gulf of Alaska. Sablefish are a highly migratory, long-lived species with individuals up to forty years old commonly caught in the commercial fishery. Adult sablefish utilize a variety of deep water benthic habitats, ranging from 600’ to 4,800’, along the continental slope, in shelf gullies, or in fjords. There are two related populations that inhabit southeast Alaska’s inside waters in
Sablefish migration in the Gulf of Alaska. Original graphic by Jessica Menges done through Alaska Conservation Foundation internship. Migration information provided by Dan Falvey.

To enlarge these and to view more maps visit seabank.org.

Sablefish vertical migration in the water column at different life stages. Original graphic by Jessica Menges done through Alaska Conservation Foundation internship. Migration information provided by Dan Falvey.
Clarence Straits and Chatham Straits and support state-managed fisheries. Sablefish reach reproductive maturity when five to seven years old and spawn annually thereafter. Spawning occurs in deep water (900’ to 1,800’) in winter or spring in Alaska. Eggs develop at depth and larvae drift in surface waters. Southeast Alaska’s nearshore waters provide important habitat for juvenile sablefish that drift inshore during their first year and utilize nearshore pelagic habitats where they grow rapidly and remain until moving back into deeper water around age two. Sablefish settle into their deep water adult habitat at four to five years of age, when they become reproductive. The southeast Alaska portion of the Gulf of Alaska provides habitat for more than a third of the harvestable sablefish stock and a quarter of the total biomass.

**Rockfish**

**Rockfish** (Sebastes Sp.) are among the longest-living vertebrates on earth. Non-pelagic species generally live longer than pelagic species. Yelloweye rockfish, for example, reach ages over 100 years. Rougheye and shortraker rockfish occasionally exceed 150 years of age. Most rockfishes do not start reproducing until they are at least 5-7 years old, and some may not reproduce until they’re 15-20 years old. Juvenile rockfish associate with complex habitat such as rockpiles and pinnacles. As juvenile fish grow and mature they move to adult habitats in deeper water (40-150 fathoms). Most rockfish species rely on an internal air bladder for buoyancy, which minimizes energetic requirements underwater but results in barotrauma and mortality in rockfish brought to the surface.

Oceanographic factors such as temperature, currents, and food availability affect the survival of larval rockfish. Rockfish have evolved to be long-lived and produce millions of offspring each year, allowing their populations to persist through long periods where conditions are unfavorable for survival of offspring. Because they are slow growing and long-lived, rockfish populations are vulnerable to excessive harvest.

**Shellfish- crab, shrimp, geoducks, and sea cucumbers**

**Dungeness crab** (Cancer magister) utilize shallow mud and sand substrate habitats throughout southeast Alaska, occupying both marine and estuarine waters. Dungeness crab Egg-bearing females use nearshore substrates when incubating eggs. Shallow coastal water habitat and estuaries are the most important habitat for juveniles and young adults and support the highest densities of juvenile Dungeness crab. Estuarine habitats contain higher prey densities for juveniles and intertidal vegetation that provides protection from predators. The Stikine River flats are one of the most important habitats, supporting a stock that contributes substantially to overall harvests. Other high productivity areas include Duncan Canal near Petersburg, Ernest Sound near Wrangell, West Kuiu Island, and Stephens Passage. Southeast Alaska is the northernmost area inhabited by Dungeness crab.

**Spot shrimp** (Pandalus platyceros) occur throughout the North Pacific Ocean and utilize primarily hard-bottom marine habitats. Limited information exists regarding the species’ life history. Juvenile shrimp use shallow water habitats and migrate as they grow to deeper rocky habitats or coral reefs. They prefer a narrow temperature range and are sensitive to
increases in water temperature. Spot shrimp are hermaphroditic and transition from male to female in the second or third year of life. Fishery managers hypothesize that southeast Alaska’s spot shrimp may live longer and grow larger because of influence of colder waters.

The largest populations occur near Ketchikan (Behm Canal, Boca de Quadra), Cordova Bay, and Ernest Sound and northern Clarence Straits near Wrangell but there are smaller, harvestable populations throughout the region. In recent years, the Alaska Department of Fish and Game has reduced harvests in some of the more productive areas in response to declines in abundance and catch efficiency.

Geoduck clams (Panopea generosa) and sea cucumbers (Holothuroidea) are the two most important species for the region’s dive fisheries. Both species are most abundant in protected bays and inlets on the outside coast. Geoduck habitat exists throughout southern southeast Alaska and around Baranof Island, with the highest densities occurring around islands west of Craig. Southeast Alaska is the northernmost portion of geoduck’s range. Sea cucumbers occur throughout southern southeast Alaska and around Sitka and in Chatham Straits. Alaska’s sea cucumbers are larger and have a high nutritional value. They use a range of habitats, most commonly shell debris and gravel substrates.

Marine Mammals

Whales and dolphins (Cetacea) are marine mammals that utilize southeast Alaska’s environment. Eight species of whales occur in Alaska’s cold waters, with five species regularly or seasonally occurring in Southeast Alaska: humpback, gray, orca, minke, fin and sperm whales. Humpback whales feed heavily off Southeast Alaska throughout the year. Mature adults travel in the winter to the warm Hawaiian waters to breed and calve. Gray whales migrate through coastal southeast Alaska en route from Baja California to the Arctic each spring and back in the fall, with the average adult gray whale traveling 400,000 miles over its lifetime. Immature male sperm whales, one of the toothed whales found off Southeast, frequent the deep waters of the continental shelf and slope, feeding on giant squid, sablefish and other fish captured during dives that can last up to two hours. Minke whales are the smallest of the baleen whales; they are generally solitary but inquisitive. Commercial whaling decimated fin whale populations during the 1800s and they remain critically endangered.

Orca whales (Orcinus orca) are found on the continental shelf of Southeast Alaska through the Aleutian Islands and both Chukchi and Beaufort seas. The orca is actually the world’s largest dolphin. Scientists have identified three ecotypes of killer whales in the North Pacific Ocean. Differences in the movement patterns among the three orca ecotypes found in Alaska have led, in part, to their names; i.e., “resident,” “transient,” and “offshore.” Resident killer whales prey primarily on fish. Transients eat marine mammals and offshore orcas likely prey primarily on fish and even sharks. Ecologists estimate that there may be several hundred orcas inhabiting southeast Alaska year-round. Black and white Dall porpoises look like miniature orcas and are abundant in the region, as are harbor porpoises.

Steller Sealions (Eumetopias jubatus) are the largest member of the eared seal family. Steller sea lions are generalist marine predators with a diet of fishes and cephalopods that tends to be predictable by season and region, with the
occasional meal of bird or true seal for variety. Populations plummeted during the 1980s for reasons that remain hotly disputed. NMFS identified two distinct populations of Steller sea lion stocks during the 1990s based on genetic and regional differences. The agency designated the Western Stock as endangered and the Eastern stock as threatened pursuant to the Endangered Species Act, but delisted the Eastern Stock in 2013. The southeast Alaska coast provides roughly 50 haul out sites and breeding rookeries, including the largest Steller’s sea lion rookery in the world, Forrester Island. Harbor seals are the other most abundant pinniped and utilize the entire southeast Alaska coast, with the greatest concentrations in Glacier Bay National Park, outer coast of Chichagof Island, and in glacier fed bays along the mainland. Harbor seals favor estuaries for fishing and tidewater glaciers for other habitat needs, particularly seal-pupping.

**Sea Otters (Enhydra lutris kenyoni)**
Commercial harvests of sea otters in the fur trade grew rapidly after Russian explorers arrived in Alaska in 1741. By the 1800s, hunters had nearly extirpated the species throughout its range, including southeast Alaska. In 1965, sea otters were translocated from Amchitka Island (Aleutian Islands) to the outer coast of southeast Alaska. Sea otters are now abundant in the region. Sea otters forage in relatively shallow coastal waters for a variety or marine species, including mussels, clams, sea urchins, crabs, and occasionally fish. They rely on their high metabolism and incredibly dense fur for warmth (up to 1 million hairs per square inch). In order to maintain its body weight, a sea otter must eat 25% of its body weight per day. Sea otters have successfully reestablished themselves in Southeast and are now fierce competitors with divers and crabbers for urchins, abalone and crab.

**Terrestrial Mammals**

Southeast Alaska island ecosystems provide a wide range of habitat values for terrestrial wildlife species. North Prince of Wales Island and Admiralty Island have particularly high biological values for large-tree forests, bear, salmon and deer habitat. Southeast Alaska rainforests differ from most regions in North America because they retain most of the wildlife species that have been here for centuries. **Sitka black-tailed deer** (*Odocoileus hemionus*) are an important ecological indicator species in southeast Alaska because of their well-known relationship to the ecosystem, need for large home ranges, dependence on old-growth forests and multiple habitats and status as game and subsistence species. They are a subspecies of mule deer adapted to northern Pacific old-growth rainforests. They are present throughout southeast Alaska and occur on nearly every island in the Alexander Archipelago but are rare to non-existent along the mainland coast.

Scientists have recognized that Sitka black-tailed deer have a particular dependence on old-growth forests in southeast Alaska because it functions as winter range and provides protection from predators. One of the most critical habitat features for deer is the presence of large-blocks of low elevation, intact old growth forest in areas with more southerly exposure. Old-growth forests provide winter forage and intercept snowfall, making forage available to deer during periods of deep snow. Maintaining sufficient amount of forested habitat that provides snow interception and forage is critical to maintaining annual deer dividends. Beach fringe forest is one of the most important habitats as the final refuge for
deer moving to low elevations in times of deep snow. Young clearcuts do provide abundant forage during snow free periods, but within several decades the newly growing forests shade out understory plants used by foraging deer, creating large areas that will be unsuitable, sterile habitat for over a century. Black bears and brown bears both inhabit the coastal mainland but rarely overlap on island ecosystems. **Black bear** (*Ursus americanus*) are present along the entire mainland coast and inhabit most Alexander Archipelago islands south of Frederick Sound. **Brown bears** (*Ursus arctos*) also occur on the entire mainland coast—especially along major river systems—and the “ABC” islands north of Frederick Sound—Admiralty, Baranof and Chichagof. Both bear species are umbrella species with large area requirements and varied habitat uses, including riparian areas, estuaries and old-growth forests. The health of southeast Alaska’s bear populations is an indicator of overall ecosystem integrity. Hunters harvest both species which return dividends because of their values for hunting, recreation and tourism.

Riparian areas provide important habitat, especially during the late summer when bears concentrate along anadromous fish-bearing streams to harvest salmon. Forested buffers alongside these streams are critical, especially for females. Bears also utilize estuaries and beach fringe habitat for seasonal foraging needs. Bears are vegetarian and carnivorous at different times, eating vegetation during early spring, deer fawns in late May and June, and consuming large quantities of salmon when available during summer and fall.

Salmon abundance in general results in larger, healthier bears and is critical to successful reproduction. Bears have the highest vulnerability to human activities in low elevation riparian areas during summer months.

Wildlife managers believe that black bears select for large-tree old-growth forest habitat and expect black bear populations to decline with further losses of old-growth forest. The availability of adequate den sites to black bear survivability and reproductive success is critical. There is considerable re-use of existing den sites, which may indicate in part a lack of adequate alternative sites.

### IV. Assessing the value of the southeast Alaska’s SeaBank resources to the people and communities within and outside the region

There are approximately 72,000 people living in southeast Alaska’s 33 communities with two-thirds of the population living in Juneau, Ketchikan and Sitka. The public sector is the largest employer, providing jobs for 13,602 residents, or 20 percent of the population. The two top private sector economies are the visitor industry and the commercial fishing / seafood industry which employ 11,295 residents. These two economic sectors rely heavily on the region’s resources—scenery, forests, shorelines, terrestrial and marine wildlife and especially salmon.

32,000 people live in the state’s capital and southeast Alaska’s largest city, Juneau. Juneau has a highly diversified economy that includes government, tourism, seafood, trades, education, and transportation. Ketchikan is the second largest community in southeast Alaska with 13,754 residents, and serves as a hub for the surrounding communities in the region. As
the southernmost gateway community to the region, the visitor products industry has an important role in its diverse economy, which also includes government, fishing and trade. With just under 9,000 residents, Sitka is the third most populous community in southeast. Sitka’s location on the outer coast of Baranof Island facilitates access to the Gulf of Alaska’s marine resources, which contribute to a diverse economy largely reliant on the visitor products and fishing industries, with other economic drivers including health care and education.

Commercial fishing and visitor products industry economies are economic drivers for northern southeast Alaska communities. The northernmost community in southeast Alaska is Yakutat, a community of 662 that has a strong foundation in commercial fishing. Haines, Klukwan, and Skagway are Lynn Canal communities in the north end of the region. Haines and Skagway each have roads that connect Alaska with British Columbia, though not each other. Tourism dominates Skagway’s economy. Commercial and subsistence fishing are the foundation for Klukwan, a Tlingit village. Haines also depends on a mix of commercial fishing and a growing visitor products industry. Hoonah and Gustavus along Icy Strait are gateway communities to Glacier Bay National Park and have strong commercial fishing and visitor products economies. Hoonah is a major cruise ship destination.

The largest central southeast Alaska communities are Petersburg and Wrangell. Petersburg has approximately 3,000 residents and has a strong seafood and fishing economy. Tourism has increased recently with fishing lodges and fishing charter businesses. Wrangell is an attraction to visitors as the gateway community to the Stikine River and has a diverse fishery economy. Wrangell’s population has slowly grown since 2006 to 2,406 residents. The native village of Kake is the third largest community in central southeast Alaska. Kake’s economy has traditionally relied on a mix of fishing and subsistence, but the community is becoming an increasing attraction for visitors as a gateway community to recreation opportunities in Frederick Sound, Chatham Strait and the adjacent coastlines. The population of Kake has grown since 2010 to 626 residents.

The Prince of Wales-Hyder Census Area is the southernmost portion of the region and extends from Prince of Wales Island to the community of Hyder at the British Columbia border. There are 5,500 residents in the larger communities of Craig, Klawock, Metlakatla and Thorne Bay and in numerous smaller fishing villages or former logging communities dispersed along the census area coastlines. Commercial fishing and nature-based tourism are vitally important to most of these communities. A McDowell group survey reports that 79% of all tourists who visit Prince of Wales intend on returning within five years.

The Subsistence Economy

Subsistence and personal use hunting, fishing, and harvesting are particularly important to rural and coastal communities because wild food harvests have a significant role in rural community food supply. For Native Alaskans, subsistence harvesting is also part of cultural values and traditions that involve the communal gathering and sharing of harvested resources, relationships with the environment, and artistic endeavors.

Federal and state laws divide wild food harvest uses into non-subsistence urban areas and
rural subsistence areas. All southeast Alaska communities other than Ketchikan and Juneau are rural, subsistence areas.

Indeed, seven out of the top 100 fishing ports by value in the entire country are southeast Alaskan communities.

According to a 2012 update on wild food harvests, the 6.7 million pounds of wild foods harvested in southeast Alaska’s rural and urban areas (Ketchikan and Juneau) amounts to between $27-$53 million annually in equivalent retail purchases. A diet rich in traditional foods also improves glucose tolerance and lipid profiles, lowers risk of cardiovascular disease, and generally contributes to a higher quality diet.

Subsistence food is collected throughout southeast Alaska, at much higher rates in villages and within Native communities. Juneau and Ketchikan have the lowest averages with 25 and 34 pounds of food collected per person, per year, respectively. Smaller communities harvest larger amounts, including Wrangell and Petersburg with 182 pounds of food for each person annually, and Sitka with 206 pounds, Angoon and Hoonah at 243, and finally Yakutat with 398 pounds of food per person, per year. On average, rural residents in subsistence areas throughout the region consume 200 pounds of wild food each year. Subsistence harvest levels have remained consistent in most communities since the in 1980s. Marine resources comprise the majority of subsistence harvests— as high as 83 percent of the total subsistence harvest in Yakutat. Sockeye salmon, halibut, Chinook salmon and herring roe are top subsistence species. Sockeye comprise 80% of the subsistence and personal use harvests. Southeast Alaska residents caught nearly 39,000 sockeye in 2015. Native Alaska subsistence harvests in the region also include marine mammals, particularly harbor seals.

Southeast Alaskans consume more deer than any other wildlife species in the region. Mostly resident hunters harvest as many as ten thousand deer annually. Prince of Wales Island historically has had the largest amount of deer habitat and has supported deer harvest for island residents, hunters from other southeast Alaska communities (including Ketchikan, Wrangell and Petersburg), and non-resident sport hunters. In total, these hunters harvest over 3,000 deer annually from the island.

The Commercial Fisheries Economy

Commercial fishing is Alaska’s largest private sector employer, with 56,800 workers employed in commercial fishing, seafood processing and fishery management earning $1.5 billion. This state economy generates positive impacts throughout the United States, with national economic impacts estimated at $12.7 billion. Southeast Alaska is one of the most important fishing regions in the state, with more fishery workers than any region other than the Bering Sea. Indeed, seven of the top 100 fishing ports by value in the entire country are southeast Alaskan communities.

In 2017, southeast Alaska produced 301.7 million pounds of seafood harvested worth an ex-vessel value (price paid to fishermen) of...
Million Dollar Fisheries of Southeast Alaska
Based on Average Annual Ex-vessel Value in All Commercial Fisheries by Statistical Area
2007 - 2017

Average Annual Ex-Vessel Value
All Commercial Fisheries by Statistical Area

- $3 million/year
- $1 million - $3 million/year
- $500,000 - $1 million/year
- $250,000 - $500,000/year
- $100,000 - $250,000/year
- $10,000 - $100,000/year
- <$10,000/year

*Fishery values in offshore waters were not available for all fisheries and are not shown here.

This map shows average annual ex-vessel values in commercial fisheries by Statistical Area during 2007 - 2017, adjusted for inflation, and including salmon, groundfish, shellfish and herring. Data were provided by the Commercial Fisheries Entry Commission. Statistical areas with less than 3 vessels reporting during any year were excluded for confidentiality. Statistical areas used for reporting of groundfish were combined with those of other fisheries using an area-weighted overlay calculation.

These results show that during 2007 - 2017, the average ex-vessel value among 219 statistical areas was $870,000. A total of 62 fishing areas produced over $1 million/year, with 15 fishing areas greater than $3 million/year.

To view this and other maps in more detail visit seabank.org.
$288.8 million. There are roughly 2,700 commercial fishing permit holders and 2,400 crew members living in southeast Alaska communities. Their harvests supported over 4,500 processing jobs, generating $50 million in wages. A large number of Washington and Oregon state residents actively participate in Alaska fisheries and southeast Alaska resources generate dividends throughout the Pacific Northwest. Earnings generated by commercial fisheries support every business in southeast Alaska communities as well as provide significant employment in the transportation, marine, academic and government sectors. Economists estimate the total impact of southeast Alaska’s commercial fishing and processing jobs as more than $700 million annually.

Southeast Alaskan resources generate annual dividends that are critical to nearly all of southeast Alaska’s 33 communities. Many of the more remote communities, such as Port Protection, Port Alexander and Pelican, are historical fishing villages that rely almost exclusively on commercial fishing and new economic activity associated with sport fishing lodges. Every resident of Point Baker has a fishing permit. Historical native communities such as Hoonah, Klawock, Metlakatla and Yakutat also heavily rely on commercial fishing; in Yakutat more than a quarter of the population participates in commercial fishing.

“Mid-sized” southeast Alaska communities of Haines, Petersburg and Wrangell are heavily dependent on southeast Alaska’s fishery resources, and are especially dependent on the salmon fishery. Petersburg is the 26th ranked fishing port in the United States based on the economic value of southeast Alaskan resources harvested by its fishermen. There are over 800 commercial fishing permit owners in the three communities who own 1,652 permits with nearly 1,000 vessels home ported. More than one in every ten residents owns a fishing permit. Including crew, over 1,300 individual fishermen live in the three communities with vessels generating over $63 million in fishing income in 2016. Southeast Alaskan resources harvested by these fishermen supported over 1,400 processing jobs generating over $15.5 million in wages. Virtually every business in the three communities benefits from fishing dollars. Prince of Wales Island is the third largest island in the United States with 4,200 residents living in 12 communities. Commercial fishing is a “cornerstone” of the economy and current trends show increases in revenues and harvests. There are 294 fishing permit holders and 274 crew members, with roughly ten percent of the population participating in commercial fishing.

The region’s three largest communities—Juneau, Ketchikan and Sitka— have diversified economies that rely on commercial fishing as the primary private sector small business generator and employer. Sitka is 16th ranked fishing port in the United States by volume and 10th ranked by value, producing 91.3 million pounds of seafood worth $75.4 million in 2017. Both Ketchikan and Juneau are among the country’s top 50 fishing ports. There are over 2,300 permit holders and crew in the three communities— and 1,655 fishing boats. Each community has multiple processing facilities which cumulatively employ over 2,500 workers earning over $31 million in wages.

Commercial fishermen and processors also provide substantial direct support to regional communities through landings and fisheries business taxes. Alaska deposits fishery business tax revenues from processors in its
general fund and the legislature then appropriates up to fifty percent of the revenue back into the community where the processing occurred. Alaska’s state fisheries resource landing tax also returns half the revenue to municipalities based on landings. State and local governments receive $1.3 million in fishery business and landing taxes.

The Salmon Economy

Salmon is the most abundant and valuable seafood species for fishermen in southeast Alaska communities and supports 1 in 10 jobs in the region. Lands managed by the Forest Service provide slightly more than half of southeast Alaska’s salmon catch. Transboundary rivers make significant contributions to the fisheries, particularly because of habitat available for higher value coho and sockeye salmon.

Salmon hatcheries provide an additional 22 percent of the statewide salmon value, and are the largest agricultural industry in Alaska, providing hundreds of jobs. Southeast Alaska hatcheries produce nearly a third of the region’s chum harvests and less than ten percent of the chinook, coho and sockeye. Pink harvests are almost entirely wild fish. Southeast Alaska hatcheries produced, on average, fish harvests worth $43.8 million from 2012 through 2017.

2013 was a record year for southeast salmon harvests, with decadal peak production in pink and coho harvests and a total harvest of 112 million fish. Production over the next four years was less than half, ranging from 31.7 million fish in 2016 to 50.8 million fish in 2015. Average effort over the past decade has been 1,881 permit holders. In 2017, 1,784 gillnet, seine and troll salmon permit holders harvested 50.1 million salmon in southeast Alaska, generating an ex-vessel value of $169 million. Largely because of stark declines in pink salmon harvests, the 2018 harvest was extremely low at 21.2 million fish and generated $133.6 million in total ex-vessel value. An exceptional chum run and high chum prices partially offset the low overall harvest. The ex-vessel value of the chum fishery was $81.1 million, exceeding the value of all other species combined.

Trollers rely primarily on chinook and coho, seiners rely primarily on pink and chum and gillnetters generate the most value from chum but utilize a mix of all five salmon species. Pink salmon harvested mostly by seiners comprise on average seventy percent of the catch but are the lowest valued species at 38 cents per pound. Chinook are by far the most valued species, generating $7.46 per pound in 2018. Sockeye are second in value at $1.96 per pound and coho ex-vessel values were $1.78 per pound.

There are nearly 1,000 salmon troll permit holders active each year, making the troll fishery the second largest fleet in the state, second only to Bristol Bay. Alaska residents comprise well over 80% of active permit holders. In 2017, 1,006 troll salmon permit holders harvested 129,000 Chinook, 2.1 million coho, and 402,000 chum salmon. Chinook salmon harvested in Alaska reflect three components: 1) coastwide mixed stocks harvested under catch limits set by the Pacific Salmon Treaty; 2) production from Southeast Alaska’s Chinook salmon enhancement programs; and 3) directed fisheries on returns to specific mainland rivers. The average all gear harvest from 1962-2014 ranges around 300,000 fish, most of them harvested by troll gear. The 2017 overall Chinook harvest of
174,000 in 2017 was the lowest in 56 years. The 2018 overall harvest was even lower at 157,876 fish.

Trollers typically harvest sixty percent of the coho catch each year. Fishermen participating in troll and marine sports fisheries harvest coho on the outer coast, and net and sport fishermen harvest coho in corridor areas. Trollers caught 2.1 million coho salmon in 2017, above the long-term average and 75 percent of the harvest. Total coho catches by all fleets over the past decade have ranged between 2.1 million and 3.9 million fish, with a decadal average of 2.6 million fish. Trollers took slightly more than 1.5 million coho on average over the past decade, including a peak of 2.4 million fish in 2013.

In 2017, 424 gillnet permit holders harvested five million fish, mostly chum and pinks, and a mix of the other three species. Seiners and gillnetters catch roughly 40% of the sockeye harvest each. 77 percent of the total southeast Alaska salmon harvest is by seine gear. Seining is typically the highest value fishery overall, averaging $69 million in ex-vessel value over the past decade. Average annual ex-vessel values generated by trollers and gillnetters typically exceed $30 million each. In 2017, 269 purse seine fishermen caught 32 million pink salmon (92 percent of the catch) and 4 million chum salmon. Hatcheries produce the majority of the chum salmon harvest.

The Groundfish Economy

Halibut and sablefish longline fisheries are second to salmon in terms of fishery outputs, producing a third of the annual value. All southeast Alaskan communities generate revenue from the longline fisheries. Petersburg and Sitka have the most engagement, combining to harvest nearly 9 million pounds of both species in 2017 worth over $42 million—roughly two-thirds of the regional volume and value. Crab and shellfish species harvested in pots or by divers comprise the remainder of the southeast Alaskan seafood dividends. Central southeast Alaska is the primary crab producer and southern southeast Alaska and Sitka are leading ports for harvests of shrimp, sea cucumbers and geoduck clams. The combined 2017 economic output from crab and other shellfish was roughly $19 million.

Halibut and sablefish continue to be a primary resource for southeast Alaska communities even with lower than historical annual average harvests. Area 2C commercial landings have slowly increased each year to 4.1 million pounds in 2017 since reaching a decadal low of 2.36 million pounds in 2011. Area 3A reached a decadal low in commercial landings of 7.4 million pounds in 2014 and annual landings have remained similar through 2017. Since 2014, the combined landings from the two regulatory areas have fluctuated between 10.1 and 11.1 million pounds and estimated landings in 2018 will be 12 million pounds if the fleet reaches its catch limit.

Ex-vessel prices have fluctuated but there has been a general positive trend in real average prices partially offsetting the lower harvests. The peak average ex-vessel price throughout the state was $6.21 per pound in 2011. Recent prices (2014-2016) have ranged between $5.68 and $5.89 per pound. However, Areas 2C and 3A generally command the highest ex-vessel prices in the state, with 2014-2016 prices exceeding $6.00 per pound and peaking at $6.61 per pound in 2016. These two areas comprise a substantial portion of the total fishery value, averaging
$76.4 million from 2012-2016. In 2017, southeast Alaska residents harvested 6.7 million pounds of halibut worth $32.6 million.

Sablefish harvests from southeast Alaska have steadily declined over the past decade with catch limits corresponding to reduced abundance. As with halibut, ex-vessel prices have helped to offset lower production. In 2017 southeast Alaska resident permit holders harvested 6.7 million pounds of sablefish worth an ex-vessel value of $31.2 million. The increased ex-vessel value also reflects market recognition that sablefish are a premium, high-priced whitefish and have strong export markets in Japan and China and growing markets in the United States and Europe. Japan has historically been the world’s largest market for sablefish. The United States provides roughly 90% of global sablefish production and most of that catch is in Alaska, making the state the primary global producer.

The Shellfish Economy

Dungeness crab harvested by fishermen in Juneau, Petersburg, Sitka and Wrangell comprised the bulk of the $9.6 million 2017 economic output from the crab fisheries. Roughly 200 permit holders participate in the Dungeness crab fishery each year. Average harvests during the 2000s were 4.6 million pounds. Recent harvests have ranged between 2.3 and 5 million pounds. Ex-vessel prices hover around $3.00 per pound, with fishery values ranging between $7.1 million and $15.1 million. Most of the harvest occurs in central southeast Alaska near Petersburg and Wrangell, which are also leading ports for tanner and king crab harvests.

Geoducks and sea cucumbers are primary harvests in southeast Alaska’s dive fisheries. Geoducks are the most valuable of the dive fishery species per pound. In 2017, 62 permit holders harvested 679,000 pounds of geoducks worth $4.3 million. The sea cucumber fishery also has high value and volume. In 2017, 174 permit holders harvested 1.3 million pounds of sea cucumbers worth $6.7 million. Spot shrimp comprise the other regionally significant southeast Alaskan resource. 105 pot shrimp permit holders harvested 568,000 pounds of shrimp worth $2.4 million in 2017. Harvest restrictions needed to address uncertainty and likely declines in abundance have reduced overall dividends- the pot shrimp fisheries expanded significantly during the 1990s and early 2000s, with harvest typically exceeding 1 million pounds. Prince of Wales Island and Ketchikan are the primary beneficiaries of SeaBank dividends from these three species, generating two-thirds of the economic value in 2017.

The Recreation Economy

Southeast Alaska’s comparative advantage in the national and global economy is its “remarkable and unique combination of features including inland waterways with over 11,000 miles of shoreline, mountains, fiords, glaciers and large or unusual fish and wildlife populations that provide opportunities for a wide range of outdoor recreation experiences.” The availability of scenic and undeveloped areas creates economic “gateway” communities that benefit from adjacency to outdoor recreation opportunities. Recreation use generates considerable economic benefits for small businesses in gateway communities – particularly through non-resident visitors who bring in “outside” dollars. Alaska’s pristine landscapes are an attraction for all visitors - whether cruise ship passengers, wilderness kayakers, or sport fishermen staying at remote
lodges. In 2005, a Forest Service economist reviewing poor market and labor conditions for timber operators in the area projected that:

> [b]ased on regional, national and international economic and demographic trends, the roles the Tongass plays as a provider of tourism and recreation opportunities and as the custodian of many of the unique natural amenities and ecosystem values that both attract tourists and enhance the quality of life for existing and potential residents, is likely to be of more importance to the economic vitality of the region.

University of Alaska research has verified this hypothesis and identified features such as undeveloped, unlogged areas as providing the recreation experiences desired by 21st century visitors: “Alaska’s wilderness character and the opportunity to see or spend time in wilderness places influenced (‘visitors’) decision to come to Alaska.” Southeast Alaska’s significant competitive advantages include intact ecosystems, dramatic attractions such as glaciers or salmon streams, and a decreasing global supply of high-quality outdoor recreation opportunities. These competitive advantages are stimulants for rapid growth in nature-based tourism in southeast Alaska. Important growth areas include opportunities for shore-based excursions from cruise passengers, development of new and creative visitor products, and increasing markets for wildlife viewing, sightseeing, and active visitor experiences such as hiking.

Recreation depends primarily on marine transportation for shoreline-based activities. The terrain and topography of southeast Alaska makes much of rest of the land base unsuitable for outdoor recreation. Primary recreation resources include the region’s estuaries and beaches used by residents and visitors for shore-based or water-based viewing of brown bears, black bears, seabirds and water fowl and marine mammals— the top ranked wildlife viewing species in the state. There are nearly 1,000 miles of trails on National Forest lands, 80,000 acres of state parks, including 16 marine parks all offering unique recreation settings not found in other areas of the United States.

Marine mammal viewing is popular for visitors on water-based excursions from nearly every community. Sport fishermen utilize the same SeaBank resources as their commercial counterparts, particularly all five species of salmon and halibut. Chinook salmon and halibut are highly prized sport fish pursued by anglers in southeast Alaska. Yakutat boasts the region’s largest steelhead run.

The Visitor Economy

Nearly two decades ago, the Forest Service projected that an inventory of undeveloped lands in southeast Alaska could become a valuable asset as the regional economy shifted towards recreation and passive use values by maintaining natural capital— “wild and unspoiled” areas and “sustainable fish and wildlife populations, natural scenery and feeling of remoteness.” There already was an economic shift in response to increased demand for Tongass tourism— recreation and tourism levels had more than doubled between the mid-1980s and mid-1990s. At a national level, demand increased for remote recreation opportunities even as the supply of lands available for high quality outdoor adventure experiences was diminishing. Large areas of intact forest lands are “increasingly scarce and
therefore, increasingly valuable ecosystems.” Preserving southeast Alaskan resources for dispersed recreation opportunities provides stability for gateway communities to maximize benefits from this growing economic sector.

In 2018, demand for visitor products has continued to grow. 21st century economic activity in Alaska relies on ecosystem values, particularly values associated with fish, wildlife, scenery and adventure outdoor recreation. Communities throughout the region have developed marketing strategies and small businesses aimed at capitalizing on southeast Alaska’s wild infrastructure. The visitor products industry is thriving because of the supply of scenery, gateway communities and outdoor adventure opportunities, with consistent annual increases in industry employment and earnings. The Southeast Conference’s 2017 annual economic report identified the visitor products industry as the region’s top private sector industry in terms of both jobs and wages. The report noted that “tourism is booming” and identified 2017 as a record year for cruise and air passengers, along with jobs and spending.

The massive growth in tourism, particularly small and large cruise ship tourism, has increased regional employment and offset downturns in state sector employment and fluctuations in seafood industry production. Visitors spent $657 million in southeast Alaska in 2017. In 2017, over 1.5 million people visited southeast Alaska by air and cruise. Alaska’s popularity is growing- particularly southeast Alaska, which hosts two-thirds of all state visitors, making it the most visited region of the state. Overall, the southeast Alaska’s annual recreation dividend to gateway communities in southeast Alaska is massive, with average visitor industry spending in excess of $1 billion per year, providing between 10,200 and 10,900 jobs, with labor income impacts ranging from $370 million to $407 million. State revenues from the visitor products sector exceed management expenses and particularly benefit local governments.

Alaska’s popularity is growing- particularly southeast Alaska, which hosts two-thirds of all state visitors, making it the most visited region of the state.

Glacier Bay National Park best demonstrates the potential for dividends returned from pristine environments. Glacier Bay is a major visitor products asset and the top cruise destination in the world. Half a million visitors cruise, boat or otherwise experience the park, resulting in $96 million in visitor spending. Gustavus is the gateway community to Glacier Bay National Park.

Nearby Juneau receives over one million visitors each year, making it the most visited community in the region. Glaciers are a primary local asset. Visitors and businesses use the Taku River and its glacier for hunting, camping sightseeing and helicopter tours. 11,000 visitors land on the Taku and Norris glaciers each year, with revenue to tour companies estimated at $6.6 million. 40,000 visitors use the Taku River watershed each year, spending $15 million and adding $800,000 to Juneau’s sales tax revenue.
Large cruise passengers often select shore excursions, particularly glacier tours. The Mendenhall glacier hosts nearly half a million tourists annually.

Ketchikan receives the second largest number of visitors—nearly 1 million per year and mostly cruise ship passengers. Local businesses provide 47 unique shore-based excursions for cruise passengers, flightseeing, marine charters, outdoor adventure, and general sightseeing. Sitka’s cruise passenger clientele is much smaller than Ketchikan and Juneau, but the city has a proportionally larger number of independent travelers who visit for fishing, kayaking, hunting, marine charters and other nature-based tourism. Wrangell is the gateway community for the Stikine River and has six companies that offer water-based tours, taking over 3,600 people in 2015. Total visitor spending in Wrangell related to the Stikine is roughly $1.15 million.

**Hunting, wildlife viewing and sport fishing economy**

Southeast Alaska’s wildlife and fishery resources are valuable assets for nearly every southeast Alaska community because of their value for viewing, hunting or sport fishing. In 2011, wildlife hunting and viewing alone generated 2,463 jobs in southeast Alaska and $138 million in labor income. Residents and visitors spent $363 million on hunting and wildlife viewing. Alaska residents accounted for 82 percent of the hunting expenditures and visitors were responsible for 81 percent of expenditures on wildlife viewing trips. These activities also generated $29 million in government revenue. Fishing related tourism creates almost $350 million per year in statewide revenue for Alaska. Guided hunting—mostly for black and brown bears—provides significant revenue for wildlife management by the Department of Fish and Game, with most of the funding going to wildlife conservation programs. Recent hunter harvests have ranged between 110–120 bears per year. 90 percent of hunting guides are Alaska residents and a significant portion of statewide hunting guide spending and income ($25 million) benefits rural communities. Guided hunters pursue deer for trophy value as part of the North American “deer slam” because the island produces large deer and bucks with record sized large antlers.

There are several popular areas closed to bear hunting and instead used for bear viewing opportunities, including the Stan Price Wildlife Sanctuary and Salt Lake Closed Area on Admiralty Island and the Port Althorp closed area near Elfin Cove. Hoonah now offers a bear viewing tour to visitors and Sitka’s Fortress of the Bear rescues orphaned cubs and is highly popular with visitors. Marine mammals are also popular with visitors, particularly in areas like Glacier Bay which provide abundant opportunities to view whales, porpoises and seals.

Over half of Alaska’s charter fishing businesses operate in southeast Alaska. Non-resident and resident anglers spend over a quarter million dollars on goods and services in the region, with indirect and induced economic effects increasing the total contribution to over a third of a billion dollars. Sport fishing anglers support between 2,300 and 3,000 jobs, generating over $84 million annually in personal income. Salmon comprise well over half the total number of fish caught in southeast Alaska sport fisheries.

Sitka and Prince of Wales Island receive the
highest dividends because of their proximity to southeast Alaskan coastal resources. Smaller and remote fishing villages such as Pelican, Port Alexander and Elfin Cove are also sportfishing destinations; summer revenues generated by over 1,500 visitors to Elfin Cove alone amount to $5 million annually. Transboundary river chinook and coho salmon assets support 32 sport fishing businesses in Petersburg and Wrangell and lodges near Ketchikan with annual visitor expenditures of over $5 million.

Formerly timber dependent regions such as Prince of Wales Island have new, redefined economies based primarily on its fishery and wildlife resources. The decline of the timber industry was an opportunity to shift into the maritime economy and visitor products industry for long term community viability. Prince of Wales Island community planners now pursue a market-based transition featuring hiking, hunting and fishing lodges that support small local businesses. Nature-based tourism generated more than $30 million in gross revenues to Prince of Wales Island in 2007—mostly from sport fishing as a “dream destination for sport fishers.” Waterfall Cannery is the largest lodge on the island and its fifth largest employer with over a hundred seasonal employees. Sport fishing lodges near the small communities of Coffman Cove and Whale Pass attract sport fishers for saltwater fishing in Clarence Strait or steelhead fishing in freshwater streams.

The island’s road system connects most of the island’s towns and villages and is a major competitive advantage relative to other southeast Alaska communities in terms of attracting visitors for road-based recreational opportunities around the island. The interstate ferry system is also a key part of the transportation system, bringing 3,000 visitors to the island—half hunters and sport fishermen and half hikers and campers. Campers, fishermen, hunters and hikers stayed for multi-day trips, spending $10.2 million, generating 213 seasonal jobs and generating a total economic impact of $14 million.

The Eco-Tour Economy

There is strong demand for outdoor adventure and eco-tour services provided by outfitters and guide and businesses. The number of guided clients on the Tongass National Forest is increasing at a high rate—from 533,388 clients during the recession in 2011 to 624,667 clients in 2015—a 15 percent increase. The primary activities sought by guided visitors are dispersed, active and remote outdoor recreation experiences such as hiking, kayaking and wildlife viewing which comprise over sixty percent of all guided visitor activity.

The small cruise vessel fleet is a major regional growth sector consisting of a diverse group of overnight commercial passenger vessels including yachts and smaller motor vessels that carry between 6 and 250 passengers. Many of the small cruise companies have Forest Service special use permits and provide visitors with remote recreation opportunities. Passenger capacity in southeast Alaska alone increased to over 16,200 passengers in 2015, up from a statewide passenger capacity of 8,800 passengers in 2011. Twenty-four small cruise vessels carrying more than 20 passengers each operated in southeast Alaska in 2015. Since then, three companies have added four more vessels and considerable additional passenger capacity to the southeast Alaska fleet.

Small cruise vessel companies increase the
number of multi-day visitors to the region and bring visitors to wider range of southeast Alaska communities. These vessels bring visitors into communities who are “willing to pay premium prices for higher quality experiences in more pristine environments.” In 2015, 11 small cruise companies offered 46 itineraries that visit southeast Alaska communities, resulting in multiple weekly port calls to southeast Alaska communities of every size from larger communities such as Juneau, Ketchikan and Sitka to mid-sized communities such as Haines, Hoonah, Petersburg and Wrangell and even to smaller communities such as Kake, Kasaan, Skagway and Tenakee Springs.

These gateway communities have developed targeted marketing strategies aimed at small cruise companies and multi-day visitors. These investments are accompanied by additional infrastructure and new local economies, including small business development. Haines’ website describes the community as “The Adventure Capital of Alaska”:

Haines boasts year-round fun for the entire family, located along the edge of North America’s longest and deepest fjord, just 68 nautical miles north of Juneau in Southeast Alaska. Craggy mountain peaks tower above a lush coastal rainforest with temperate seasons that call to the adventurer in all of us. Fill the long daylight hours of summer with a rafting trip, a deep-sea halibut fishing charter, or a hike through an ancient spruce forest. Visit museums dedicated to our earliest residents, the Native Tlingit people, and a national favorite, the American Bald Eagle. And if you’re still up for more, explore gold rush era Fort William H. Seward, or find yourself alone at the end of a rocky beach trail.

Haines is an important tourism destination for small cruise vessels. Multiple small cruise itineraries describe Haines as “the center of adventure” and offer weekly visits or rotating visits that bring hundreds of visitors to the community between April and September. Kake and other partners are investing in reconstruction of the historic cannery so that it will provide space for artisans, vendors and other activities. Kake’s effort to integrate tourism into the local economy reflects market demand trends for rural Alaska community experiences and a business model proven to be successful over the past decade by increasing local jobs, municipal revenues and visitor spending. In 2004, the Huna Totem Corporation developed Icy Strait Point, a tourism complex near Hoonah. This development now provides 130 seasonal and permanent jobs each year, mostly to Hoonah residents. In 2010, wages, taxes and visitor spending injected $3.6 million into the Hoonah economy.

The small cruise vessel economy provides significant returns on these investments in the visitor products economy. Conservative estimates show that one small cruise vessel operating from May to September with a seasonal total of 700 passengers can generate $1.3 million in combined company spending on fuel, moorage, supplies, services and taxes and client spending on shopping, lodging, meals, transportation and activities. The estimate is conservative; actual spending data for small cruise passengers is not available so the estimate reflects data based on per person spending from all Alaska cruise passengers and is likely lower than per visitor spending by small cruise vessel clientele.
The natural systems and myriad resources that comprise southeast Alaska’s ecosystems are subject to variation and cyclical fluctuation. Long and short-term climate variations shift ecosystem relationships, at once favoring, for example, poor winter survival of deer but strong recruitment of juvenile sablefish. The shifts may be related or happen independently. Scientific research can explain some of the shifts while others remain largely a mystery. The vectors of change may be global, such as climate change, or local, such as timber harvest and transboundary river pollution. All risks impact SeaBank capital and dividends, highlighting the importance of enumerating assets, calculating tradeoffs, and carefully managing the natural wealth of southeast Alaska.

The specific risk factors considered in this report are: (1) abundance trends; (2) fishery permit access and migration; (3) transboundary river pollution; (4) subsistence resources; (5) global warming and (6) habitat degradation.

**Trends in Abundance**

Recent harvests of all five salmon species in all southeast Alaskan systems have fallen well below historical averages. Fishery managers and state of Alaska management goals seek to minimize harvests in areas of anticipated weak returns. In order to provide for escapement in times of weak returns, fishery managers implement spatial and temporal closures to reduce fishery impacts on individual salmon stocks.

**Chinook Salmon** - The 2017 all-gear Chinook harvest was the lowest since 2011 when the fishery began developing. The 2018 harvest was 20% lower than 2017. Despite unprecedented restrictions, escapement in the largest Chinook salmon-producing systems in Southeast (Taku and Stikine) is at or near the lowest point since surveys began in the 1970s. Recent low levels of Chinook escapements across southeast Alaska are a significant concern. There are escapement goal failures in nearly all systems. The Chilkat River historically supported the region’s fifth largest population. Declines in escapement numbers began over the past decade. From 2012-2016 escapements fell below established thresholds every year but 2015. The Alaska Board of Fisheries designated Chilkat chinooks as a stock of management concern in 2018. The Unuk River stock has suffered similarly poor escapements and is also now a stock of management concern.

**Coho Salmon** - Most surveyed coho systems are meeting escapement goals. Abundance as measured by harvests has fluctuated between 2 million and 3.9 million fish over the past decade. However, catch rates for coho salmon were well below historical averages in 2018.

**Pink Salmon** - Even year cycles of pink salmon runs have historically been much lower than
odd years. Significant downturn in the even-year cycle beginning in 2006 has exacerbated this disparity. There is an ongoing failure to meet escapement goals in northern southeast Alaska inside waters. Even though 2013 was an exceptional year, average annual harvests of Pink salmon over the past decade are 25 percent lower than average harvests during the 1990s. Exceptionally poor returns in northern southeast Alaska inside waters in 2016 and 2018 are a particular concern. Fishery managers identify the marine heat wave in the Gulf of Alaska from 2013 through 2016 as a potential cause of the recent decline.

The 2016 pink salmon return was a declared federal fishery disaster for southeast Alaska. 2018 returns were even worse. Fishery managers anticipated a poor year—juvenile abundance indices developed by NOAA were the lowest since that agency began surveys and suggested extremely low harvests. Across southeast Alaska the pink salmon run failed to meet even low expectations, with a 7.3 million fish harvest—the lowest since 1976 and over ten million fewer fish than fishermen caught during the 2016 disaster year. Some of the poorest returns were in northern and central southeast Alaska watersheds adjacent to Frederick Sound and Chatham Strait.

**Sockeye Salmon** - Most sockeye populations are meeting escapement goals, but there is now a sockeye population designated as a stock of concern. Gillnetters and seiners harvest most of the sockeye. The 2017 harvest of 801,000 fish was well below recent and historical averages. The 2015 subsistence harvest was 10,000 fish below the annual average and the lowest harvest in a decade.

**Halibut** - Halibut populations steadily declined from the late 1990s until 2010. The reduced size-at-age is the primary driver of the stock decline, but has slowed and stabilized over the past decade. Recruitment strengths were also weaker. The female spawning biomass has stabilized and increased, resulting in recent productivity gains for the overall stock. However, incoming recruitment classes are small and fishery scientists anticipate potential declines in the stock over the near future.

Linkages between environmental conditions and halibut productivity are unclear. Overall halibut population abundance, like many fish species, appears to benefit from the positive phase of the Pacific Decadal Oscillation. Climate change related risks may include prey depletion- juvenile halibut rely on species that are vulnerable to ocean acidification. Gulf of Alaska and Bering Sea and Aleutian Island trawl fisheries damage benthic habitat and cause substantial bycatch mortality for halibut. There is considerable uncertainty about bycatch in the Gulf of Alaska trawl fisheries because of inadequate observer coverage. One of southeast Alaska’s primary marine assets is a large no-trawl area encompassing 526,000 square nautical miles with habitat features that include numerous deep-water living substrates, including red tree coral.

**Sablefish** - Sablefish abundance has fluctuated over the past half century with increases and decreases tied to the presence or absence of strong year classes. There has been a slow but persistent decline in abundance over the past two decades with low recent harvests. The 2017 stock assessment identifies positive indicators for strong incoming recruitment based on a strong 2014-year class. Fishery scientists project near term increases in spawning biomass and fishery harvests. State of Alaska sablefish stocks in Clarence Straits and Chatham Straits also are gradually...
recovering from recent low abundance levels.

Climate and environmental conditions appear to have the greatest effect on sablefish abundance. Some of the largest year classes followed near historic low abundances associated with changes in the Pacific Decadal Oscillation regimes. These changes in abundance suggest that favorable environmental conditions may have a greater effect on recruitment than the spawning biomass. In general, colder than average wintertime sea surface temperatures in the central North Pacific represent oceanic conditions that are favorable for positive recruitment events for juvenile sablefish.

**Marine mammals**– Sea otters are thriving in southeast Alaska’s marine environment. The population doubled between 2003 and 2013, and the Fish and Wildlife Service now estimates that there are over 25,000 sea otters throughout the region. 8,500 sea otters inhabit Glacier Bay alone, and there are 12,200 sea otters inhabiting the southernmost portion of the region. The population is growing by 12 percent to 14 percent annually. Particular areas of expansion are Cordova Bay near Craig and northward through Chatham Straits and into Frederick Sound. Southeast Alaska also hosts a growing population of Steller sea lions. The estimated 25,000 sea lions inhabiting southeast Alaska rookeries comprise nearly half of the stock. There are five geographically distinct stocks of harbor seals and a total population of 60,000. The stocks are stable or increasing except in Glacier Bay.

Although scientists have produced estimates for several cetacean species, acquiring precise data on population status and trends for many cetaceans is challenging. An estimated 3,000 to 5,000 humpback whales may be present in Gulf of Alaska waters each year and the overall population may be increasing. Scientists estimate the global population of sperm whales at 102,000, and the population is likely not declining but trends are unknown. There are an estimated 109 resident orcas in southeast Alaska, and roughly another 1,000 orcas from various stocks may be present in the Gulf of Alaska. There are roughly 5,500 harbor porpoises in the region, concentrated primarily in Glacier Bay and near Wrangell. Population trends are unknown.

**Terrestrial mammals**– Severe winter weather, habitat changes caused by clearcut logging, and predation by wolves and bears are primary factors governing fluctuations in deer populations. Deer population numbers vary in Southeast’s island ecosystems. Southern islands provided most of the historical winter deer habitat. Extreme snowfall during the winter of 2006 and 2007 reduced deer numbers throughout the region. Areas that combine the presence of predators with a legacy of logging and road construction can experience rapid population declines during a snowy winter, requiring prolonged periods of recovery. Alaska Department of Fish and Game biologists estimate that eighty percent of the deer population on Chichagof Island perished during the record snowfall years between 2006 and 2008. But there are no wolves on the northern islands and deer populations on Admiralty, Baranof and Chichagof Islands are now recovering following a series of mild winters. These three islands produce more than half of the annual deer harvest in southeast Alaska.

Southeast Alaska may support as many as 6,000 to 8,000 brown bears and 17,000 black bears. Admiralty, Baranof and Chichagof Islands support an estimated 4,300 brown
bears, roughly 70 percent of the entire southeast Alaska population. There are no precise population estimates for southeast Alaska’s black bears, although a study specific to north Kuiu Island estimated densities as high as 3.9 bears per square mile. Alaska Department of Fish and Game wildlife managers consider the brown bear population to be stable. However, wildlife managers have observed recent indications of declines in black bear populations, particularly in the more heavily logged island ecosystems.

Permit migration

State data establish that between 1975 and 2014 more than 2,300 Alaska limited entry permits (nearly 28 percent) migrated away from Alaska’s rural fishing communities to non-residents. Individual Fishing Quota (IFQ), issued in 1995 to participants in the halibut and sablefish longline fisheries, have also migrated away from Alaska’s rural communities, particularly native communities, to larger towns in Alaska or the lower 48. The number of active halibut and salmon fishing permits in Kake declined tenfold between 1980 and 2017 and declined by a third in Hoonah over the same time period. Rural fishing villages Port Alexander and Pelican also have lost over two-thirds of their active halibut and salmon permits since 1980. Overall, the number of participants in the commercial halibut fishery has been reduced to half relative to pre-IFQ days, and the cost of quota has increased six-fold.

Across Alaska, the average age of fishermen has increased from roughly 40 to 50 since 1980 and the number of young people entering the fishery has decreased. Alaska’s isolated coastal communities offer few alternative sources of employment, and as access to fisheries declines, so too does the viability of the communities. The Alaska State legislature, the North Pacific Fishery Management Council, and the Alaska Sustainable Fisheries Trust are all exploring avenues to address the outmigration of fisheries access from rural Alaska communities.

Transboundary river pollution

At least ten large-scale mines are in some stage of advanced exploration, environmental review, permitting or operation in Northwest British Columbia. The mines will extract minerals such as gold, copper, silver, lead and zinc and produce watershed pollution known to have severe and even population-level effects on salmon caused by acid mine drainage and toxic heavy metals. These mining projects are located in watersheds of key transboundary salmon rivers— the Taku, Stikine and Unuk—that originate in B.C. and flow into southeast Alaska. Transboundary watersheds span almost 30,000 square miles and provide significant natural capital in support of the southeast Alaska culture and economy. The existing and proposed mines in these watersheds are highly likely to harm southeast Alaska’s lucrative fishing and tourism industries, the traditional practices of indigenous peoples, and the way of life of all the residents of the region.

Mining processes release toxic heavy metals from waste rock and mine tailings into the surrounding environment. British Columbia mines that drain into the transboundary rivers will generate levels of aluminum, cadmium, copper, lead, silver, zinc and selenium in concentrations that will be at best harmful and in many cases lethal to salmon. The mines will cumulatively produce well over a billion metric
tons of mine tailings and several billion metric tons of waste rock that can cause long-term acid mine drainage. Concentration levels of aluminum are likely to exceed known thresholds for fish by an order of magnitude. Cadmium and copper concentrations will be just below or at times above lethal levels.

Other heavy metals may impair fish reproductivity, survival, growth and development for decades. In addition, the presence of these metal concentrations may cause salmon to avoid impacted habitat entirely, thus functioning as a toxic dam permanently obstructing salmon migration and eliminating upstream habitat. Finally, the combination of these toxic pollutants may create multiple toxic “cocktails” that combined may be more destructive than any single element.

Mining companies promise mitigation measures but have failed to correct acid drainage from existing mines. There is a long history of mines failing to meet predictions of low impacts. In particular, tailings dam failures, which occur annually, would be catastrophic. If water treatment plants fail to operate as speculated, chronic, long-term leakage of acid mine drainage and heavy metals is likely. Significant long-term loss or degradation of fish production from these watersheds could cost southeast Alaskan commercial and sportfishing businesses over $1.6 billion over the next century.
Threats to subsistence

The well-being and economic security of Southeast residents is directly tied to the health and productivity of local natural resources. Residents depend on wild foods, which in turn depend on an intact and healthy ecosystem. Logging, road construction and mining are activities most likely to adversely affect subsistence uses. Additionally, competition from non-subsistence resource consumers is an increasing concern for subsistence users of deer on Prince of Wales Island or for subsistence users of the herring resource.

Global warming and effects on southeast Alaska resources

Significant warming trends are ongoing in Alaska. The state overall has experienced significant temperature increases over the past century, warming twice as fast as the rest of United States, with a considerable reduction in extremely cold days and increase in extremely hot days. Climate change is likely to impact southeast Alaskan resources through sea level rise, glacial retreat, increased storms, changing thermal regimes for freshwater and marine ecosystems, changes in rain and snowfall, and changes in distribution of plant and animal species. Scientists expect average annual temperatures to continue to increase in southeast Alaska by the end of the century. 2100 temperatures will be warmer by 6° to 8°F Fahrenheit under an increasing greenhouse gas emission scenario or by 4° to 6°F Fahrenheit should greenhouse gas emissions substantially decrease.

These rising temperatures are causing a rapid loss of glacier ice in Alaska. 95% of the glaciers are losing volume, some at the highest rates on in the world. Glacial melt in Alaska and neighboring British Columbia transfers more freshwater to the ocean than the melting Greenland ice sheet. Changes in glacial inputs and changes in the timing of freshwater discharges will impact stream habitats of glacial fed systems. In the long term, loss of glacial ice will result in lower water yields. The loss of glacial and ice sheet volume will likely be one of the more significant causes of rising sea levels this century.

Increases in sea level and increased frequency and severity of storm surges could change the hydrology of coastal wetlands and deltas. Half or more of the world’s tidal wetlands could disappear this century due to sea level rise. This effect will occur primarily in the southern portion of southeast Alaska– the sea level is actually decreasing in northern southeast Alaska due to glacial rebound. The numerous avian, fish and wildlife species that utilize these habitats during portions of their life cycle will face declines in essential seasonal habitat. In particular, sea level rise will reduce the amount of low elevation habitat for chum and pink salmon.

Scientists project southeast Alaska will experience the largest change in winter days above freezing in all of North America. Watersheds currently fed by snowpack will change into rain-fed systems. Glacial-fed watersheds will shift to relying on snow melt and eventually also become dependent on rainfall. This change likely means increased winter flows, reduced summer flows and higher temperatures all year. The rain-snow transition zone will increase in elevation, resulting in less precipitation stored as snowpack. Some climate models project a decline in precipitation for southeast Alaska in both
summer and winter. Evidence of this changing water balance is already appearing with quantifiable decreases in the number and area of some waterbodies.

Changes in ocean chemistry and warming temperatures will also impact southeast Alaskan marine resources. Warming oceans will redistribute marine fish species, opening new habitat for some species but also causing viability risks for others. Across the North Pacific, there was an extreme marine heat wave from 2014-2016. Consecutive years of warm water patterns and associated changes in the food web in general will reduce overall marine ecosystem productivity, with particular risks for ectothermic marine species. Surveys measuring the abundance of juvenile cod, pollock and salmon in the eastern Gulf of Alaska showed precipitous declines following the heat wave with record low levels of juvenile coho and Chinook salmon.

Marine waters have absorbed a quarter of the anthropogenic carbon dioxide (CO²) emitted into the atmosphere. CO² uptake has caused oceans to become more acidic with adverse impacts on most marine species. Ocean acidification has significant adverse impacts on shelled species such as crab and planktonic species that form a key component of the marine food web. Alaska’s oceans and marine species have a high degree of vulnerability to ocean acidification. The southeast Alaska communities have highest vulnerability to ocean acidification because of dependence on crabs, salmon and shellfish, economic dependence on fisheries and projections of more rapid acidification.

**Climate change effects on salmon and fisheries**

Global climate change is likely to exacerbate the effects of habitat degradation by stressing salmon stocks and disrupting migration patterns, decreasing summer stream flows and altering temperature regimes. A primary concern for the marine environment will be the food web; a primary prey species for salmon, pteropods, may be substantially at risk as populations in increasingly acidic waters showed “rapid and significant” shell dissolution. Juvenile pink salmon in particular feed heavily on pteropods. Warming ocean temperatures are likely to result in smaller sized adults. Hydrological changes will challenge fishery managers responsible for conserving and managing southeast Alaskan resources. One of the more predictable aspects of climate change will be stream warming. Decreased snowpack and changes in glacial system runoff will alter stream flow patterns that historically maintained cooler summer temperatures. Stream warming will affect each salmon species differently, with moderately higher temperatures benefitting some life stages (increased biomass of smolts) while negatively affecting others. High temperature events which periodically occur in southern southeast Alaska are likely to become more common and spread to northern southeast Alaska, increasing pre-spawning mortality for pink and chum salmon. Temperature increases in freshwater systems will adversely affect coho and sockeye salmon at various stages of their life cycle.

Climate caused changes in stream flow will also likely have primarily adverse effects on SeaBank salmon. Late summer low stream flows, which periodically occur in southern southeast Alaska, are likely to become more common and spread to northern southeast Alaska, increasing pre-spawning mortality for pink and chum salmon. High flows during
winter increase embryo mortality, resulting in declining numbers of returning spawners.

Increased storm strength and sea level rise will also reduce the amount of freshwater habitat and estuarine habitat available to all salmon species for spawning and rearing. Glacial runoff influences downstream freshwater and near shore marine ecosystems—changes in flow, temperature and nutrient dynamics in freshwater ecosystems influence fish abundance across life history stages. Glacial recession can cause the development of new streams that over time may support new salmon runs.

Some of these issues are already occurring—NMFS identified that low smolt production in Auke Creek was caused by warm creek temperatures and low water depths which in turn were caused by lack of snowfall and snow melt. Because these and other climate related changes are not favorable for salmon, remaining intact watersheds in southeast Alaska “are important buffers to many of the effects that may be imposed by climate change.”

Climate change risks to shelled species are significant because all shelled species are highly vulnerable to ocean acidification. Sea level rise may change the quantity, quality and location of nearshore habitat that is essential to the life cycle of crabs and other shellfish. Additionally, climate change risks may compound risks to commercial shellfish fisheries associated with the region’s growing sea otter population. There is now an imbalance between fishery harvests and expanding sea otter predation on shellfish resources. The southeast Alaska’s sea otter population has grown significantly and may further expand at rates between four percent and twelve percent a year. Alaska Department of Fish and Game researchers and dive fishermen believe that this growing population is having a significant adverse effect on commercial harvests of geoduck, crabs and other species. Sea otter predation is a particular concern for Dungeness crab. Commercial fishery harvests in areas with major sea otter presence in the southern part of the region and outside coast line have fallen by roughly 40 percent even while remaining stable in areas with minimal sea otter presence.

Timber harvest climate change effects

Logging is responsible for substantial CO² emissions. Global deforestation and degradation cause more greenhouse gas emissions than the entire global transportation system. Planned logging on federal lands in southeast Alaska alone would result in CO² emissions equivalent to 4 million vehicles each year on Alaska roads over an entire century.

Social costs caused by implementation of the Forest Service’s 2016 Forest Plan and associated logging emissions include reduced value of ecosystem services, property damage and other climate change related harms. Estimated annual social costs per ton of carbon released into the atmosphere range between $27 per metric ton to $221 per metric ton. At the lower range, implementation of the 2016 Forest Plan would result in $108 million in annual global warming costs over the next century. Conversely, southeast Alaska’s coastal temperate rainforest is a champion at carbon sequestration, absorbing large amounts of CO² from the atmosphere and providing a globally significant ecosystem service.
Timber harvest effects on salmon and other fisheries

The amount and quality of aquatic habitat directly corresponds to salmon production. Less habitat where fish can reproduce means fewer fish. During the 1990s, scientists identified most southeast Alaskan salmon stocks as healthy largely because of the large amount of undisturbed habitat. At the time, more than half of the stream length of anadromous salmon habitat was still intact. In 2018, both pink salmon and Chinook salmon returns plummeted. Fishery managers believe that decades of logging have reduced habitat capability for coho salmon through alterations in stream channels, culverts that block fish passage on logging roads, and effects on smaller streams. Coho are particularly susceptible because they use tributary streams—systems that offer few refuges and are sensitive to disruption.

Clearcutting and timber road construction in salmon habitat harms habitat productivity for salmon. These anthropogenic disturbances “substantially” reduce habitat quality, even if there are forested buffers on known anadromous streams. Tree buffers in southeast Alaska are narrow and tend to blow down, losing their effectiveness over time. Unbuffered, smaller streams classified as non-anadromous now comprise the bulk of the stream mileage in southeast Alaska watersheds.

Reduction in the value of salmon habitat assets occurs through the removal of natural vegetation, installation of culverts and reductions in habitat complexity. Sedimentation of stream beds caused by clearcutting and timber road construction in particular is a major cause of salmon population declines throughout the species’ range. Timber roads increase sediment, degrade water quality, fragment habitat, and increase high temperature regimes. There are 1,100 stream crossings, mostly failed culverts, on Forest Service lands alone in southeast Alaska that function as small dams, blocking 250 miles of important stream spawning habitat. Repairing or removing culverts that block fish habitat can result in rapid increases to salmon populations. In southeast Alaska, watersheds damaged by intensive logging and road construction take over a century to recover, and short timber rotation cycles of less than 100 years prevent recovery.

A major concern of fishery scientists is that high levels of habitat degradation may coincide with periods of low marine productivity, creating a potential for “double jeopardy.” Intensively logged watersheds may have some habitat value during periods of high marine productivity, but these degraded habitats will be of lower value during periods of environmental stress. Smolt production will likely be more variable in logged watersheds, and other environmental disturbances such as droughts, flooding or landslides will be more severe in logged watersheds.

The double jeopardy scenario exists because management plans continue and even accelerate intensive logging of old growth and immature recovering forests at a time when the region’s salmon production capacity is at risk due to multiple environmental factors. The most highly productive fish habitat in southern southeast Alaska overlaps with areas managed for timber production. These areas have also suffered habitat loss at a much greater rate than other portions of southeast Alaska. The Forest Service is currently considering plans to open Inventoried Roadless Areas for logging.
that the agency had previously protected in significant part to reduce impacts to aquatic habitat. Other timber land owners are also considering plans to implement a massive logging project in the Chilkat River valley— an area that already includes a high percentage of degraded habitat.

Habitat loss has had a substantial impact on the commercial, sport and subsistence salmon fisheries. Researchers are developing methodologies to estimate the loss of salmon related economic values caused by logging and related road construction. Canadian researchers in 2003 developed habitat values (which the authors described as conservative estimates) that ranged from $.026 to $1.40 per acre of watershed, or $1,491 to $7,914 per mile of spawning stream (converted to 2003 U.S. dollars— or roughly $10,000 per mile of spawning stream today). This means the 250 miles of Southeast habitat blocked by culverts alone represents a $2.5 million annual loss.

A 1988 study identified significant economic losses to salmon fisheries caused by logging and road construction on just 21% of the Siuslaw National Forest. The author noted that logging and road construction resulted in substantial and unavoidable losses even with improved road design practices and stream buffers. Another study found that, “if habitat improvements resulting from salmon-related logging restrictions generated one additional fish for the recreational fishery per year per acre for the foreseeable future, the asset value of the habitat would be about $2,800 per acre”— or seven times the forgone timber asset value of the land.

Case Study: Prince of Wales timber sales

One of the primary reasons why ecosystem loss continues despite net socio-economic losses is that “intervention failures” exaggerate the purported benefits of habitat conversion. The Forest Service and other landowners are liquidating some of the region’s most important natural capital: remaining old-growth and recovering second-growth forests in southern southeast Alaska. The Forest Service spends millions of taxpayer dollars annually supporting two timber companies that provide few jobs and spends at least $10 million for every $1 million received in timber sale revenue. High intensity logging is one of the big losers on global scale, with loss of non-timber products, fish and wildlife species and carbon stocks routinely exceeding timber values.

The Forest Service is proposing a large timber sale Prince of Wales that would remove nearly two-thirds of a billion board feet of federal timber over the next fifteen years. Prince of Wales Island is the largest island in southeast Alaska and the 3rd largest island in the United States, and its remaining public forests form an essential piece of southeast Alaska’s natural capital.

Prince of Wales Island has been a primary producer of deer in southern Southeast Alaska, supporting harvest by island residents and residents of other southeast Alaska communities. The Forest Service and other timber agencies have already destroyed much of the best remaining publicly owned winter deer habitat on the island. Recent deer seasons have already been less productive. Additional logging is almost certain to cause local or even island-wide wildlife extirpations and force survivors into isolated patches of lower quality habitat. The Forest Service plans to remove much of the remaining old-growth habitat for old-growth dependent wildlife.
species, and then liquidate the oldest second-growth stands that would otherwise grow to provide wildlife habitat features in the long-term.

Prince of Wales Island has historically been the most important island ecosystem in southeast Alaska for salmon production. Most of southeast Alaska’s salmon production occurs in just over a quarter of Tongass National Forest watersheds known as Primary Fish Producers—the core of sport, commercial, subsistence and ursine fisheries. Across the entire region, 243 of 934 watersheds produce 60 percent of the pink salmon and 72 percent of cohos. Roughly a third of these high value, Primary Salmon Producer watersheds (77) are on Prince of Wales Island. But the Forest Service and other timber agencies have logged watersheds in the 1.5 million acre North Central Prince of Wales Island biogeographic province so intensively that only 15% of the island’s watersheds consist primarily of intact habitat.

There have been recent and staggering declines in pink salmon harvests in fishing districts adjacent to Prince of Wales Island. Commercial salmon harvest data from 2017 and 2018 indicate that productivity from Prince of Wales Island watersheds is declining at a faster rate than other portions of southeast Alaska, raising serious questions about whether effects from timber sales over the past decade are adding to losses associated with declines in marine productivity. Potential lost income due to degradation of the Prince of Wales 77 Primary Salmon Producers—potentially a quarter of the region’s wild salmon production in any given year—could cost the region billions in ecosystem services over the next decade.

Any natural or anthropogenic disturbances to estuarine habitat pose risks to Dungeness crab. One of the primary anthropogenic disturbances to crab and other shellfish habitat in estuaries is the use of in-water log transfer facilities by timber operators. During the 1990s, the use of these facilities by the Forest Service and other landowners caused severe damage to sixteen saltwater ecosystems in southeast Alaska that are just now recovering after several decades of non-use or limited use.

In-water log storage degrades water quality below levels necessary to protect existing commercial fisheries. There is a significant body of science that shows the incompatibility of the marine log storage with benthic habitat. Scientists and non-timber agency resource managers recognize that toxins, bark debris accumulations, and the associated low dissolved oxygen levels cause adversely impact shellfish species such as Dungeness crab in numerous ways, causing reproductive problems, disease, deformities, and prey depletion.

**Timber harvest effects on deer and bears**

A major challenge for preserving southeast Alaska’s wildlife is the nature of island ecosystems, which make wildlife species highly vulnerable to climatic events and habitat alteration and fragmentation. In general, the subsistence, sport, visitor products and intrinsic existence values derived from southeast Alaska’s most productive wildlife ecosystems are also highly vulnerable to future habitat loss caused by industrial scale clearcut logging. Industrial logging has altered habitat values for deer and bears, particularly on southeast Alaska’s southernmost island ecosystems that provided the largest numbers
of salmon streams and high value old-growth wildlife habitat. These losses include nearly one third of the most valuable large-tree old-growth forest stands.

Hunter harvests are lower on the more heavily logged southern islands where Alexander Archipelago wolves are part of the ecosystem. Deer population numbers are extremely low in three island ecosystems—Kuiu, Kupreanof and Mitkof—and have been since the 1960s. The severe 2006/2007 winters resulted in further declines. Other heavily logged areas such as Wrangell Island have lost more than a third of the lower elevation deer winter habitat. There are fewer deer than there are on surrounding islands. There are not enough deer to meet hunter demand in the Ketchikan area.

Ketchikan area wildlife managers fault clearcutting and loss of winter habitat for poor deer production near Ketchikan. They anticipate that Ketchikan hunters will increasingly utilize Prince of Wales Island for deer hunting. However, biologists expect the Prince of Wales deer population to decline because of habitat loss. Clearcutting removed a third of the most important deer winter range on the island by 2005. Recent and ongoing clearcutting by multiple landowners on the island target areas that provide the last remaining stands of high-quality winter deer habitat and travel corridors in the central part of the island.

The combination of habitat loss, deer deficits in other communities, and increases in guided non-resident hunting cause concerns about the stability of Prince of Wales Island’s deer populations. Subsistence users identified a harder time harvesting deer during the 2016 season. Then, the 2017 deer season “was the worst in recent memory for a lot of hunters.” The Alaska Department of Fish and Game has concerns about the cumulative adverse effects of past, ongoing and future industrial scale clearcutting on future deer dividends. Area biologists believe that the public has not received adequate information on the effects of logging and the tradeoffs between clearcutting and wildlife—particularly long-term loss of hunting opportunity and unmet subsistence needs.

A major challenge for preserving southeast Alaska’s wildlife is the nature of island ecosystems, which make species highly vulnerable to climatic events and habitat alteration and fragmentation.

Climate change effects on deer and deer habitat are unknown. However, warming temperatures and associated average milder winters will not necessarily diminish the importance of winter habitat. Precipitation and the probability of extreme storms may increase and even exacerbate risks of deep snow.

There are concerns about black bear population declines in central southeast Alaska and on Prince of Wales Island. Hunter harvests and the skull sizes of harvested bears have declined considerably over the past decade.
State biologists speculate that the population decline may be evidence of reduced carrying capacity due to habitat loss, and consider logging to be the most serious long-term threat to black bear habitat. Past logging has also reduced habitat carrying capacity for brown bears. There is significant bear habitat degradation on eastern Chichagof and eastern Baranof Islands. However, federal wilderness areas on Admiralty, south Baranof and west Chichagof islands provide brown bears with large areas of intact habitat. The population is stable and the most serious current risk to the species likely results from declining numbers of pink salmon during even year spawning cycles.

**Marine mammal risks**

Commercial harvesting of marine mammals resulted in significant depletion of many species. Because some of these populations are recovering, they remain particularly vulnerable to environmental changes. Interactions with other human uses of the marine environment can result in population effects or effects to individual mammals. While the studies remain controversial, some scientists believe that prey depletion caused by industrial scale groundfish trawling was a significant factor in the decline in the western Steller’s sea lion stock. Military training activities in the Gulf of Alaska pose acoustic and toxic threats to many marine mammals. Whales are also vulnerable to ship strikes, entanglement in fishing gear (infrequent in southeast Alaska due to the generally low-impact nature of regional fisheries) and whale watching in close proximity. Habitat loss for species dependent on habitat features provided by glaciers is a significant concern. The sudden retreat of the Muir Glacier in Glacier Bay caused a loss of haulout areas and decline in the harbor seal population.

**Timber harvest effects on visitor industry**

Small cruise vessel companies depend on the ability to market and provide unique recreation experiences. This business model requires guided public access not just to lands in general but rather to uncrowded areas that offer higher quality recreation experiences in environments free from industrial activities. Outfitters and guides select for natural appearing landscapes and avoid cutover areas until they grow back in order to meet visitor expectations to see the region in “a wild and unspoiled state.”

The State of Alaska’s small cruise report explains that:

> [t]he number one challenge that operators indicated was lack of sufficient access to public land. These operators require increased and more flexible access to landing sites, including new and maintained trails to provide sufficient space between clients traveling on different vessels. The branding that is associated with [small cruise tours] is one of uncrowded experiences away from masses of people and the companies that depend heavily on access to U.S. Forest Service land along the cruise routes, any action that limits access… threatens business stability and reduces opportunities for growth.

The growth of the visitor industry over the past two decades has created management challenges in terms of providing sufficient access to remote recreation opportunities. Primary risks to the visitor products industry
are any developments that would reduce the asset value of fish and wildlife resources, negatively affect scenic values, or interfere with outdoor adventure activities. The loss of recreational habitat would result in more competition for available areas and conflicts between recreation users, with demand and carrying capacity exceeding supply in various locations. Remote locations such as north Kuiu Island have become so important that tour operators have had to resort to litigation to stop timber sales. These eco-tour operators are the most outspoken southeast Alaska business sector with regard to concerns about potential Alaska-specific exemptions to the Roadless Area Conservation Rule. Any exemptions would disturb existing use patterns and displace these lucrative operations.
Coastal ecosystems such as SeaBank are the most productive economic systems in the world. SeaBank’s natural capital provides goods and services that include the highest quality and most valuable seafood on the planet, scenic and remote recreation experiences for hundreds of thousands of visitors each year, plus 11 million acres of forest that sequester carbon and abundant wildlife. This combination of assets is globally rare, if not unique. If not overdrawn, the future economic value of this natural capital to the region’s fishery and visitor products industries could amount to $200 billion over the next century.

Asset values are also vulnerable to rapid environmental change caused by the cumulative effects of a warming planet and industrial development that degrade natural capital assets. The SeaBank economic system works best through a fully capitalized business model. Actions that degrade key assets such as adding toxic mine pollution to watersheds, removing forested habitat, or disrupting streams through industrial logging and timber road construction will diminish the capital and reduce dividends. Climate change and the attendant ocean acidification are likely to alter the distribution, quantity and productivity of water, wildlife, forests and fish, heightening the need to aggressively safeguard existing assets.

The Alaska Sustainable Fisheries Trust will monitor changes in SeaBank’s natural capital assets such as habitat changes, trends in fish and wildlife abundance and natural capital dividends— seafood sales, visitor numbers and spending. Subsequent reports will update the status SeaBank’s natural capital, annual sales, and asset risks in order to better inform the public as well as local, regional and national decisionmakers.


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