7.0 Natural Resource Profile

Fisheries Resources

The fertile ocean environments and freshwater rivers, streams, and lakes of Southwest Alaska produce a variety of abundant fisheries resources. Many species of groundfish, finfish, shellfish, and marine invertebrates are available in commercially exploitable quantities.

Groundfish are those fish species that live on the sea bottom especially commercially important gadoid fishes like cod and haddock or flatfish like flounder.[1] In Southwest Alaska, the most important groundfish species are pollock, Pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, rex sole, rock sole, flathead sole, Alaska plaice, other flatfish, sablefish, Pacific Ocean perch, northern rockfish, shortraker/rougheye, pelagic shelf rockfish, demersal shelf rockfish, thornyhead rockfish, Atka mackerel, ling cod, and other species.

Halibut are also available in the fishing grounds of the Gulf of Alaska and the Bering Sea. Classified as a flounder, the State of Alaska does not rank halibut as a groundfish. Halibut are subject to U.S.-Canada agreement and are therefore managed and regulated under a model that differs from other fisheries re-sources in the region.

Other harvestable pelagic and anadromous finfish species include herring and all five species of Pacific Salmon. Herring are harvested in a number of forms including spawn-on-kelp, sac roe, and food/bait fisheries. Salmon are harvested for subsistence, commercial and sport fisheries. Sockeye salmon are the most abundant commercial salmon fishery. Chinook, Coho, pink, and chum salmon are harvested commercially and for subsistence uses. Salmon runs vary from year to year depending upon the area and the life cycle of each particular species. In addition to Pacific salmon and halibut, rainbow trout, Arctic grayling, Arctic char, Dolly Varden, northern pike, lake trout, burbot, and several species of whitefish are targeted by sport anglers.

Three varieties of king crab (red, blue and golden (or brown)) are commercially harvested in various locations in Bristol Bay and the Bering Sea. Tanner, snow, Dungeness, and Korean hair crab also occur in the waters of the Bering Sea and/or the Gulf of Alaska. Various varieties of shrimp, clams, and weathervane scallops also occur in commercially harvestable quantities.

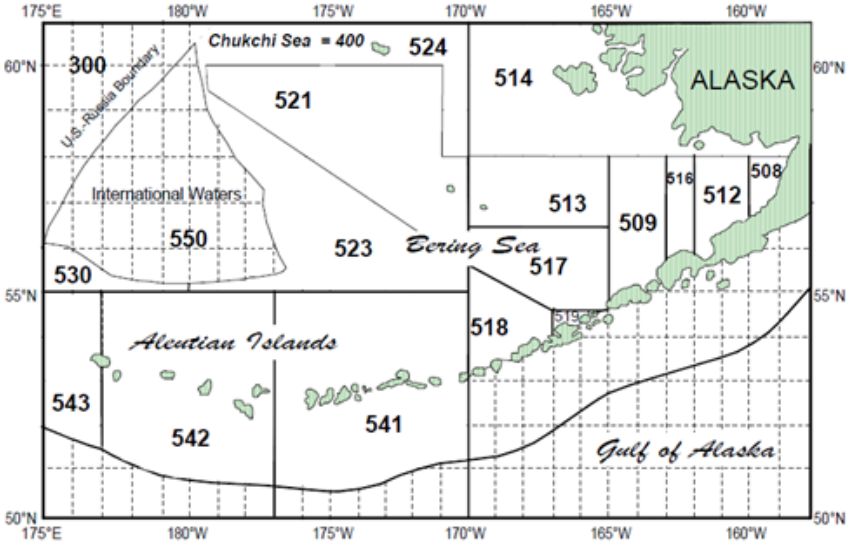
Marine invertebrates such as red sea cucumber, green sea urchin, squid, octopi, and miscellaneous other species are commercially harvested on a relatively small scale, primarily for export markets. These and other marine and intertidal invertebrates are also harvested for subsistence foods.

A variety of international, national, and state laws and agencies govern the management, regulation, and harvesting of fisheries resources within Southwest Alaska. Federal fisheries are managed by the National Marine Fisheries Service, a unit of the National Oceanic and Atmospheric Administration in the U.S. Department of Commerce, with the oversight of the North Pacific Fishery Management Council (NPFMC). State fisheries are managed by the Alaska Department of Fish & Game under the oversight of the Alaska Board of Fish. The halibut fishery is managed by the International Pacific Halibut Commission with allocation and limited entry decisions made by the NPFMC.

Federal fisheries are those fisheries resources within the Exclusive Economic Zone (EEZ), which is that area from three to 200 nautical miles offshore. Authorization for federal control of resources in the EEZ comes from the Fishery Conservation and Management Act (FCMA), now known as the Magnuson-Stevens Act (MSA 1996), originally passed by the U.S. Congress in 1976.[2]

The NPFMC is one of eight regional councils established by the FCMA/MSA to oversee management of the nation's fisheries. With jurisdiction over the 900,000 square mile EEZ off Alaska, the Council has primary responsibility for groundfish management in the Gulf of Alaska (GOA) and Bering Sea and Aleutian Islands (BSAI), including cod, pollock, flatfish, mackerel, sablefish, and rockfish species harvested mainly by trawlers,

Map 7.1: Bering Sea/Aleutian Islands (BSAI) Groundfish Management & Reporting Areas



Source: http://www.alaskafisheries.noaa.gov/rr/figures.htm

Map 7.2: Gulf of Alaska (GOA) Groundfish Management & Reporting Areas

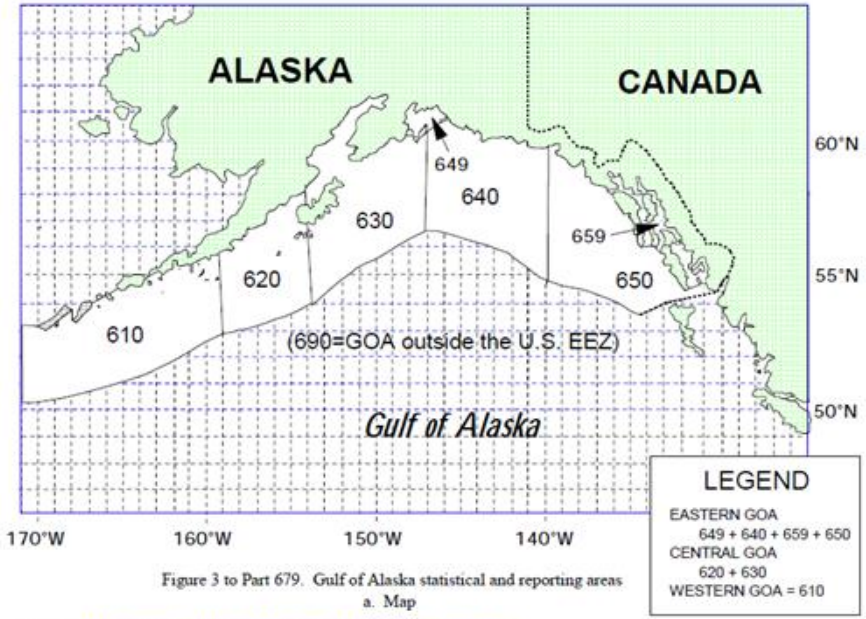
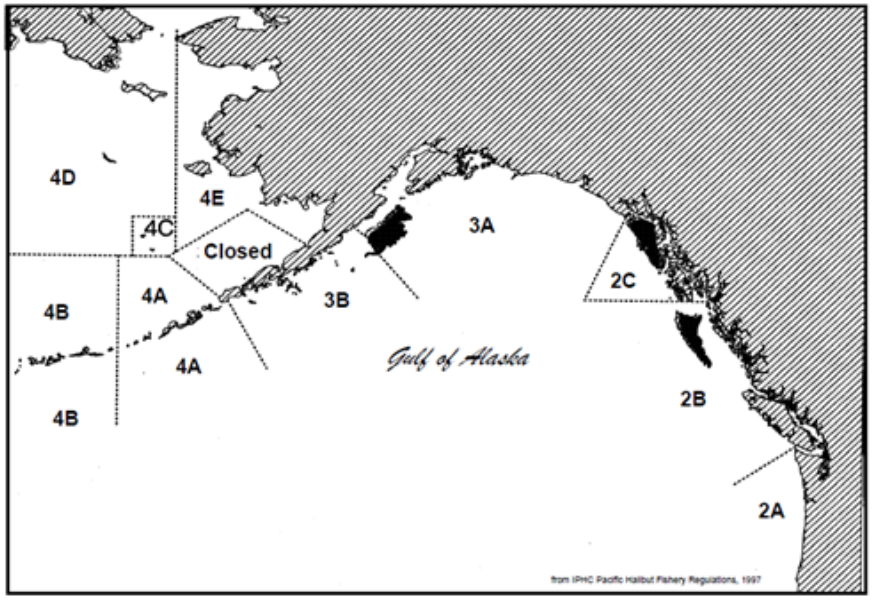


Figure 3 to Part 679. Gulf of Alaska statistical and reporting areas
a. Map

Source: http://www.alaskafisheries.noaa.gov/rr/figures.htm

Map 7.3: Alaska IPHC Halibut & Reporting Areas



Source: http://www.alaskafisheries.noaa.gov/rr/figures.htm

hook and line longliners and pot fishermen.[3] Maps 7.1 and 7.2 show the management statistical and reporting areas for the BSAI and GOA, respectively.

The Council has eleven voting members, six from Alaska, three from Washington, one from Oregon, and a federal representative, the Alaska Regional Director of NMFS. The non-federal voting members represent state fisheries agencies, industry, fishing communities, and academia. The Council also has four non-voting members representing the U.S. Coast Guard, U.S. Fish and Wildlife Service, the Pacific States Marine Fisheries Commission, and the U.S. Department of State.[4]

The NPFMC and NMFS have developed five fishery management plans (FMPs) that outline the conservation, management, and harvesting of federal fisheries resources in Alaska. Each FMP encompasses regional fisheries for certain species, as listed below:

- The Bering Sea/Aleutian Islands Groundfish FMP covers all species of groundfish (pollock, cod, flatfish, sablefish, rockfish, etc.) fished commercially by vessels using trawl, longline, pot, and jig gear. In-season management of these fisheries is done by NMFS in Juneau.

- The Groundfish of the Gulf of Alaska FMP essentially mirrors the BSAI groundfish FMP. Some commercial species (black rockfish, blue rockfish, and lingcod) are not included in this FMP, but are instead managed by the State of Alaska.

- The Bering Sea/Aleutian Islands King and Tanner Crab FMP includes all species and fisheries for king and Tanner crab (red, blue, and brown king crab, Tanner crab, and snow crab).

- The Alaska Scallop FMP was drafted to control fishing effort in the weathervane scallop fishery. Only nine vessels are permitted under a license limitation program. In-season management of the fishery is provided by ADF&G in Kodiak.

- Salmon Fisheries in the EEZ off the Coast of Alaska FMP was developed to prohibit fishing for salmon in the EEZ except by a limited number of vessels using troll gear in Southeast Alaska. All management of the salmon fisheries is deferred to the State of Alaska.[5]

The Council also makes allocative and limited entry decisions for halibut. However, the U.S. - Canada IPHC is responsible for the conservation of halibut stocks.[6] Map 7.3 shows the IPHC's management areas for halibut conservation.

The International Pacific Halibut Commission (IPHC) was established in 1923 by a Convention between the governments of Canada and the U.S. Its mandate is research on and management of the stocks of Pacific halibut within the waters of both nations. The IPHC consists of three government-appointed commissioners for each country. At its annual meeting budgets, research plans, biomass estimates, catch recommendations, as well as regulatory proposals are discussed and approved then forwarded to the respective governments for implementation. The IPHC conducts numerous projects annually to support both mandates – stock assessment and basic halibut biology.[7] The halibut fishery harvest is managed through an Individual Fishery Quota (IFQ) process as established by the NPFMC, which essentially allocates the harvestable resource among privately owned quota shares.

The BSAI groundfish fishery is widely regarded as one of the best-managed fisheries in the world. According to the National Marine Fisheries Service (NMFS), not a single species in the Bering Sea fishery is overfished or approaching overfished condition. Federal fishery scientists and managers have been successful in maintaining sustainable fisheries in the North Pacific by using the most sophisticated stock assessment technology available to determine abundance levels and then setting sustainable catch limits (quotas) for each species.[8]

The American Fisheries Act (AFA) allocated BSAI groundfish fisheries among various harvester and processor groups including Motherships, Catcher/Processors, Catcher Vessels, Community Development Quota organizations (CDQs), and inshore processors Allocations vary by fishery, gear type, and other factors. Each at-sea processing vessel carries two federal fishery observers onboard at all times to monitor catch amounts and collect scientific information. Fishing ceases when the quota is met.

The AFA was signed into law in October of 1998. The purpose of the AFA was to tighten U.S. ownership standards that had been exploited under the Anti-reflagging Act, and to provide the BSAI pollock fleet the opportunity to conduct their fishery in a more rational manner while protecting non-AFA participants in the other fisheries.[9]

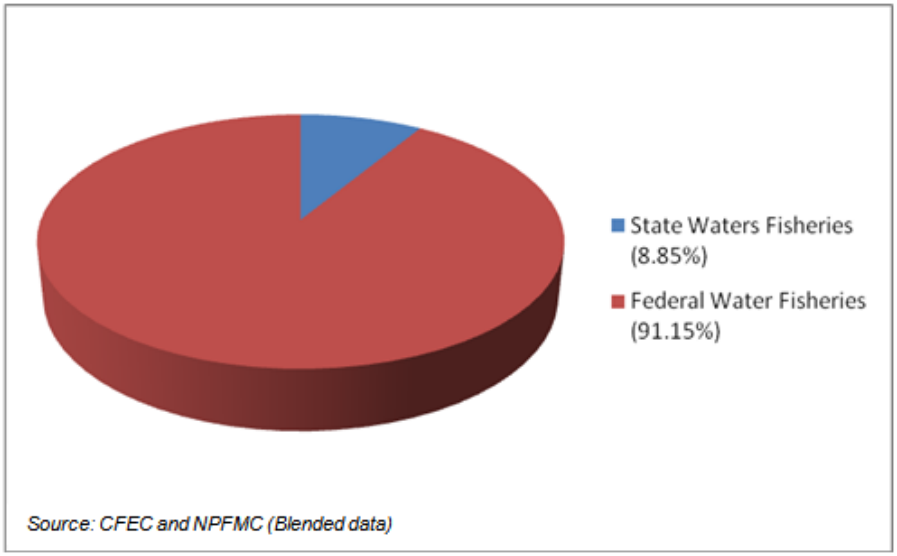
The State of Alaska has management authority for fisheries resources within the "waters of Alaska", meaning the internal waters of the state including rivers, streams, lakes and ponds, the tidal zone of the state from mean higher high water to mean lower low water, and those waters extending three miles seaward, except for subsistence uses on federal lands.[10] Authority for management of state fisheries resources comes from the Alaska Statehood Compact of 1958, the state Constitution, and Alaska Statutes. The Alaska Department of Fish and Game is mandated to manage, protect, maintain, and improve the fish, game and aquatic plant resources of the state. The agency's primary goals are to ensure that Alaska's renewable fish and wildlife resources and their habitats are conserved and managed on the sustained yield principle, and the use and development of these resources are in the best interest of the economy and well-being of the people of the state.[11]

Alaska state fisheries are managed for commercial, sport, and subsistence uses. For Southwest Alaska, commercial fisheries management is divided across two management regions. The Central Region includes Bristol Bay finfish fisheries, while the Westward Region includes Kodiak, Chignik, Alaska Peninsula, and Bristol Bay crab fisheries. Within each region, fisheries management plans are developed for fisheries districts, usually based on a specific river drainage. For sports fishing, all of Southwest Alaska is managed as a part of the Southcentral Region. Subsistence fisheries for the area are managed as the Southwest Region. Map 7.4 shows the boundaries for the ADF&G commercial fish regions.

The Board of Fisheries (BOF) provides oversight to the ADF&G's management of the state's fisheries resources. This involves setting seasons, bag limits, methods and means for the state's subsistence, commercial, sport, guided sport, and personal use fisheries, and it also involves setting policy and direction for the management of the state's fishery resources. The board is charged with making allocative decisions, and the department is responsible for management based on those decisions.[12]

The Alaska Board of Fisheries consists of seven members serving three-year terms. Members are appointed by the governor and confirmed by the legislature. Members are appointed on the basis of interest in public affairs, good judgment, knowledge, and ability in the field of action of the board, with a view

Chart 7.1: Fisheries Resources by Federal and State Waters (2007 Metric Tons Harvested)



to providing diversity of interest and points of view in the membership.[13]

The BOF has a local advisory committee process to provide communities, harvesters, and citizens with a means to give local input into the fisheries resources regulation and management process, and make recommendations to the Board. There are 81 local advisory committees throughout the state. The purpose of local advisory committees, as established by the legislature established includes: developing regulatory proposals; evaluating regulatory proposals and making recommendations to the BOF; providing a local forum for fish and wildlife conservation and use, including matters relating to habitat; advising the appropriate regional council on resources; consulting with individuals, organizations, and agencies.[14] There are local advisory committees in thirteen Southwest communities and/or fisheries: Chignik, False Pass, King Cove, Kodiak, Lake Iliamna, Lower Bristol Bay, Naknek/Kvichak, Nelson Lagoon, Nushagak, Sand Point, Togiak, Unalaska/Dutch Harbor, Central Bering Sea.

Chart 7.1 illustrates the 2007 fisheries resource harvests based on state and federal waters. However, because the collection of commercial fishing data is not absolute, data from this chart should be taken with caution. For example, the federal fisheries data includes areas of water that are not in Southwest Alaska, specifically the Gulf of Alaska region, which includes Kodiak and Prince William Sound data.

Forest Resources

All four of the forest types that occur in Alaska can be found in Southwest Alaska.[15] Map 7.5 illustrates the types and distribution of forest resources in the region.

Coastal Western Hemlock-Sitka Spruce forested areas are confined primarily to the Kodiak Archipelago, with small isolated stands on the Alaska Peninsula. These forests are the westernmost progression of the Hudsonian Coniferous Band that begins at Hudson Bay in Canada and extends across the North American continent. Rather than the mixed forest that the name implies, in Southwest Alaska this forest type is a monostand of Sitka Spruce. This coastal species is seldom found far from tidewater, where moist maritime air and summer fogs help to maintain humid conditions necessary for growth. This forest type is also referred to as a temperate rain forest.

In the Kodiak Archipelago, the spruce forest is advancing at the rate of ten feet every decade. Dendrochronological studies of fossilized trees on Afognak Island indicate that the advance of spruce trees into the region began approximately 5,000 years ago. It is theorized that seed stock was carried to the region by currents in the Gulf of Alaska. Compared to older, multigenerational stands in Southeast Alaska, the stands in Southwest Alaska are considerably shorter, exhibit less natural pruning, and therefore, have more knots.[16]

The other three forest types: Bottomland Spruce-Poplar, Upland Spruce-Hardwood, and Lowland Spruce Hardwood are found in the

Map 7.5: Forest Resources and Distribution in Southwest Alaska

Bristol Bay Borough, Dillingham Census Area, and Lake & Peninsula Borough. These boreal forests are also referred to as "taiga", a Russian word meaning "little sticks."[17] Bottomland Spruce-Poplar forests typically occur on broad floodplains and river terraces. In Southwest Alaska they can be found along the Nushagak and Kvichak Rivers. These forests are generally composed of dense stands of white spruce mixed with cottonwood and balsam poplar.[18]

Upland Spruce-Hardwood forests are generally dense areas of white spruce, birch, aspen and poplar with stands of black spruce on north facing slopes and poorly drained flats.[19] This forest type can be found in the Kilbuck Mountains along the westernmost boundary and scattered patches along the northern portion of the Dillingham Census Area toward the Taylor Mountains, as well as stands along Lake Iliamna, Naknek Lake, and throughout Lake Clark National Park.

Lowland Spruce-Hardwood forests are made up of mixed evergreen and deciduous trees, but in Southwest Alaska are most often large monostands of black spruce and areas of slow-growing, stunted tamarack (eastern larch) in wet low lying places. This forest type can be found on the southwest end of Lake Iliamna and an expanse that extends from the Nushagak River to the Kilbuck Mountains.

Mineral Fuels

Mineral fuel resources in Southwest Alaska may be significant; however, efforts to assess and explore these resources have been limited or preempted by energy developments elsewhere in the state, nation and world. According to the U.S. Geological Survey (USGS), the U.S. Minerals Management Service (MMS) and the Alaska Department of Natural Resources (DNR), there are both onshore and offshore oil and gas basins and coal fields in the region.

Oil and Gas

Potential mineral fuel resources occur in federal and state waters adjacent to the region, and on state and private lands onshore. Map 7.6 illustrates the locations of oil and gas basins in and around Southwest Alaska. The MMS defines basins as large downwarped regions serving as a center of sedimentary deposits, which may contain numerous geological plays.[20] The Outer Continental Lands Act requires the Department of the Interior (DOI) to

prepare a 5-year program that specifies the size, timing and location of areas to be assessed for Federal offshore natural gas and oil leasing. It is the role of DOI to ensure that the U.S. government receives fair market value for acreage made available for leasing and that any oil and gas activities conserve resources, operate safely and take maximum steps to protect the environment.[21] DNR mirrors this process with a similar 5-year leasing program.

Oil and gas basins in the region include the Susitna/Cook Inlet Basin that extends to the southwest into Shelikof Strait and the Kodiak and Shumagin Basin that extends from the Gulf of Alaska to the north and borders the Kodiak Archipelago on the east and continues southward to the Shumagin Islands. The expansive Aleutian Arc extends from the Alaska Peninsula near Egegik, continues out into the Bering Sea along the Aleutian Chain, and incorporates both onshore and offshore formations. The Bering Sea also has smaller oil and gas basins such as the Aleutian Basin, Bowers Basin, North Aleutian Basin and St. George Basin.[22]

The USGS divides Alaska into three provinces. Southwest Alaska is included in Province Three – Southern Alaska, which is all of the area south of the Alaska Range. Both onshore and offshore geological formations in the Southern Alaska Province have been assessed by the MMS using play analysis.[23]

A play is a set of discovered or undiscovered oil and gas accumulations or prospects that are geologically related. A play is defined by the geological properties that are responsible for the accumulations or prospects.[24] These properties include the trapping style, the type of reservoir, and the nature of the seal for the formation. Chart 7.2 illustrates the stratigraphy of regional geological formations.

The Alaska Peninsula includes two hypothetical plays. An outcrop of Mesozoic rocks and part of the southwestern Bristol Bay lowlands form the Alaska Peninsula Mesozoic Play. This play extends over 400 miles in a band of 30 to 50 miles wide that begins in lower Cook Inlet and reaches to the southwest near Cold Bay. Characterized as very speculative by the MMS due to limited assessments and disappointing test wells, this play has evidenced large surface oil seeps along three anticlines: Ugashik, Bear Creek and Wide Bay.[24]

The Alaska Peninsula Tertiary Play extends 300 miles from Becharof Lake down the peninsula to a narrow strip of coastline opposite Cold Bay with an average width of 25 miles.

Map 7.6: Mineral Fuel Prospects in Southwest Alaska

Further seismic studies are needed to determine the structure and resource potential of this play. However, test wells encountered gas and, in one case, oil.[25]

The region's offshore resources may be considerably more substantial. The Cook Inlet Basin is the only area in the Southern Alaska Province that is currently producing both oil and gas. However, these wells are confined to areas of Cook Inlet in the vicinity of the Kenai Peninsula Borough. Three geological plays are identified in the basin, only two of which occur in the region. The Mesozoic Structural Play extends from Cook Inlet to the northeast to Shelikof Strait which is bounded by the Alaska Peninsula on the northwest and the Kodiak Archipelago to the southeast. The Mesozoic Stratigraphic Play runs the entire length of Shelikof Strait encompassing areas of both the Alaska Peninsula and the Kodiak Archipelago.[26] During assessments for Federal Lease Sale Number 149, economically recoverable oil resources throughout the planning area were estimated at 1.2 million barrels. Only two leases from Lease Sale 149 remain active and these are offshore from the community of Anchor Point on the Kenai Peninsula.

According to an MMS assessment, the potential resources of the Shumagin-Kodiak shelf province are consolidated into a single play.[27] The Neogene Structural Play encompasses the entire shelf and slope of the province and is characterized as gas-prone. Assessment estimates for risked, undiscovered, conventionally recoverable resources were 600,000 to 2.5 million barrels of oil and 2.33 to 9.66 trillion cubic feet of gas in this play, [28] but the economically recoverable quantities may be negligible. Further assessment and exploration of the Kodiak-Shumagin Basin are required to determine future resource potential. Six offshore test wells were drilled in the Kodiak-Shumagin Basin, but resulted in no ongoing exploratory activity. The USGS reports that onshore assessments for the Kodiak Archipelago indicate little if any prospects for recoverable resources.

The Navarin and St. George Basins have more complex geological formations, seven and four plays, respectively. Lease sales in the early 1980s generated some industry interest in both basins, but resulted in no ongoing activity. MMS estimates suggest considerable resources in both basins. In the Navarin Basin, it has a mean of 1.22 trillion cubic feet of natural gas and 1.3 million barrels of oil. The St. George Basin is estimated to have 2.8 trillion cubic feet of gas and 2.1 million barrels of recoverable oil. However, the remoteness, lack of infrastructure, and outdated assessments have impeded further interest in these provinces.[29]

The federal moratorium on OCS exploration and leasing expired in the fall of 2008. The USGS and MMS have both identified the need for additional information about the Aleutian Basin, as well as other planning areas. Repeal of the moratorium is tantamount to developing the region's offshore oil and gas reserves.

In its 2006 assessment of national oil and gas resources, the MMS developed new estimates of economically recoverable resources in some OCS basins in the Alaska region. The MMS divides the OCS into fifteen planning areas, which are depicted in Map 7.7. Kodiak, Shumagin, Aleutian Arc, Navarin Basin, North Aleutian Basin, St. George Basin and Bowers Basin planning areas surround Southwest Alaska, although some planning areas are not adjacent to onshore areas. Currently, the North Aleutians Basin is the only area in Southwest Alaska included in the MMS' 2007 – 2012 five-year lease program schedule of sales.[30]

Based on the 2006 MMS assessment update, the North Aleutian Basin continues to offer the greatest potential for oil and gas development in Southwest Alaska. Table 7.1 outlines the base case for economically recoverable oil and gas in the region. Estimates are based on $80/bbl oil and $4.54/mcfg of natural gas. Based on this analysis, the North Aleutian Basin has a mean estimate of 8.62 trillion cubic feet of undiscovered gas and 75 million barrels

Table 7.1: Risked, Undiscovered, Economically Recoverable Oil and Gas in OCS Basins in Southwest Alaska (Base Case Scenario)

	Oil (BBO) - $80/bbl			Gas (TCFG) - $4.54/mcfg		
Area	F95	Mean	F05	F95	Mean	F05
Navarin Basin	0.00	0.06	0.31	0.00	0.00	0.00
North Aleutian Basin	0.02	0.74	2.47	0.00	0.91	2.78
St. George Basin	0.00	0.13	0.52	0.00	0.00	0.01
Shumagin Basin	0.00	0.01	0.03	0.00	0.00	0.00
Kodiak Basin	0.00	0.04	0.18	0.00	0.39	1.93

Source: U.S. Minerals Management Service, 2006 National Assessment Update

Map 7.7: U.S. Minerals Management Service Outer Continental Shelf Planning Areas Region One – Alaska

Source: http://www.mms.gov/alaska/lease/hlease/PLANMAP.HTM

Table 7.2: Historical OCS Lease Sales in basins in Southwest Alaska

Plan Area	Sale	Date	Leases Issued	Tracts Offered	Acres Offered	Acres Leased	Sum of All Bids Received
St. George Basin	70	1983	96	479	2,688,787	540,917	$427,343,830
Navarin Basin	83	1983	163	5,036	28,048,995	927,989	$631,228,331
North Aleutian Basin	92	1988	23	990	5,603,586	121,757	$95,439,500

Source: http://www.mms.gov/alaska/lease/hlease/LeasingTables/lease_sales.pdf

of undiscovered oil. Table 7.2 summarizes federal OCS oil and gas lease sales in the region.[31]

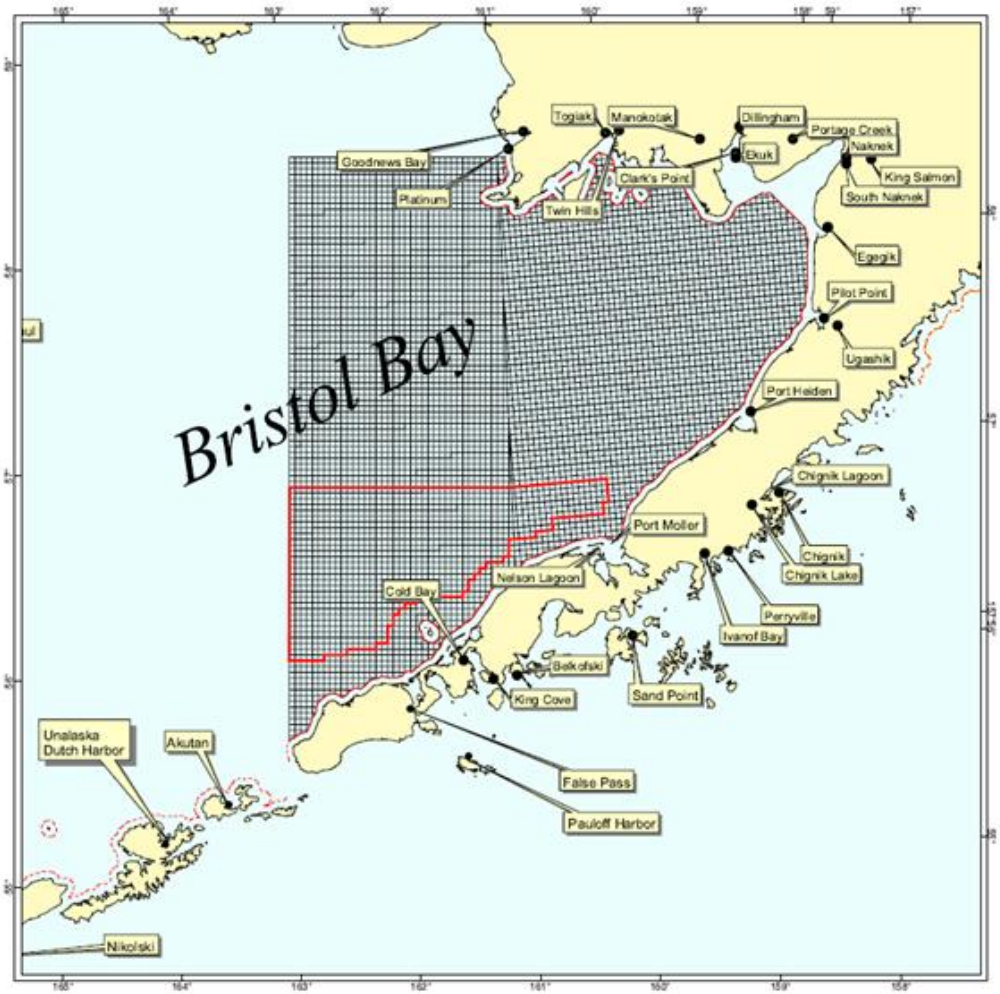
In the fall of 2008, the 30-year old federal moratorium on OCS exploration and leasing expired. Shortly after, a five-year leasing plan was issued by the Bush Administration, but was put on hold by the Obama Administration. Additionally, a court ruling effectively delayed some Alaskan plans for oil and natural gas until the government has reassessed environmental effects.[32] Information and recent updates on the North Aleutians Basin are presented below.

North Aleutians Basin

Introduction

The North Aleutians Basin is an Outer Continental Shelf (OCS) planning area designated by the U.S. Minerals Management Service and is located south of Bristol Bay and just off the northern shore of the Alaska Peninsula. The Basin is estimated to have 12.8 trillion cubic feet equivalent of recoverable natural gas along with 753 million barrels of recoverable oil. Although the area is particularly attractive for exploration, it is also prone to opposition from environmentalists and commercial fisherman. The Basin contains some of the nation's richest and most revered crab, pollock, cod, halibut, and salmon fisheries, marine mammal and seabird habitats, and stunning natural beauty. The region also is considered essential habitat for endangered species including the northern right whale and Steller sea lion. The abundant natural fisheries resources are the foundation of the region's commercial and subsistence economies and are integral to the fabric and lifestyle of its people and communities. However, the region's potential for nearly nine trillion cubic feet of natural gas makes the basin particularly attractive for exploration.[33]

Map 7.8: North Aleutians Basin with Proposed Sale 214 Highlighted in Red



Source -
http://www.doi.gov/news/07_News_Releases/MMS%20Map%20North%20Aleutian%20Basin%20Area.pdf

History

In 1988, 990 blocks in the North Aleutian Basin were offered in Federal Lease Sale Number 92. Twenty-three leases were sold. However, in the wake of the 1989 Exxon Valdez Oil Spill, opposition to the sale and exploration of the leases was intense. A Congressional moratorium prohibited further lease sales in the basin and subsequent presidential moratoria extended the prohibition to 2012.[34] However, as mentioned above, the offshore moratorium expired in 2008. According to the MMS, the only significant play in the North Aleutian Basin is the Tertiary Play, which is also characterized as gas-prone. Assessment estimates for risked, undiscovered, conventionally recoverable resources in 1995 were 233 to 575 million barrels of oil and 6.8 to 17.3 trillion cubic feet of gas in this play. However, the 2000 National Resource Assessment estimated economically recoverable quantities using the base case scenario may be only 20 to 200 million barrels of oil and 0.88 to 7.71 trillion cubic feet of gas.[35]

On January 9, 2007, President George W. Bush modified the leasing status of two areas in the Outer Continental Shelf in response to Congressional action and the requests of state leaders. One of those areas was the North Aleutians Basin. In July 2007, U.S. Secretary of the Interior Dick Kempthorne approved a 2007-2012 OCS Oil and Gas Leasing Program, also known as a five-year plan, that scheduled a lease sale (Area 214) of the North Aleutians Basin in 2011.[36]

Lease Sale Area 214, previously known as Area 92, is a wedge-shaped 8,700-square mile area adjacent to Nelson Lagoon in the southwestern portion of the North Aleutian Basin, approximately 200 miles away from the Bristol Bay fisheries. Map 7.8 highlights the proposed lease sale.

Geologists from the Minerals Management Service estimate the North Aleutian Basin could hold up to 23.278 trillion cubic feet of natural gas and 2.5 billion barrels of oil. That could translate into nearly 11,500 jobs, $12 billion dollars in federal income tax, $850 million in state and local taxes and $7 billion in royalties over a 25-year period.[37]

Recent Activity[38A]

In 2008, the Minerals Management Service (MMS) began the process of preparing a required environmental impact statement (EIS) to assess the potential impacts of proposed OCS oil and gas leasing, and potential subsequent exploration and development activities in the North Aleutian Basin Planning Area in the Bering Sea, off southwestern Alaska.

Through the EIS scoping process, MMS receives information used to identify potential impacts, define alternatives, and determine mitigation measures to be analyzed in depth in the EIS. Scoping also identifies those issues, alternatives, and mitigation measures that may not necessitate analyses in the EIS.
The MMS conducted a scoping process from April 8 to October 17, 2008, to obtain input on the scope for this EIS. During that period, MMS encouraged the public and interested groups to provide information, raise issues, and express concerns and opinions on all aspects of proposed Sale 214. Approximately 245 persons participated in this process. The MMS conducted a total of 10 public scoping meetings between May and September 2008. In addition, MMS met with several stakeholder groups to gather information as part of the scoping process.

Three local governments expressed favor of proposed Sale 214 and see oil and gas development as an opportunity with conditional support: (1) Lake and Peninsula Borough; (2) Bristol Bay Borough; and (3) Aleutians East Borough. City governments in the area of the NAB are mixed in their favor of, or opposition to, the sale. Bristol Bay communities and some Native Tribal entities largely are opposed to the sale. The city governments of the AEB favor the sale with specific conditions, or mitigation measures. Most individual commenters oppose the sale, because they believe the risks outweigh the benefits. [38B] Those that largely favor a proposed oil and gas lease sale do so with conditions.

Most commenters emphasized the critical importance of resource protection in the NAB, namely commercial fisheries, human subsistence resources, and internationally important marine mammal and seabird populations and habitats.

The AEB, as a cooperating agency with MMS in preparation of the EIS, gave presentations at each of the 10 scoping meetings in addition to the MMS presentation. The MMS and AEB continue to work toward agreement on a final list of the following mitigation measures for

inclusion in the EIS process. The AEB supports Sale 214 and presented this list of recommended mitigation measures at each meeting:

Fisheries protection – Lease-related use will be restricted to prevent conflicts with local commercial-, subsistence-, and sport-harvest activities.

Transportation, Utility Corridors and Infrastructure Siting – Transportation routes, utility corridors, and infrastructure must be carefully sited and constructed to allow for the free passage and movement of fish and wildlife, to avoid construction during critical migration periods for fish and wildlife.

Coastal Habitat Protection – Offshore operations must use the best available oil-spill prevention and -response technologies to prevent oil spills from adversely impacting coastal habitat and to rapidly respond to oil spills.

Local Hire and Training – The OCS operators will be required to submit a local hire and training program describing the operator's plans for partnering with local communities to recruit and hire local residents, local contractors, and local businesses, and a training program to prepare local residents to be qualified for oil and gas jobs within their region.

Air Pollution – Best available emission control technology will be required for all industrial sources of air pollution, including criteria air pollutants and hazardous air pollutants.

Water Pollution – A zero water pollution discharge will be required for all industrial operations.

Marine Mammals and Essential Habitat – All onshore and offshore facilities and OCS-support vessel and air craft routes must be carefully sited to avoid marine mammal and essential habitat impacts.

Social Systems – All onshore and offshore facilities must be carefully sited, designed and operated to avoid adverse social system disruptions and impacts.

Good Neighbor Policy –All OCS operators, operating off the AEB coastline, should be required to adopt a Good Neighbor Policy and work with the AEB to provide cost-effective fuel, power, transportation, medical services, emergency and other services to the local communities.

Cultural and Historic Site Protection –The OCS operators must protect all existing cultural and historic sites and notify the local government as soon as possible about the discovery of prehistoric, historic, and archaeological sites.

Seismic Design –All onshore and offshore facilities must be designed to the Seismic Zone IV, Uniform Building Code design standard for the Aleutian Chain.

Future

Although the formal public scoping process concluded on October 17, 2008, MMS continues to gather and consider new information throughout the preparation of the EIS. Additional opportunities for public involvement will be provided during the preparation of the EIS. The next public comment period will commence with publication of the draft EIS, tentatively scheduled for winter 2010. The MMS appreciates public and interested stakeholder participation and comments during the scoping process and welcomes continued involvement in the next stage of the EIS process.

Coal

Coal resources in the region are known to exist in the Aleutians East, Kodiak Island and Lake & Peninsula Boroughs. According to the Alaska Department of Natural Resources, bituminous coal is widely distributed on the Alaska Peninsula. Sub-bituminous and lignite deposits are also found throughout the Alaska Peninsula and on Unga, Kodiak and Sitkinak Islands.

The Herendeen Bay field in the Aleutians East Borough reportedly has nine recognizable seams of bituminous coal ranging from 1.5 to 6.4 feet thick of which 4.6 feet is clean coal.[39] In the Lake & Peninsula Borough, another large bituminous coal field extends from Kujulik Bay to Chignik Bay underlying the Chignik communities. Estimates indicate the Chignik field has a 7.8-foot seam of coal, including 4.7 feet of clean coal and 3.1 ft of bone and shaly coal.[40] The reported quality for both of these fields is high volatile bituminous with about 20 percent ash. Through washing, the heating value of this coal type could be raised to approximately 12,000 BTUs per

pound and ash content could be reduced to about ten percent.[41] The coal-bed methane potential of the Chignik field is currently being evaluated for local power production.[42]

Another bituminous coal deposit exists south of Ugashik. According to DNR, not much is known about this deposit. Sub-bituminous deposits are also little known, but line the northern side of the peninsula. Coal-bearing rocks of Tertiary age are probably also widely distributed at depth (1,200 ft or more) in the North Aleutian basin adjacent to Bristol Bay.[43]

Lignite occurs in the region in seams less than eight feet thick and range in heat content from 5,800 to 7,000 BTUs per pound. These lignites are extensive on the Alaska Peninsula mainland particularly near Ugashik as well as on the northwest part of Unga Island. There are also several locations on Kodiak and Sitkinak islands where Tertiary lignite coals crop out. In the Kodiak Archipelago, these lignites are typically less than 1.5-feet thick and of very limited extent.[44]
Additional research on the coal resources of the region are needed to determine economic viability for local use or export. Limited transportation infrastructure, particularly deep water ports, constrains potential development scenarios. Studies of the Alaska Peninsula coal fields are sufficient to give an identified resource of 430 million short tons and a hypothetical resource of 3 billion tons.[45]

Minerals

Mineral resources in Southwest Alaska include nonmetallic industrial minerals; and precious, base, and other polymetallic minerals in porphyry, lode, placer and skarn deposits. Map 7.8 shows mineral deposit terranes and approximate locations for some metalliferous lode deposits in the region. Historical mining activity in the area dates back to the late 19th Century.

Geographic distances, limited transportation infrastructure, high energy costs and generally poor market conditions have served as significant barriers to development of the region's mineral resources. Development of some known mineral deposits in the region has been precluded by federal land withdrawals. These and other factors specific to each deposit have prevented further determinations of economic viability for many deposits. Recent changes in market conditions and mineral developments north of the region have increased interest and exploration in some areas.

All areas of the region have at least some sources of industrial minerals. Given its small size, the Bristol Bay Borough has no known mineral resources other than some local sources of rock, sand and gravel.[46] All other boroughs and census areas in the region have known sources of rock, sand and gravel, although there is little inventory information available in some areas.

Sulfur deposits, some with commercial possibilities, are associated with volcanoes and fumaroles on the Alaska Peninsula and the Aleutian Islands. DNR has investigated sulfur occurrences at four areas: near Stepovak Bay on the peninsula, on Akun Island, at Makushin Volcano on Unalaska Island, and on Little Sitkin Island.[47]

In the Lake & Peninsula Borough in the southeast vicinity of Lake Iliamna, "open" systems of freshwater lakes and groundwater systems have transformed vitric volcanic material into zeolites. Classified as an industrial mineral, zeolites are any one of a family of hydrous aluminum silicate minerals whose molecules enclose cations of sodium, potassium, calcium, strontium, or barium.[48] A cation is an ion or group of ions having a positive charge and characteristically moving toward the negative electrode in electrolysis.[49] Clinoptilolite, mordenite, heulandite and laumontite have been identified in possible economic concentrations with additional nearby deposits at Chinitna Bay in the Kenai Peninsula Borough.

Zeolites are used as filter-and storage-media, as an ion-exchange medium, a paper filler, an animal feed additive, and for catalytic cracking of petroleum products.[50] Development of the Williamsport-Pile Bay Road is essential for the future development of these resources. Another development scenario for zeolites would be to serve as a storage or transport medium for hydrogen obtained through electrolysis from seawater near geothermal sources in the Aleutians West Census Area.[51]

Gold, copper, silver, lead, molybdenum, zinc, chrome, iron, tungsten, mercury, antimony, titanium, platinum, palladium, tin, arsenic and bismuth are metallic minerals that exist in known deposits in the region.[52] The Kodiak Island Borough has the only known gold placer deposits in the region. These deposits occur

Map 7.9: Mineral Deposit Terranes and Known Metalliferous Lode Deposits (x) in Southwest Alaska (some locations approximated)

along the beaches at the outlet of Uganik Bay from Miners Point to Broken Point; from Rocky Point to Bear Point near the village of Karluk; along Bumble Bay north of Ayakulik on the west side of the island, near Cape Alitak; and on Sitkinak and Tugidak islands. These gold concentrations are believed to be the result of wave and current action on auriferous and quaternary gravels that form the sea cliffs along the coast.[53]

Hardrock prospects in the region are generally found in quartz veins, but some porphyry and skarn prospects area also found. In the Aleutians East Borough, the Apollo-Sitka and Shumagin prospects offer known deposits of 150,000 ounces of gold and 700,000 ounces of silver. The Centennial deposit has probable gold reserves of 4.8 million tons with a possible additional two million tons.[54] Other locations of hard rock prospects in the Aleutians East Borough are Canoe Bay, Aquila, and San Diego Bay with gold and other minerals present.

One hardrock prospect is known in the Aleutians West Census Area. The Sendanka or Biorka prospect contains copper, lead, zinc, gold and silver.[55] It is located on Sendanka Island east of Unalaska. The only other known development opportunity in the census area relates to the use of geothermal energy sources at Geyser Bight on Umnak Island and Makushin Volcano on Unalaska Island. Geothermal energy can be used for electrolytic smelting and hydrogen production from seawater, with the latter potentially made possible through the use of zeolites from the Lake & Peninsula Borough for storage and transport mediums.[56]

Additional mapping and exploration are needed to better assess hard rock mineral prospects in the Dillingham Census Area. However, five known prospects contain gold, copper, lead, zinc, arsenic, molybdenum, tin, tungsten, silver, bismuth, iron, titanium, platinum, palladium, mercury, and antimony. In addition to Shotgun Hills, Sleitat, and Kemuk Mountain, which are depicted in Map 7.8, deposits are known at Cinnabar Creek and Kagati Lake.[57]

Development of the Kemuk Mountain iron deposit is dependent upon increased findings of platinum and/or palladium to make it economically viable. The Shotgun Hills gold deposit is speculated to be similar to Donlin Creek, which is currently being developed by NovaGold Resources. Additional geological assessment of the region and further development of Donlin Creek may increase

interest in development of these deposits in the Dillingham Census Area.[58]

Three hardrock prospects in the Kodiak Island Borough exhibit or have known deposits of chrome, gold, silver, or tungsten. Some 200,000 tons of chrome are estimated in the Halibut Bay deposit on the south end of Kodiak Island. At Anton Larsen Bay, eleven miles by road from the City of Kodiak, deposits at Chalet Mountain evidenced gold, silver and tungsten. However, early assessments deemed this deposit as not economically viable.[59]

The only commercially viable mineral development in the Borough was by the Amok Gold Mining Company which worked gold-bearing quartz veins cutting through black slate at Uyak Bay. Principal veins averaged three feet thick, with a maximum of five feet and are composed of quartz with minor pyrite. Additional assessments are needed to determine future potential of this deposit.

DNR and the USGS have noted other lodes and prospects in the region, but it is estimated that less than 20 percent of the borough has been assessed for mineral deposits. Other noted mineralized areas include: the Barling Bay, Whale Island, Dry Spruce Island, Brenneman, Moyle and Uyak Bay prospects; and lode deposits at Kizhuyak Bay and Women's Bay.[60] Hardrock prospects in the Lake & Peninsula Borough include six prospects at Fog Lake, Manhatten, Warner Bay, Cathedral Creek, Kilokak Creek, and Kuy. Copper, gold, silver, lead, zinc, iron, and arsenic are known in these deposits. Additional assessments are needed to determine the scale of these resources. Skarn deposits of iron, copper, silver, gold, and zinc are also known in three locations: Crevice Creek, Kasna Creek, and Glacier Fork.[61]

The Aleutian Range batholith, which is also referred to as the Naknek Lake batholith, is the one of the largest igneous complexes in the state. It extends about 200 miles in a northeasterly direction on the north side of Cook Inlet and is between 40 and 80 miles wide. It forms the backbone of the Chigmit Mountains in the Cook Inlet region. Much of the pluton is unmapped or covered only by reconnaissance surveys. Work in the Iliamna area has shown the batholith to be a composite body consisting of hornblende quartz diorite, hornblende-biotite quartz diorite, biotite-hornblende quartz diorite, and biotite quartz diorite. Phases of granodiorite, quartz monzonite, and granite are also present locally.[62]

Porphyry deposits of copper, molybdenum, gold, lead, and zinc are known in the Aleutians East and Lake & Peninsula Boroughs. The Pyramid and Mt. Dana prospects occur in the Aleutians East Borough. Eight porphyry deposits are known in the Lake & Peninsula Borough. These deposits are: Pebble Copper, Kawisgag, Bee Creek, Rex, Mallard Duck Bay, Mike, Kijik River, and Bonanza Hills.[63]

Pebble Mine

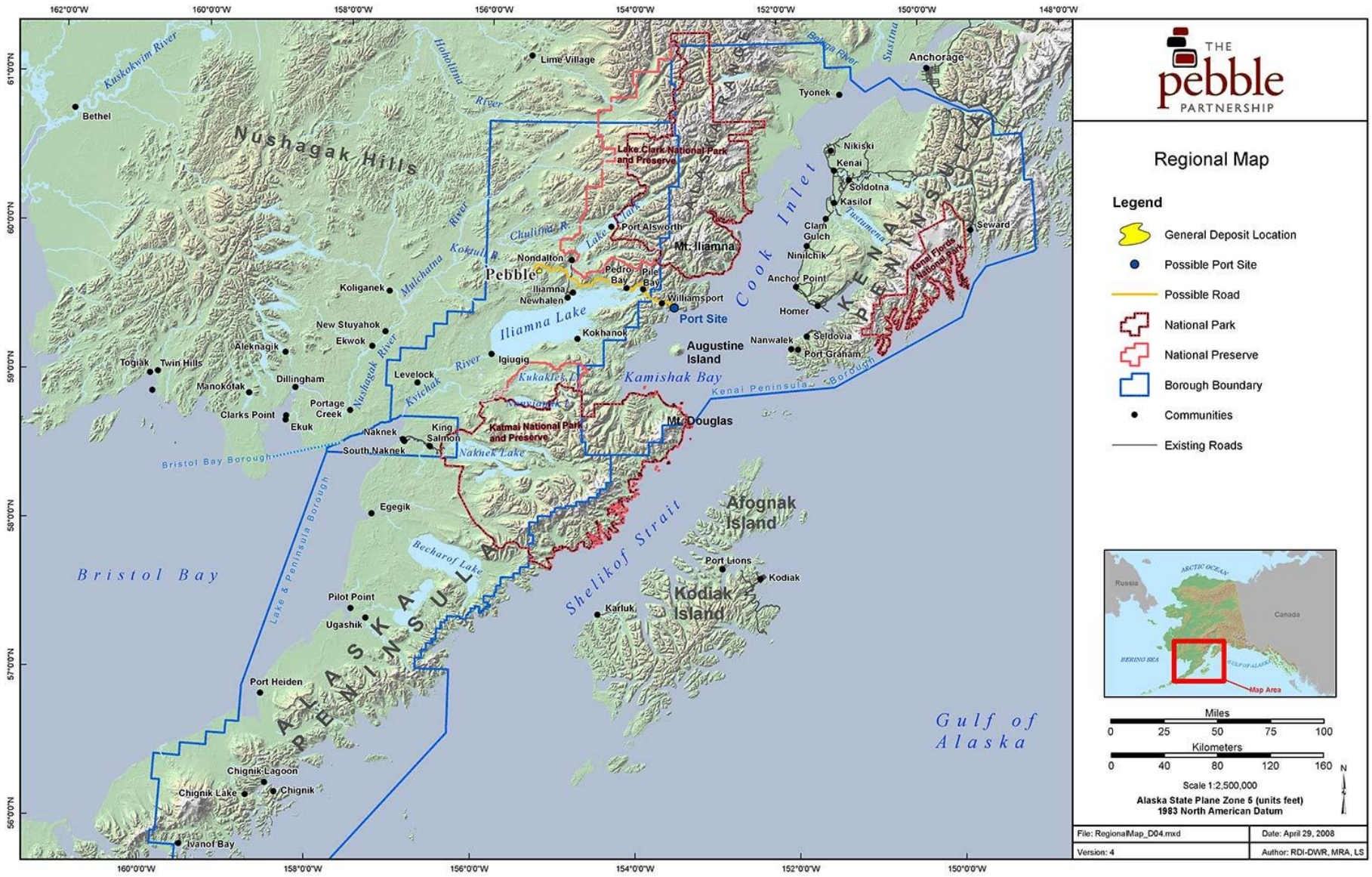
Pebble Mine is a massive mineral deposit, with billions of dollars worth of copper and gold, located in the Bristol Bay region of southwest Alaska, about 200 miles southwest of Anchorage and 70 miles from tidewater at Cook Inlet. The location of Pebble, along streams that flow into two of the five rivers that support the Bristol Bay salmon fishery, has brought opposition from commercial fisherman and environmentalists alike who are concerned about the impact of mining. According to the State, in 2008 commercial fishermen caught roughly 31 million red salmon in the Bristol Bay watershed worth $128 million. They also caught about $2 million worth of other kinds of salmon. Bristol Bay is the state's most valuable commercial salmon fishery.[64]

History

In 1988, mining company Cominco (now Teck Cominco), discovered the Pebble property. The discovery attracted widespread attention, and by 1997 exploration and drilling programs had defined a near-surface mineral deposit of 1 billion tones. Northern Dynasty Minerals (NDM) acquired rights to the Pebble Project in 2001 and began deposit exploration in 2002. By early 2004, NDM had invested almost $5 million on drilling programs and almost tripled the resource estimate.[65]

In September of 2005, it was announced that a deeper but richer deposit had been discovered in the eastern portion of Pebble. Drill data to year-end 2005 confirmed a 3.4 billion-ton inferred resource, and the new deposit expanded the scope and potential of the project because of its higher grades and mineral content, sending the company back to project definition drawing board to develop an integrated development plan for the expanded deposit. Development and permitting timelines were deferred so more studies could be conducted in support of the project. [66]

Map 7.10: Location of Pebble Mine Project



Source: http://www.pebblepartnership.com/images/RegionalMap.jpg

In July, 2007 the Pebble Limited Partnership, an Alaska limited partnership, was formed between a wholly owned US subsidiary of Anglo American PLC and a wholly owned entity of Northern Dynasty Minerals Ltd. to advance the Pebble Project, toward permitting, construction and operations. The deal saw Anglo American, one of the world's leading mine operators become a 50% partner in Pebble with equal rights, in exchange for a staged cash investment of US $1.425 billion.[67]

By December 2008, extensive drilling had confirmed a measured and indicated resource of 5.1 billion tons, and 4.0 billion tons inferred. The deposit contains an estimated 94 million ounces of gold, 72 billion pounds of copper, and 4.8 billion pounds of molybdenum as well as commercially significant amounts of silver, rhenium and palladium.[68]

Future

The Pebble Partnership continued its engineering, environmental and socio-economic studies throughout 2009 in order to support the preparation of a proposed development plan that will be submitted for government and public review in the next few years. However, the plan faces many challenges and will have to overcome opposition from not only commercial fisherman and environmentalists, but also businesses. Recently, many jewelers have boycotted any gold produced from the mine. Tiffany & Co., with more than $1.5 billion in sales, is leading the jewelers' campaign against Pebble. Despite this, plans for the development of Pebble Mine continue.[69]

Renewable Energy

It’s no secret that energy costs in rural Alaska are significantly higher than the more urban areas of Anchorage, Fairbanks, Juneau and to a lesser extent, the Matanuska-Susitna Borough. And in Southwest Alaska, many communities and villages are beginning to look into the potential long-term economic benefits of investing in renewable energy.

Renewable energy comes in many different forms. From utilizing the energy produced by flowing rivers and streams on the Alaska Peninsula to harnessing the massive gusts of wind along the Aleutians, Southwest Alaska truly has the potential to diversify its resources and reduce the high energy costs that handicap the region.

Hydroelectric[70]

Hydroelectric power is the generation of electric power from the movement of water flowing from a higher to a lower elevation. A hydroelectric facility requires a dependable flow of water and a reasonable height of fall of water. When the flowing water falls onto turbine blades (installed in a hydroelectric facility) it causes a shaft to rotate. The rotating shaft is connected to an electrical generator, which converts the shaft motion into electrical energy. After exiting the turbine, water is discharged into the river.

Currently, hydroelectric power is the most widely used renewable energy in the state of Alaska, and in the Southwest region, the City of King Cove has been a pioneer in this field. Its Delta Creek facility, a $5.7 million utility, came online in August 2008 as an alternative to diesel and has served as a great energy source for the community. Recently, the city installed a new boiler that has already generated enough waste heat to save the area's school district thousands of dollars in pricy diesel fuel. Because the electric boiler was installed in the fall of 2009, at the time of this printing it is still too early to predict the potential energy savings for the city. However, the waste heat component has saved the borough 19,439 gallons of diesel fuel in one year, a cost savings of $63,452 in operation of the school.[71]

Hydroelectric facilities are also a large energy source for several communities on Kodiak Island. Hydro is also used in Iliamna, Newhalen, and Nondalton. Many other communities in the Southwest region are also researching the possibilities of installing hydroelectric facilities in their community.[72]

Wind[73]

Wind is caused by temperature and pressure fluctuations in the atmosphere as the sun warms the earth. Wind devices are powered by air. Air moving relative to an object such as the blades of a wind turbine (or the winds of a plane) imparts a force on that object.

Wind turbines use this aerodynamic force to convert the kinetic energy of the wind into mechanical energy that can be harnessed for use. However, wind energy is directly related to the unpredictability of wind speed. This fact is important when considering the integration of wind into existing power systems. In most instances Alaska needs its power to be

constant, and wind energy is as variable as the blowing wind.

Wind turbines are installed in just a few Southwest communities, most notably, the City of Kodiak. In August 2009, Kodiak Electric Association (KEA) installed three 1.5 megawatt wind turbines, each producing enough electricity to power 330 homes. According to KEA's chief executive, the turbines are expected to save 800,000 gallons of diesel each year.[74]

According to the Alaska Energy Authority (AEA) and Renewable Energy Alaska Project (REAP), wind systems are also currently installed in Pilot Point, Perryville and St. Paul.

Biomass[75]

Bioenergy is a collective term for renewable energy made from the organic material of recently deceased plants or animals. Sources of bioenergy are called "biomass" and include agricultural and forestry residues, municipal solid wastes, industrial wastes, and terrestrial and aquatic crops grown solely for energy purposes. Bioenergy includes the generation of energy from biological sources such as landfill gas and the combustion of organic fuels to produce electricity or heat.

Biomass is an attractive petroleum alternative because, developed responsibly, it is a renewable resource that is more evenly distributed over the Earth's surface than finite energy sources, and may be exploited using more environmentally friendly technologies. It is also considered "carbon neutral," meaning the carbon absorbed during the lifespan of the organisms from which it was created counters the carbon released by the combustion of the biofuel.

While biomass systems are in the early stages of development and demonstration (mainly in the Interior and Southeast region), at this point in time they are not widely used in Southwest Alaska, although some communities are exploring it.

Geothermal[76]

Geothermal energy uses the heat of the earth to provide for direct heat or electricity production. Direct heat geothermal uses low to moderate temperature water to heat structures, grow plants in greenhouses, and in industrial processes such as drying food or fish farming. These systems pump hot water directly into the structures they are warming. Producing electricity from geothermal uses high temperature resources to convert heat into power, though new technologies are emerging that allow lower temperature resources to be utilized in electricity generation.

Southwest Alaska's location on the Ring of Fire, a volcanic arc circling the Pacific Ocean, means there are many opportunities for geothermal development in the region.

Drilling and exploration done at Mt. Makushin near Unalaska in the 1980s indicates that tens of megawatts could be generated using geothermal resources. The adoption of binary-cycle power generators has made this project economically feasible and in early 2008 the Alaska Energy Authority gave a matching grant of $1.5 million to the City of Unalaska for further drilling in the area to start in the summer of 2009.

The City of Akutan is planning geophysical and geochemical exploration and possible drilling in the summer of 2009 at the nearby Hot Springs Valley to investigate providing power and heat to the city and a local fish processor. Naknek Electric Association is actively pursuing geothermal potential and development of a regional electrical transmission system. This local electric utility has a $12 million drilling program that began in the summer of 2009 and will affect the City of King Salmon.

Solar[77]

Energy technologies that use the sun's radiation directly are referred to as solar energy technologies. These technologies may be employed to heat or light living space directly, to supply energy to a heat storage system for later use, or to generate electricity.

Direct use of solar energy for heating or lighting is often referred to as passive solar use. The term passive is used because a building employs solar energy by virtue of its design without requiring additional equipment to actively move or store energy. In other words, passive solar systems use the energy of the sun where it falls.

Major challenges to using solar energy in Alaska are its seasonal variability and its dependence on weather conditions. In general, the solar resource is most abundant in the summer, when it is least needed. However, active systems hold the most promise for Alaskan applications. These are systems that

can store energy for longer periods of time or be incorporated as auxiliary energy sources into existing energy systems. Passive solar lighting systems use sunlight only during the daylight hours.

In conclusion, solar energy holds little promise to economically reduce Southwest Alaska's dependence on fossil energy. Prices for solar electric and hot water systems make them more expensive than conventional fuel technologies. It is conceivable that innovative design for specific applications could reduce the capital cost of a system, but technology has not caught up yet.

Hydrokinetic/Tidal[78]

Hydrokinetic devices are powered by moving water and are different from traditional hydropower turbines in that they are placed directly in a river, ocean or tidal current. They generate power only from the kinetic energy of moving water (current). The available hydrokinetic power depends on the speed of the river, ocean or tidal current. In contrast, traditional hydropower uses a dam or diversion structure to supply a combination of hydraulic head and water volume to a turbine to generate power. In order to operate, hydrokinetic devices require a minimum current and water depth. Hydrokinetic devices are ideally installed in locations with relatively steady flow throughout the year, locations not prone to serious flood events, turbulence, or extended periods of low water level.

Alaska has significant potential for hydrokinetic development in both rivers and tidal basins. However, most of the promise lies in inland communities as they are situated along navigable waterways. As a whole, the entire state of Alaska is home to some of the best tidal energy resources in the world.

In a 2009 report, the Alaska Energy Authority (AEA) identified 13 communities in Southwest Alaska that show some potential for tidal energy. These cities and villages include: Atka, Cold Bay, Dillingham, False Pass, Igiugig, Karluk, King Cove, Larsen Bay, Naknek, Nikolski, Old Harbor, Sand Point and Unalaska.

Alternative Energy[79]

While many use the two terms interchangeably, there is actually a subtle difference between renewable energy and alternative energy. Technically, renewable energy is clean energy – energy provided by natural resources that are always around us. Alternative energy on the other hand really just refers to an alternative from fossil fuels.

Although there are many types of alternative energy uses currently under discussion – propane, ethanol and biodiesel, waste oil and alternative fuels – the most promising alternative energy source in Southwest Alaska is fish oil.

Fish Oil

Fish oil is a natural fuel that can be a co-product of the fish processing industry. The oil is rendered from fish waste using a multi-step process of heating, pressing, centrifugal separation and filtering. Fish oil can be used either directly as a boiler fuel or converted into a biodiesel and used for diesel engine fuel and/or heating fuel. Raw fish oil is also being used by a number of fish processors around the state for onsite heating and power generation.

Despite these advantages, a high level of caution should be exercised when using biodiesel made from fish oil. When compared to petroleum based diesel, fish oil diesel oxidizes more quickly and can damage machinery.

A lot of promise for fish oil exists in Southwest Alaska considering the large presence of the commercial seafood industry.

Endnotes

[1] http://www.fishbase.org

[2] http://www.fakr.noaa.gov/npfmc/

[3] IBID

[4] IBID

[5] IBID

[6] http://www.iphc.washington.edu/halcom/default.htm

[7] IBID

[8] http://www.fakr.noaa.gov/

[9] http://www.fakr.noaa.gov/sustainablefisheries/afa/afa_sf.htm

[10] http://www.state.ai.us/adfg/adfghome.htm

[11] IBID

[12] http://www.boards.adfg.state.ak.us/fishinfo/index.php

[13] IBID

[14] http://www.boards.adfg.state.ak.us/advisory/index.php

[15] Alaska in Maps

[16] Jim Loaris, ANC Forester, personal communication 1998 – 2000

[17] Alaska in Maps

[18] IBID

[19] IBID

[20] http://www.mms.gov/

[21] IBID

[22] Alaska in Maps

[23] http://certnetra.cr.usgs.gov/1995OGData/Region1/PROV03.pdf

[24] IBID

[25] IBID

[26] IBID

[27] http://www.mms.gov/alaska/re/asmtdata/shumkod/shumplay.pdf

[28] http://www.mms.gov/revaldiv/PDFs/NA2006BrochurePlanningAreaInsert.pdf

[29] IBID

[30] http://www.mms.gov/ooc/PDFs/FactSheet-OCS5-YearProgram.pdf

[31] http://www.mms.gov/alaska/lease/hlease/LeasingTables/lease_sales.pdf

[32] http://blog.energytomorrow.org/2009/10/stop-delaying-drill-now.html

[33] http://seagrant.uaf.edu/research/projects/initiatives/energy_and_fisheries/background/

[34] http://www.mms.gov/alaska/lease/hlease/LeasingTables/lease_sales.pdf

[35] http://www.mms.gov/alaska/re/asmtdata/naleutia/naleplay.htm

[36] http://www.noia.org/website/article.asp?id=1846
and
http://www.mms.gov/ooc/PDFs/FactSheet-OCS5-YearProgram.pdf

[37] http://www.aleutianseast.org/index.asp?Type=B_BASIC&SEC={CB8DFB52-6D75-42CE-94D4-673FE1762830}

[38A] http://www.mms.gov/alaska/cproject/NAB214/2009_0109_scoping_report.pdf

[38B] IBID, page 5.

[39] Merritt, R.D., Alaska Coal Fields and Seams, Alaska Department of Natural Resources, Division of Mines

[40] IBID

[41] IBID

[42] Alaska Energy Authority

[43] Merritt, R.D., Alaska Coal Fields and Seams, Alaska Department of Natural Resources, Division of Mines

[44] IBID and Kelley and Denman, Geological Literature on the Alaska Peninsula and Adjacent Areas, Alaska Department of Natural Resources, Division of Geological and Geophysical

[45] IBID

[46]

http://dnr.alaska.gov/mlw/planning/areaplans/bristol/pdf/bbap_ch2_mineral.pdf

[47] AGS, Staff, 1976, Short notes on Alaskan geology - 1976: Alaska Division of Geological & Geophysical Surveys, Geologic Report 51

[48] Madonna, J.A., Alaska Department of Natural Resources, DGGS Zeolite Deposits of Possible Economic Significance on the Northern Alaska Peninsula

[49] Madona, J.A., Clinoptolilite and mordenite deposits of possible economic value at Iliamna Lake, Alaska: in Short Notes on Alaskan Geology – 1981: Alaska Division of Geological & Geophysical Surveys, Geologic Report 73C, p. 13-15

[50] IBID

[51] IBID

[52]

http://www.dnr.state.ak.us/mlw/mining/index.htm

[53] McGee, D.L., 1973, Geology and mineral resources of Kodiak Island and vicinity: Alaska Division of Geological & Geophysical Surveys, Alaska Open File Report 31

[54]

http://www.dnr.state.ak.us/mlw/mining/index.htm

[55]

http://www.commerce.state.ak.us/oed/minerals/Mineral_Prospects/LINKED_RESOURCE_MAP.pdf

[56] Nye, C.J., Motyka, R.J., Turner, D.L., and Liss, S.A., 1992, Geology and geochemistry of the Geyser Bight Geothermal area, Umnak Island, Aleutian Islands, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigation 92-1, 85 p., 2 sheets, scale 1:24,000

[57] IBID

[58] Humble Oil Refining Company, 1959, Kemuk Mountain iron ore prospect, Dillingham District, Alaska: Alaska Territorial Department of Mines, Miscellaneous Report 102-01, p. 13

[59]

McGee, D.L., 1972, Kodiak Island and vicinity, Alaska: Geology and mineral resources: Alaska Division of Geological & Geophysical Surveys Alaska Open-File Report 31, 7 p.

[60] IBID

[61] Kelley, J.S., and Denman, J.M., 1972, Geological literature on the Alaska Peninsula and adjacent area: Alaska Division of Geological & Geophysical Surveys Special Report 20, 64 p.

[62] IBID

[63]

Frisken, J.G., 1992, Interpretation of reconnaissance geochemical data from the Port Moller, Stepovak Bay, and Simeonof Island quadrangles, Alaska Peninsula, Alaska: U.S. Geological Survey Bulletin 1968, 47 p.

[64]

http://www.pebblepartnership.com/pages/project-information/location.php
and
http://www.adn.com/front/story/957845.html

[65]

http://www.pebblepartnership.com/pages/project-information/project-overview.php

[66] IBID

[67] IBID

[68] IBID

[69] IBID and
http://www.adn.com/front/story/957845.html

[70] Alaska Energy: A first step toward energy independence. Alaska Energy Authority (AEA). January 2009

[71] Bauman, Margaret., October 15, 2009. King Cove's hydropower sources get boiler enhancement. Alaska Journal of Commerce.

[72] Alaska Energy: A first step toward energy independence. Alaska Energy Authority (AEA). January 2009

[73] Alaska Energy: A first step toward energy independence. Alaska Energy Authority (AEA). January 2009
and
Alaska Renewable Energy Project (REAP)

[74] White, Rindi. "Wind turbines beginning to energize Alaska." Anchorage Daily News. December 2, 2009.

[75] Alaska Energy: A first step toward energy independence. Alaska Energy Authority (AEA). January 2009
and
Alaska Renewable Energy Project (REAP)

[76] IBID

[77] IBID

[78] IBID

[79] Alaska Energy: A first step toward energy independence. Alaska Energy Authority (AEA). January 2009