

**Baseline Inventory of Freshwater Fishes of the Southwest  
Alaska Inventory and Monitoring Network: Alagnak Wild  
River, Aniakchak National Monument and Preserve, Katmai  
National Park and Preserve, Kenai Fjords National Park, and  
Lake Clark National Park and Preserve**

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**Acronyms:**

I&M	Inventory and Monitoring
SWAN	Southwest Alaska Network
LACL	Lake Clark National Park and Preserve
KEFJ	Kenai Fjords National Park
ANIA	Aniakchak National Monument and Preserve
KATM	Katmai National Park and Preserve
ALAG	Alagnak Wild River

**Initial Distribution:**

Southwest Alaska Network

## **Executive Summary:**

The National Park Service (NPS) Inventory and Monitoring (I&M) Program has undertaken a nationwide inventory of natural resources. As part of this effort, freshwater fish inventories were conducted for Alagnak Wild River (ALAG), Aniakchak National Monument and Preserve (ANIA), Katmai National Park and Preserve (KATM), and Kenai Fjords National Park (KEFJ). A previous fisheries inventory of Lake Clark National Park and Preserve (LACL) matching the scope of current I&M program objectives was conducted by the Alaska Department of Fish and Game (ADF&G) in 1980 (Russell et al. 1980). All of these parks (KATM, LACL, ANIA, ALAG, and KEFJ) combine to form the Southwest Alaska Network (SWAN) within the I&M program.

Thirty three species of freshwater fish were identified as potentially occurring within the entire SWAN network (AKNHP 2000). The SWAN freshwater fish inventory project identified 28 of the 33 freshwater species (84.8% of all freshwater species) predicted to occur within park boundaries (AKNHP 2000). For individual SWAN parks, this inventory verified 66.7% of expected species within ALAG (16 of 24), 56.3% within ANIA (9 of 16), 96.0% within KATM (24 of 25), 81.3% (13 of 16) within KEFJ, and 96.2% (25 of 26) within LACL. Verification of expected species was highly dependent on sampling gear and sampling effort. Spatio-temporal residencies of freshwater fish species and the ecological context of the particular habitat may also affect success rates throughout the SWAN parks.

Lack of data in several areas made ecological assessments difficult. Water quality and flow characteristics in many rivers throughout SWAN parks are completely unknown making thorough ecological assessments impossible. Sampling methods made accurate determinations of total freshwater fish taxa residencies difficult. However, there appears to be a slight increase in diversity with regards to the combined factors of lake area and elevation. Lakes with large area at low elevation had greater diversity, but these results were strongly influenced by the few large low elevation lakes. Some species exhibited elevational distribution limitations.

Recommendations for water quality assessments of ANIA, KATM, KEFJ, and LACL were made to establish a basis for ecological assessments. Future fisheries inventory sampling methods were identified, ongoing monitoring suggested, and expanded spatio-temporal inventory processes recommended.

# Contents

<b>List of Figures</b>	<b>v</b>
<b>List of Tables</b>	<b>v</b>
<b>List of Graphs</b>	<b>v</b>
<b>Abstract</b>	<b>vi</b>
<b>Executive Summary</b>	<b>vii</b>
<b>Introduction</b>	<b>1</b>
<b>Area Overview</b>	<b>2</b>
SWAN Region	<b>2</b>
Alagnak Wild River	<b>3</b>
Aniakchak National Monument and Preserve	<b>4</b>
Katmai National Park and Preserver	<b>4</b>
Kenai Fjords National Park	<b>4</b>
Lake Clark National Park and Preserve	<b>5</b>
<b>Methods and Materials</b>	<b>5</b>
<b>Sampling Protocol</b>	<b>5</b>
<b>Analyses</b>	<b>6</b>
<b>Results</b>	<b>6</b>
Entire SWAN	<b>7</b>
Alagnak Wild River	<b>7</b>
Aniakchak National Monument and Preserve	<b>8</b>
Katmai National Park and Preserver	<b>9</b>
Kenai Fjords National Park	<b>10</b>
Lake Clark National Park and Preserve	<b>11</b>
<b>Species Distribution</b>	<b>11</b>
<b>Discussion</b>	<b>17</b>
<b>Recommendations</b>	<b>18</b>
<b>Acknowledgements</b>	<b>19</b>
<b>Literature Cited</b>	<b>20</b>

<b>List of Figures</b>	<b>Page</b>
Figure 1) Southwest Alaska Location Map	9
Figure 2) Ecological Subsections Grouped by Physical Units	11
Figure 3) Alagnak Wild River Area Map	24
Figure 4) Aniakchak National Monument and Preserve Area Map	25
Figure 5) Katmai National Park and Preserve Area Map	26
Figure 6) Kenai Fjords National Park Area Map	27
Figure 7) Lake Clark National Park and Preserve Area Map	28

<b>List of Graphs</b>	<b>Page</b>
Graph 1) Species Diversity Relative to Elevation	11
Graph 2) Species Diversity Relative to Elevation (Rivers)	12
Graph 3) Species Diversity Relative to Elevation (Lakes)	13
Graph 4) Species Diversity Relative to Lake Area	13
Graph 5) Species Diversity Relative to Lake Area (< 10mi <sup>2</sup> )	14
Graph 6) 3-D Contour Graph of Lake Area, Elevation, and Species Diversity	15
Graph 7) Species Diversity Relative to Flow Rate	16
Graph 8) 3-D Contour Graph of Flow Rate, Elevation, and Species Diversity	16

<b>List of Tables</b>	<b>Page</b>
Table 1) Predicted Species for Entire SWAN Region	8
Table 2) Predicted Species for the Alagnak Wild River	8
Table 3) Predicted Species for the Aniakchak National Monument and Preserve	9
Table 4) Predicted Species for the Katmai National Park and Preserve	9
Table 5) Predicted Species for the Kenai Fjords National Park	10
Table 6) Predicted Species for the Lake Clark National Park and Preserve	10
Table 7) Regression Analysis of Diversity Components	15

<b>List of Appendices</b>	<b>Page</b>
Appendix 1) Locations of all fish occurrences by species in all locations throughout the NPS SWAN network	30
Appendix 2) Species list of Alaska fishes potentially found within SWAN park unit boundaries	55
Appendix 3) Expected freshwater fish species list based on Mecklenburg et al. and the Alaska Natural Heritage Program	58
Appendix 4) Success rates of SWAN fish inventory surveys in SWAN park units	59
Appendix 5) Species location relative to elevation throughout all SWAN lakes	60
Appendix 6) Individual Species Confirmation Locations	66
Appendix 7) Geographical information regarding water bodies sampled in the SWAN fish inventory	94

**Abstract:**

The National Park Service (NPS) Inventory and Monitoring (I&M) Program has undertaken a nationwide inventory of natural resources. As part of this effort, freshwater fish inventories were conducted within Southwest Alaska Network (SWAN) for the Alagnak Wild River (ALAG), Aniakchak National Monument and Preserve (ANIA), Katmai National Park and Preserve (KATM), and Kenai Fjords National Park (KEFJ). A previous fisheries inventory of Lake Clark National Park and Preserve (LACL) matching the scope of current I&M program objectives was conducted by the Alaska Department of Fish and Game (ADF&G) in 1980 (Russell et al. 1980). Thirty three species of freshwater fish were identified as potentially occurring within the entire SWAN network (AKNHP 2000). The SWAN freshwater fish inventory project documented 28 of the 33 freshwater species (84.8% of all freshwater species) predicted to occur within park boundaries (AKNHP 2000). For individual SWAN parks, this inventory verified 66.7% of expected species within ALAG (16 of 24), 56.3% within ANIA (9 of 16), 96.0% within KATM (24 of 25), 81.3% (13 of 16) within KEFJ, and 96.2% (25 of 26) within LACL.

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Recommendations for water quality assessments of ANIA, KATM, KEFJ, and LACL were made to establish a basis for ecological assessments. Future fisheries inventory sampling methods were identified, ongoing monitoring suggested, and expanded spatio-temporal inventory processes recommended.

## Introduction:

The National Park Service (NPS) Inventory and Monitoring (I&M) program has undertaken a nationwide inventory of natural resources, dividing the nation's parks, preserves, monuments, and wild rivers into a series of 32 regional network areas (NPS 2000). The I&M program's Southwest Alaska Network (SWAN) is responsible for the administration of I&M program goals for Aniakchak National Monument and Preserve (ANIA), Alagnak Wild River (ALAG), Katmai National Park and Preserve (KATM), Kenai Fjords National Park (KEFJ) and Lake Clark National Park and Preserve (LACL) (NPS 2004)(Figure 1).

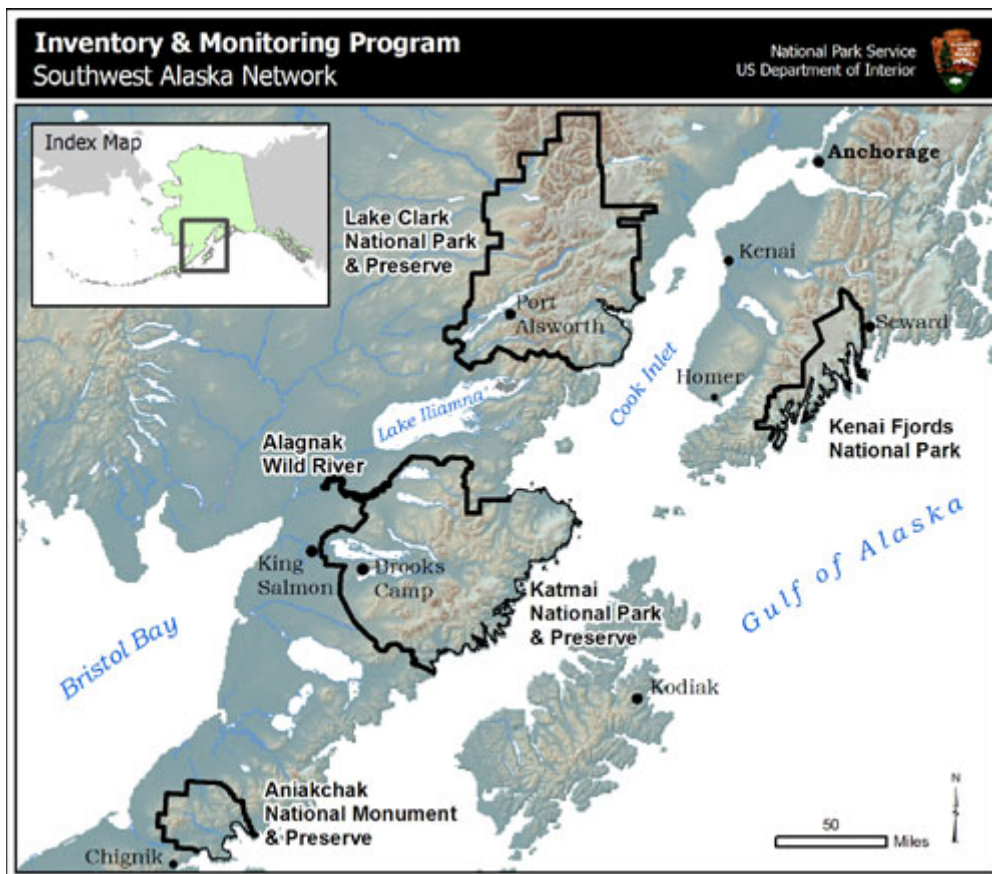


Figure 1. Southwest Alaska Network location map. (Created by D. Mortenson 2002).

Freshwater fish inventories in most of the SWAN parks (ANIA, ALAG, KATM, and KEFJ) were conducted between 2002 and 2004 (Miller 2003, Miller and Markis 2004, Miller et al. 2005, Jones et al. 2005) as a part of the species inventory process to reach I&M compliance goals mandated by NPS policies (NPS 2001) and congress (P.L. 105-391 1998). These goals were to document 90% of all expected species within NPS units. SWAN managers used a list of expected species, developed by the Alaska Natural Heritage Program (AKNHP 2000), to direct the inventory process. A previous fisheries inventory of LACL matching the scope of current I&M program objectives was conducted by Richard Russell with the Alaska Department of Fish and Game (ADF&G) in 1980 (Russell et al. 1980), precluding the necessity of creating and conducting a



separate baseline data research project. Additionally, the KATM fish inventory was supplemented by a 1969 freshwater fish inventory by the U.S. Fish and Wildlife Service (Heard et al. 1969) and a 1954 sport fish survey (Greenbank 1954).

The primary objective of the freshwater fish inventory research was to document, through capture or observation, freshwater fish species present within each of the sampled park units, with a secondary objective to provide descriptions of the distributions, abundance, and biological characteristics of these species.

The fish species likely to occur within freshwater SWAN park units fall into two broad categories: resident (living in freshwater year round) and anadromous (living in freshwater for early life history stages and reproduction but spending time at sea to feed and grow). Many of the anadromous fishes have significant economic value (mainly salmon) and have been well documented and studied, whereas the majority of resident fishes are neither economically important nor sufficiently documented. These undocumented species include a broad range of fishes with highly diverse life histories and variable habitat requirements (e.g., sculpin and stickleback species).

Undocumented species present a variety of problems for resource managers. It is difficult to impossible to understand ecological interactions within an ecosystem without knowing which species are present in that ecosystem: species community composition directly affects interspecific competition levels, predator-prey relationships, habitat partitioning and, subsequently, growth rates, population dynamics, and natural selection. Detecting the ecological effects of environmental change, regardless of cause (anthropogenic or natural) can be problematic without species presence, abundance, and distribution information. Regardless of magnitude, changes in the physical, chemical, geological, or biological characteristics of freshwater habitat may result in local extinction, range extension, or variation in life-history tactics. Without baseline data to serve as a reference point, documenting and determining appropriate managerial actions or responses to these events becomes difficult. Harvest management decisions are also compromised by a lack of species presence/absence data. Setting harvest limits and determining when overharvest occurs are arbitrary processes for undocumented species. Ultimately both fish and fishers are vulnerable to mismanagement under these circumstances (Miller 2003, Miller and Markis 2004, Miller et al. 2005, Jones et al. 2005).

## **Area Overview:**

### ***SWAN Region***

Based along the northern edge of the Pacific “Ring of Fire”, the SWAN parks are located on the upper portions of the Alaska Peninsula, encompassing the majority of the Chignik Mountains, and along the eastern portion of the Kenai Peninsula (Figure 1). Combined, the SWAN parks encompass an area of 14,687 square miles (38,040 km<sup>2</sup>), or 11.6 percent of all NPS lands, and 2 percent of the total Alaska landmass.

SWAN parks are largely shaped by geological processes such as volcanic eruptions, tectonic events, glacial advances and retreats, and meteorological phenomena that over time created a varied array of ecological regions and geological features. Volcanoes, lava flows, tundra, muskeg, ice fields, glaciers, glacial valleys, glacial rivers, lakes, streams, coastal rivers, and protected marine bays can all be found within SWAN park boundaries. These ecologically diverse parks (figure 2), home to the fourth and sixth largest lakes in Alaska, have abundant freshwater lakes and streams supporting a considerable abundance and diversity of freshwater fish species.

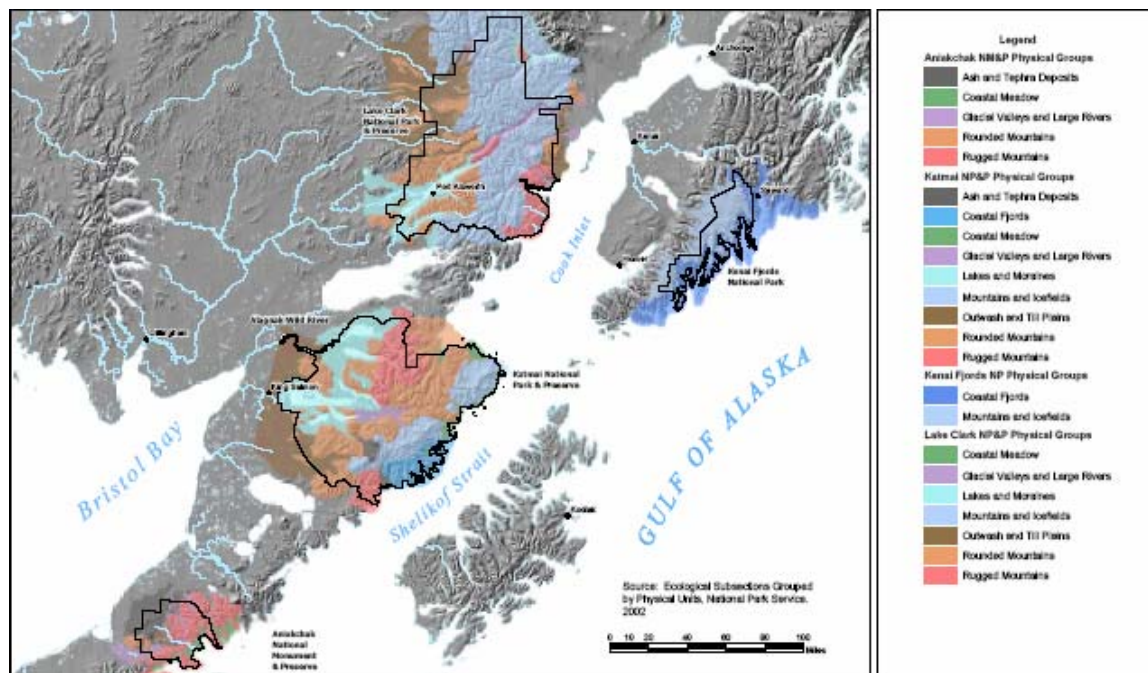


Figure 2. Ecological subsections grouped by physical units (Created by D. Mortenson 2002).

### *Alagnak Wild River*

The Alagnak Wild River is a wide multi-channelled river extending from the extreme northwestern portion of KATM in southwestern Alaska (figures 1 and 3). It includes the majority (approximately 2/3) of the Alagnak River (also known as the Branch River), a tributary to the Kvichak River, which drains a 3600 km<sup>2</sup> area, including Kukaklek and Nonvianuk Lakes. The Alagnak is a long, high gradient river relative to the Bristol Bay area, and starts at a relatively high altitude for the region as well (max elevation 250 m). It flows primarily through coastal lowlands (figure 2) (comprised of Taiga, spruce-Birch woodland, and lowland tussock tundra). Twelve percent of the Alagnak basin is covered by lakes and ponds of all sizes (Curran 2003). The only major tributary joining the Alagnak River along its 127 km length is the Nonvianuk River, with a confluence approximately 34 km downstream from the Alagnak source at the outlet of Kukaklek Lake. The central portion of the Alagnak River, contained within the ALAG, has notable bank instability and is subject to significant erosional processes from water flow and wave propagation from boat use on the river.

### ***Aniakchak National Monument and Preserve***

Located approximately 640 km (398 miles) southwest of Anchorage on the Alaska Peninsula (figures 1 and 4), ANIA is a 602,779 acre (942 mi<sup>2</sup>, 2440 km<sup>2</sup>) park unit. It encompasses the Aniakchak caldera, its outflowing river (Aniakchak River), and the coastal Aleutian mountain drainages of Aniakchak and Amber Bays in the Gulf of Alaska. Meshik Lake and the upper Meshik River basin which drains into Bristol Bay near Port Heiden (Norris 1996) are also included within the boundary. Aniakchak Caldera is 9.5 km (6 mi) wide and 762 m (2500 ft) deep with a small lake (Surprise Lake) covering 4% of the caldera floor (Mahoney and Sonnevil 1991). Aniakchak volcano last erupted in 1931, and the caldera contains numerous vents, eruption craters and maars, in addition to an intracaldera stratovolcano (Vent mountain)(Neal et al. 2000). A previous lake filled the entire caldera, but breached the caldera walls and drained in a mass flood event, forming a large flood plain through which the Aniakchak River now flows. The Aniakchak River drains the majority of ANIA with two main tributaries (Albert Johnson Creek and the Aniakchak River North Fork), flowing out of the Aleutian Range and into Aniakchak Bay.

### ***Katmai National Park and Preserve***

Katmai National Park and Preserve is located approximately 300 miles southwest of Anchorage on the northern end of the Alaska Peninsula and adjoins the Shelikof Strait on the Gulf of Alaska (figures 1 and 5). The 4.1 million acres (6,396 mi<sup>2</sup>) of KATM (Norris 1996) include 15 active volcanoes, 432,000 acres of surface water (12% of the Park), 216,000 acres of glaciers (6% of the Park), and 398 miles of continuous coastline (Weeks 1999). Extending from sea level to 7606 ft (2318 m) elevation in the Aleutian range, KATM encompasses the entire watershed of its coastal drainages with the exception of Little Kamishak and Strike Creek, almost the entire Naknek River watershed (73%, or 2,660 mi<sup>2</sup> of the 3460 mi<sup>2</sup> watershed), approximately half of the Alagnak Wild River watershed, and a small portion of the Egegik River basin (Weeks 1999). KATM is also home to the Valley of Ten Thousand Smokes created when Novarupta erupted in 1912 with one of the most violent eruptions ever recorded (Norris 1996), ejecting roughly 5 mi<sup>3</sup> of ash (20.8 km<sup>3</sup>) and covering the valley in up to 700 ft (213 m) of ash (Harris 1990).

### ***Kenai Fjords National Park***

Kenai Fjords National Park, located on the eastern Kenai peninsula near Seward, Alaska (figures 1 and 6), is a 669,983 acre (1047 mi<sup>2</sup>) park characterized by glacially carved coastal fjords with tidewater glaciers, long mountainous peninsulas, and short coastal streams. KEFJ is bounded by the Kenai Mountains on the north and west, and by the Pacific Ocean on the east. The majority of land in KEFJ is under the Harding Icefield (the largest icefield in the United States), while coastal landscapes are relatively unprotected from oceanic processes (Tande and Michaelson 2001). Ice free land within KEFJ is typically steep valley walls with varying degrees of vegetation and some lake-river systems, but lakes are generally small and surrounded by private lands. This landscape is

in constant change with glaciers continually retreating and exposing new land. Much of the freshwater habitat is newly formed by glacial recession in the last century, and some of the fjords were covered in glaciers in the early twentieth century (Cook and Norris 1998).

### ***Lake Clark National Park and Preserve***

Lake Clark National Park and Preserve is a 4,030,025 acre (6,297 mi<sup>2</sup>) park approximately 265 km (165 mi) west of Anchorage (figures 1 and 7). It includes 198 km (123 mi) of coastline, two active volcanoes (Mt. Redoubt [10,197 ft (3108 m)] and Mt. Iliamna [10,016 ft (3053 m)]), and encompasses the juncture of two mountain ranges, Aleutian and Alaskan, forming the Chigmit mountains. Within LACL boundaries are several mountain lakes [including Lake Clark (sixth largest lake in Alaska)], coastal grasslands, tundra slopes, and the headwaters of the Kvichak watershed. The western portions of the park are characterized by large lakes with long drainages leading to Bristol Bay and the Kuskokwim River, while the eastern regions are characterized by relatively short glacial streams. Both of LACL's volcanoes have had explosive eruptions recently (Mt. Redoubt in 1990 and Mt. Iliamna in 1953) as well as two volcanoes lying just outside the park boundaries (Mt. Spurr erupted in 1992 and Mt. Augustine erupted in 2006).

### **Methods and Materials:**

The sampling methods used in the freshwater fish inventories for ANIA, ALAG, KATM and KEFJ were all similar. Specific sampling sites within each park unit were chosen to maximize the likelihood of fish encounters by preferentially selecting habitats with the greatest likelihood of fish presence based on known habitat requirements of fish suspected to occur in the area (e.g. Heard et al. 1969; McPhail and Lindsey 1970; Russell 1980, Mecklenburg 2002). Salmon (chinook, chum, coho, pink, and sockeye) in any location and certain sportfish (rainbow trout, arctic grayling, and Dolly Varden) in regions where those sportfish are already known to occur were not specifically targeted during the freshwater fish inventory process.

Latitude, longitude, time, water depth, and a brief habitat assessment were recorded using a Garmin<sup>®</sup> GPS 76 (NAD 27 datum) and a portable Hummingbird<sup>®</sup> Piranha II depth sounder at each sampling site. Habitat appearances (description of water movement, fluvial characteristics, and general observations) were assessed in the immediate vicinity of the sampling gear.

### ***Sampling protocol***

A number of different gear types (Murphy and Willis 1996) were used to document species presence in specific habitat types (habitats follow gear type parenthetically): minnow traps (benthic lake and river, littoral lake, main channel river, side-channel river, ponds), hoop traps (benthic lake and river, littoral lake), minnow seines (littoral lake, side

channel river, ponds), beach seines (littoral lake), gill nets (littoral lake, limnetic lake), and hook-and-line (all habitats).

Minnow traps were baited with either salmon eggs or salmon flesh and were set by boat or from shore. Traps were fished for 2.0 to 67.0 h at depths ranging from 0.5 to 20.0 m (0.15 to 65.6 ft). In waters  $\geq 2.0$  m (6.6 ft), traps were marked with a buoy and anchored with a 3.0 to 5.0 kg (6.6 to 11.0 lb) sand bag.

Hoop traps were baited with salmon eggs and set by boat. The hoop traps were 122.9 cm (48.0 in) long and 60.9 cm (24.0 in) in diameter and constructed of four steel rings with 25.4 mm (10.0 in) mesh netting (all mesh sizes represent diagonal or stretched measurements as opposed to square or bar measurements). Hoop traps were marked with a buoy and fished for 4.0 to 22.0 h at depths ranging from 6.7 to 17.4 m (22 to 57 ft).

Minnow seines were set from shore and in shallow areas less than 1.0 m (3.3 ft) deep. Minnow seine dimensions were 2.0 m (6.6 ft), 4.0 m (13.1 ft), or 15.0 m (49.2 ft) long by 1.0 m (3.3 ft) deep with a mesh size of 12.7 mm (0.5 in).

The beach seine was deployed in nearshore waters (less than 4.0 m [13.1 ft] deep) where large snags were not apparent. The net was 30.5 m (100.0 ft) long and 3.7 m (12.0 ft) deep, comprised of 10 variable mesh panels (3.2, 4.8, 6.4, 12.7, and 22.2 mm [0.1, 0.2, 0.3, 0.5, and 0.9 in]). Panels were symmetric about the midline of the net with the smallest mesh at the center.

Small and large variable mesh gill nets were fished across a range of depths and at both surface and subsurface locations. Gill nets were 60.0 m (196.9 ft) long, 1.8 m (5.9 ft) deep and made up of six 10.0 m (32.8 ft) panels. The larger mesh net had 10.0, 19.0, 33.0, 45.0, 55.0, and 60.0 mm (0.4, 0.7, 1.3, 1.8, 2.2, and 2.4 in) panels, whereas the smaller net had 10.0, 12.5, 16.0, 19.0, 22.0, and 25.0 mm (0.4, 0.5, 0.6, 0.7, 0.9, and 1.0 in) panels.

Hook-and-line sampling was performed with setlines and conventional sport fishing equipment. Fishing gear was deployed from boats or from shore and both artificial lures and bait (salmon flesh) were used.

Fish samples were processed by identifying, counting, measuring and then releasing or retaining individual fish. Fish were identified to species level using dichotomous keys (McPhail and Lindsey 1970; Mecklenburg et al. 2002; Pollard et al. 1997). Captured fish were counted and, when time permitted, lengths were measured [fork length (FL) or total length (TL)]. Following measurement, most fish were released; however, some fish or fish parts were retained as voucher samples.

Two types of voucher sample were collected: tissue and whole-fish. Tissue sampling was non-lethal and consisted of taking a small fin-clip, usually from the caudal fin, and preserving it in 95.0% ethanol. Whole-fish samples were collected when the identity of the fish could not be determined in the field.

## *Analyses*

The AKNHP (2000) species list was used to conduct analyses of documentation rates for the SWAN program. However, several species were identified as missing from the AKNHP lists by fisheries biologists within SWAN. Therefore, another species list using Mecklenburg et al. (2002) was compiled. This was chosen because it was a recent and thorough published reference list that included distributions of all fish species known or suspected to occur in Alaskan waters utilizing traceable references not available with the AKNHP (2000) report. The two lists were compared and combined to create as complete a species list for species predicted to occur in SWAN parks as possible. This list was then used to determine overall documentation rates based on the most recent literature of occurring fishes in addition to the SWAN list used to determine 90% identification rates mandated by the national protocol.

Data was collected through literature review of fisheries inventories conducted within SWAN park boundaries (appendix 1), available published and unpublished water quality assessments, and U.S. Geological Survey topographic maps. The compiled data was then used to conduct regression analyses of environmental data relative to individual species and species diversity.

## **Results:**

### *Entire SWAN network*

The freshwater fish inventory was based on an AKNHP (2000) report indicating a total of 33 potential freshwater fish species predicted to occur within SWAN parks and specifically targeting 19 specific fish species that were expected in SWAN parks, but not yet confirmed (appendix 3). Of the 33 AKNHP (2000) potential fish species, 28 species were confirmed, yielding a total documentation rate for the SWAN freshwater inventory projects of 84.8% (appendix 4).

Together, Mecklenburg et al. (2002) and AKNHP (2000) predicted 36 potential species, of which 31 were located during the freshwater fish inventory process (table 1, appendix 2, 3). The five fish species not identified in the freshwater fish inventory process were American shad (potentially present in KATM and KEFJ), cutthroat trout (potentially present in KEFJ), Pacific lamprey (potentially present in all SWAN parks), rainbow smelt (potentially present in all SWAN parks), and white sturgeon (potentially found in KEFJ).

### *Alagnak Wild River*

Twenty four species were predicted to occur in ALAG by AKNHP (2000), and 16 were confirmed, providing a documentation rate of 66.7% (appendix 4). Mecklenburg et al. (2002) suggested an additional 4 species of freshwater fish in ALAG but did not predict two species that were identified by AKNHP (2000), yielding a combined freshwater species list of 28 (Table 2, appendix 2 and 3).

Table 1. Predicted species for entire SWAN region. Normal lettering indicates predicted species by both Mecklenburg et al. (2002) and AKNHP (2000). Italics indicates species predicted by only AKNHP (2000). Bold indicates species presence predicted by Mecklenburg et al. (2002). Shaded boxes indicate a failure to confirm predicted species through AKNHP literature research (2000) or the current SWAN freshwater fishes inventory process.

Alaska Blackfish	Coastrange sculpin	Longnose sucker	Rainbow smelt
<b>American Shad</b>	Coho Salmon	Ninespine stickleback	Rainbow trout
Arctic char	<b>Cutthroat trout</b>	Northern Pike	Round whitefish
Arctic grayling	Dolly Varden	<b>Pacific Lamprey</b>	Slimy sculpin
Arctic Lamprey	Eulachon	Pacific staghorn sculpin	Sockeye Salmon
<b>Brook Lamprey</b>	Humpback whitefish	Pink Salmon	<b>Starry flounder</b>
Burbot	Lake trout	Pond Smelt	<i>Surf Smelt</i>
Chinook Salmon	Least cisco	<i>Prickly Sculpin</i>	Threespine stickleback
Chum Salmon	<i>Longfin Smelt</i>	Pygmy whitefish	<b>White Sturgeon</b>

Table 2. Predicted species for the Alagnak Wild River. Normal lettering indicates predicted species by both Mecklenburg et al. (2002) and AKNHP (2000). Italics indicates species predicted by only AKNHP (2000). Bold indicates species presence predicted by Mecklenburg et al. (2002). Shaded boxes indicate a failure to confirm predicted species through AKNHP literature research (2000) or the current SWAN freshwater fishes inventory process.

Alaska blackfish	Coastrange sculpin	Longnose sucker	<i>Pygmy whitefish</i>
<b>Arctic char</b>	Coho salmon	Ninespine stickleback	<b>Rainbow smelt</b>
Arctic grayling	Dolly Varden	Northern pike	Rainbow trout
Arctic lamprey	<b>Eulachon</b>	<b>Pacific lamprey</b>	Round whitefish
Burbot	Humpback whitefish	<i>Pacific staghorn sculpin</i>	Slimy sculpin
Chinook salmon	Lake trout	Pink salmon	Sockeye salmon
Chum salmon	Least cisco	Pond smelt	Threespine stickleback

### ***Aniakchak National Monument and Preserve***

Nine of 16 species identified by AKNHP (2000) as potentially present in ANIA were documented, for a rate of 56.3% (appendix 4). Mecklenburg et al. (2002) identified an additional 11 species of freshwater fish potentially present in ANIA (Table 3) but did not predict one species identified by AKNHP (2000). This yielded a combined freshwater species list of 27, and a tidepool and estuarine species list of 22 (appendix 2 and 3, table 3).

Table 3. Predicted species for Aniakchak National Monument and Preserve. Normal lettering indicates predicted species by both Mecklenburg et al. (2002) and AKNHP (2000). Italics indicates species predicted by only AKNHP (2000). Bold indicates species presence predicted by Mecklenburg et al. (2002). Shaded boxes indicate a failure to confirm predicted species through AKNHP literature research (2000) or the current SWAN freshwater fishes inventory process.

<i>Alaska blackfish</i>	<b>Coastrange sculpin</b>	<b>Northern pike</b>	<b>Rainbow smelt</b>
<b>Arctic char</b>	Coho salmon	Pacific lamprey	<b>Rainbow trout</b>
Arctic grayling	Dolly Varden	<b>Pacific staghorn sculpin</b>	Round whitefish
Arctic lamprey	Eulachon	Pink salmon	<b>Slimy sculpin</b>
<b>Burbot</b>	<b>Lake trout</b>	<b>Pond smelt</b>	Sockeye salmon
Chinook salmon	Longnose sucker	<i>Prickly sculpin</i>	Threespine stickleback
Chum salmon	Ninespine stickleback	<b>Pygmy whitefish</b>	

### *Katmai National Park and Preserve*

AKNHP (2000) identified twenty five potentially occurring freshwater fish for KATM, of which 24 were confirmed, for a documentation rate of 96.0% (Table 4, appendix 4). An additional five freshwater species were recognized by Mecklenburg et al. (2002), while 25 tidepool or estuarine species were considered to occur within KATM (appendix 2 and 3, table 4).

Table 4. Predicted species for Katmai National Park and Preserve. Normal lettering indicates predicted species by both Mecklenburg et al. (2002) and AKNHP (2000). Italics indicates species predicted by only AKNHP (2000). Bold indicates species presence predicted by Mecklenburg et al. (2002). Shaded boxes indicate a failure to confirm predicted species through AKNHP literature research (2000) or the current SWAN freshwater fishes inventory process.

Alaska blackfish	Chum salmon	Longnose sucker	Rainbow smelt
<b>American shad</b>	Coastrange sculpin	Ninespine stickleback	Rainbow trout
Arctic char	Coho salmon	Northern pike	Round whitefish
Arctic grayling	Dolly Varden	<b>Pacific lamprey</b>	Slimy sculpin
Arctic lamprey	<b>Eulachon</b>	<b>Pacific staghorn sculpin</b>	Sockeye salmon
<b>Brook lamprey</b>	Humpback whitefish	Pink salmon	Threespine stickleback
Burbot	Lake trout	Pond smelt	
Chinook salmon	Least cisco	Pygmy whitefish	



***Kenai Fjords National Park and Preserve***

Sixteen freshwater species potentially occurred in KEFJ (AKNHP 2000) and 13 were confirmed, for a documentation rate of 81.3% (Table 5, appendix 4). Mecklenburg et al. (2002) identified an additional 11 freshwater species with ranges that included KEFJ, while AKNHP (2000) recognized one species as potentially present that Mecklenburg et al. (2002) did not (Table 5, appendix 3). A total of 56 species could potentially be found within KEFJ boundaries, with 29 of them tidepool or estuarine (appendix 2 and 3).

Table 5. Predicted species for Kenai Fjords National Park. Normal lettering indicates predicted species by both Mecklenburg et al. (2002) and AKNHP (2000). Italics indicates species predicted by only AKNHP (2000). Bold indicates species presence predicted by Mecklenburg et al. (2002). Shaded boxes indicate a failure to confirm predicted species through AKNHP literature research (2000) or the current SWAN freshwater fishes inventory process.

<b>American shad</b>	Coastrange sculpin	<b>Ninespine stickleback</b>	Rainbow trout
<b>Arctic char</b>	Coho salmon	Pacific lamprey	Round whitefish
<b>Arctic grayling</b>	<b>Cutthroat trout</b>	<b>Pacific staghorn sculpin</b>	Slimy sculpin
<b>Arctic lamprey</b>	Dolly Varden	Pink salmon	Sockeye salmon
Burbot	Eulachon	<b>Pond smelt</b>	Threespine stickleback
Chinook salmon	<b>Lake trout</b>	<i>Prickly sculpin</i>	<b>White sturgeon</b>
Chum salmon	Longnose sucker	<b>Rainbow smelt</b>	

Table 6. Predicted species for Lake Clark National Park and Preserve. Normal lettering indicates predicted species by both Mecklenburg et al. (2002) and AKNHP (2000). Italics indicates species predicted by only AKNHP (2000). Bold indicates species presence predicted by Mecklenburg et al. (2002). Shaded boxes indicate a failure to confirm predicted species through AKNHP literature research (2000) or the current SWAN freshwater fishes inventory process.

<b>Alaska blackfish</b>	Coho salmon	Ninespine stickleback	Rainbow trout
Arctic char	Dolly Varden	Northern pike	Round whitefish
Arctic grayling	Eulachon	Pacific lamprey	Slimy sculpin
Arctic lamprey	Humpback whitefish	<b>Pacific staghorn sculpin</b>	Sockeye salmon
Burbot	Lake trout	Pink salmon	<i>Surf smelt</i>
Chinook salmon	Least cisco	<b>Pond smelt</b>	Threespine stickleback
Chum salmon	<i>Longfin smelt</i>	<i>Pygmy whitefish</i>	
Coastrange sculpin	Longnose sucker	<b>Rainbow smelt</b>	

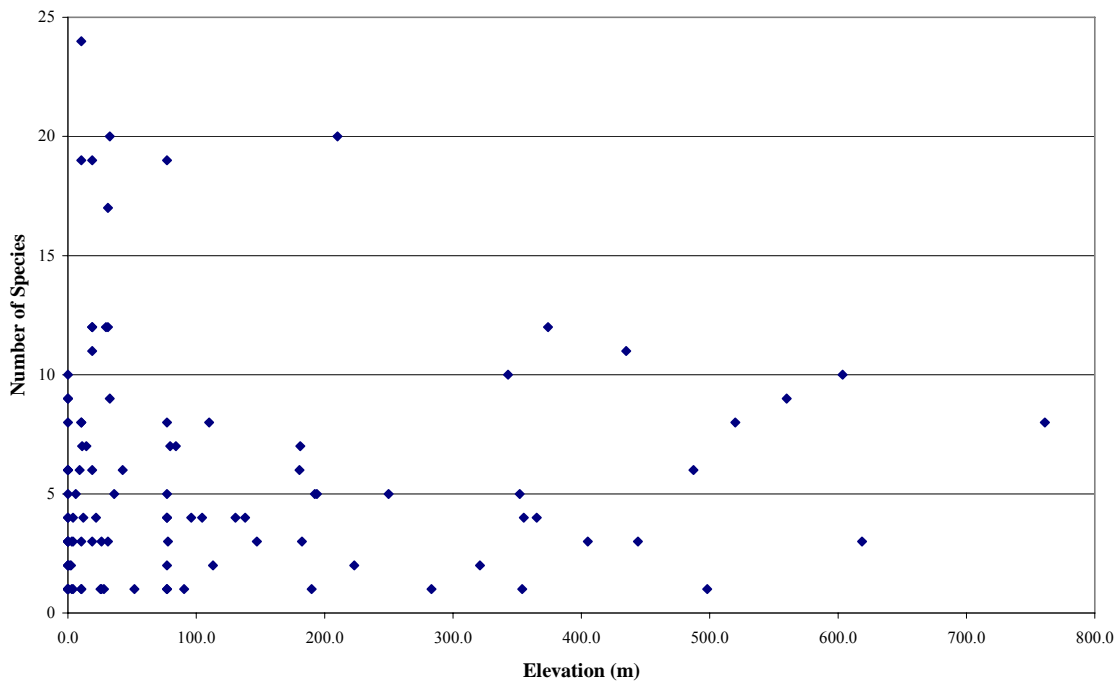
## *Lake Clark National Park and Preserve*

Twenty-six species of freshwater fish were predicted to occur in LACL by AKNHP (2000) and 25 were verified, for a documentation rate of 96.2% (Table 6, appendix 4). Mecklenburg et al. (2002) indicated another four species could potentially occur within LACL boundaries, but did not predict one species identified by AKNHP (2000)(Table 6, appendix 4). An additional 24 species were considered tidepool or estuarine fish (appendix 2).

### *Species Distributions*

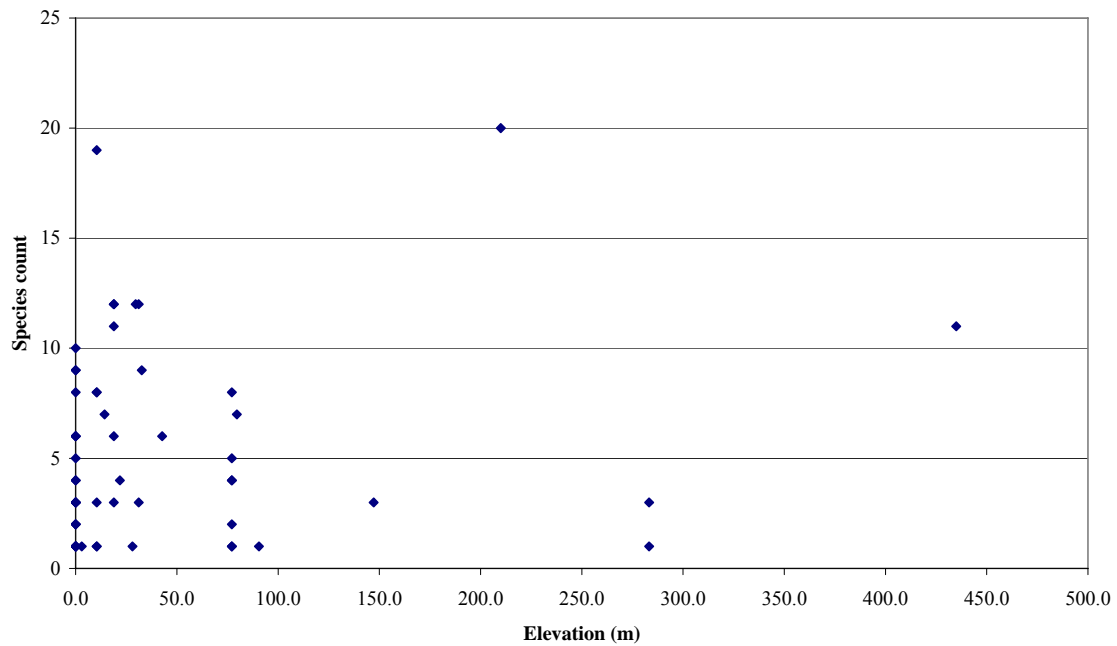
A plot of the species distribution relative to elevation regardless of habitat type (river or lake), shows what appears to be a decrease in the diversity relative to increasing elevation (graph 1). An elevational species diversity plot for just rivers shows relatively few high elevation rivers were sampled and little, if any, diversity trends associated with elevation gradients (graph 2). There is still no apparent gradient in distributions relative to elevation after removing the few high elevation rivers that were sampled.

### **Species Diversity Relative To Elevation**



Graph 1. Species Diversity relative to Elevation. Includes all sites throughout SWAN network (Lakes and Rivers). River elevations are recorded as the lowest elevation at the outflow into another river, lake, or the ocean. Some river elevations are recorded as the lowest elevation near the last sampled point within the park. Elevation in meters.

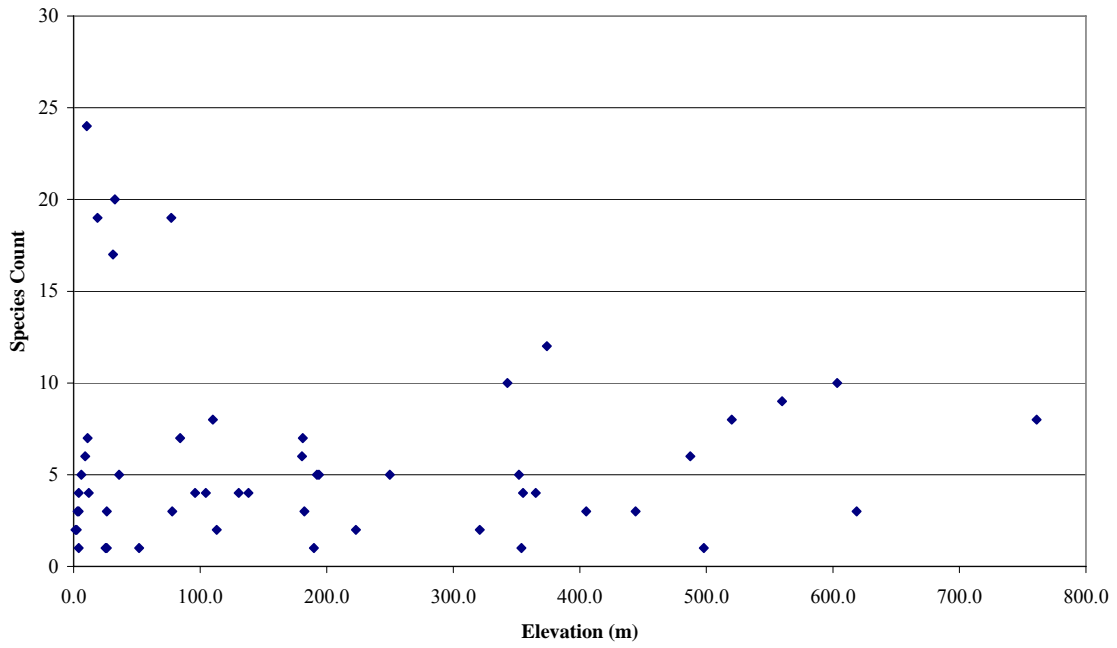
## Species Diversity Relative To Elevation (Rivers)



Graph 2. Species Diversity Relative To Elevation (Rivers). River elevations are recorded as the lowest elevation at the outflow into another river, lake, or the ocean. Some river elevations are recorded as the lowest elevation near the last sampled point within the park. Elevation in meters.

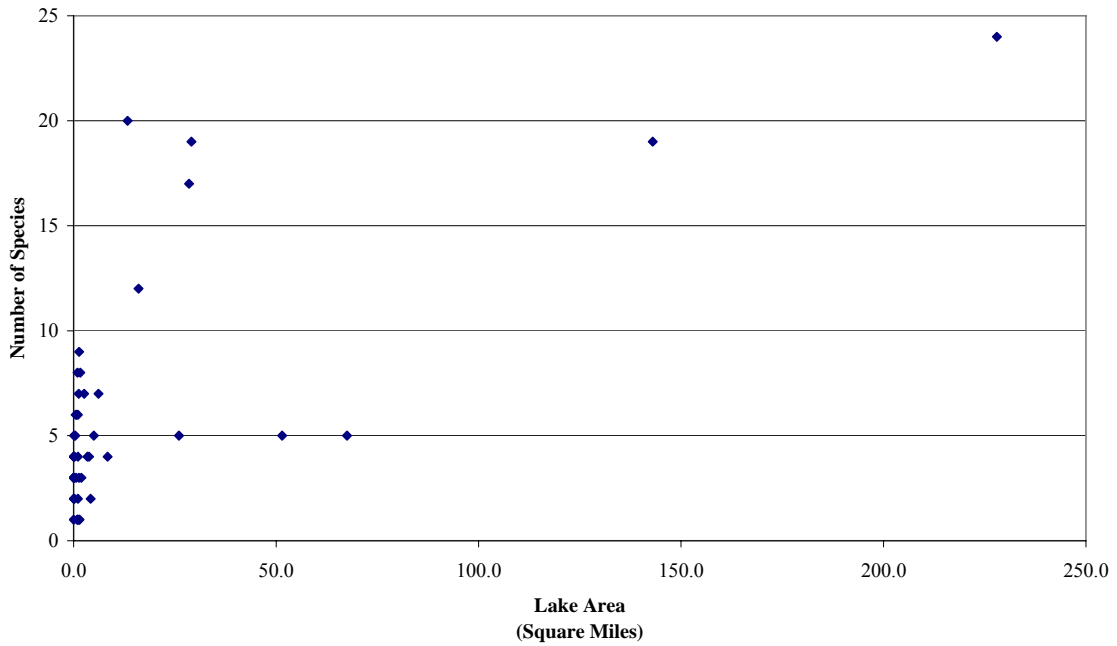
When species diversity relative to lake elevation is examined (graph 3), there again appears to be a decrease in diversity with increasing elevation; however, this is driven by five low elevation high diversity lakes (Naknek, Brooks, Coville, Grosvenor, and Lake Clark). Four of these five lakes are in the same watershed drainage (Naknek, Brooks, Coville, and Grosvenor), and all have relatively close migration pathways to the ocean. Removing these five lakes from examination reveals no readily apparent change in species distribution relative to elevational gradient.

### Species Diversity Relative To Elevation (Lakes)



Graph 3. Species Diversity Relative to Elevation (Lakes). Elevation in meters.

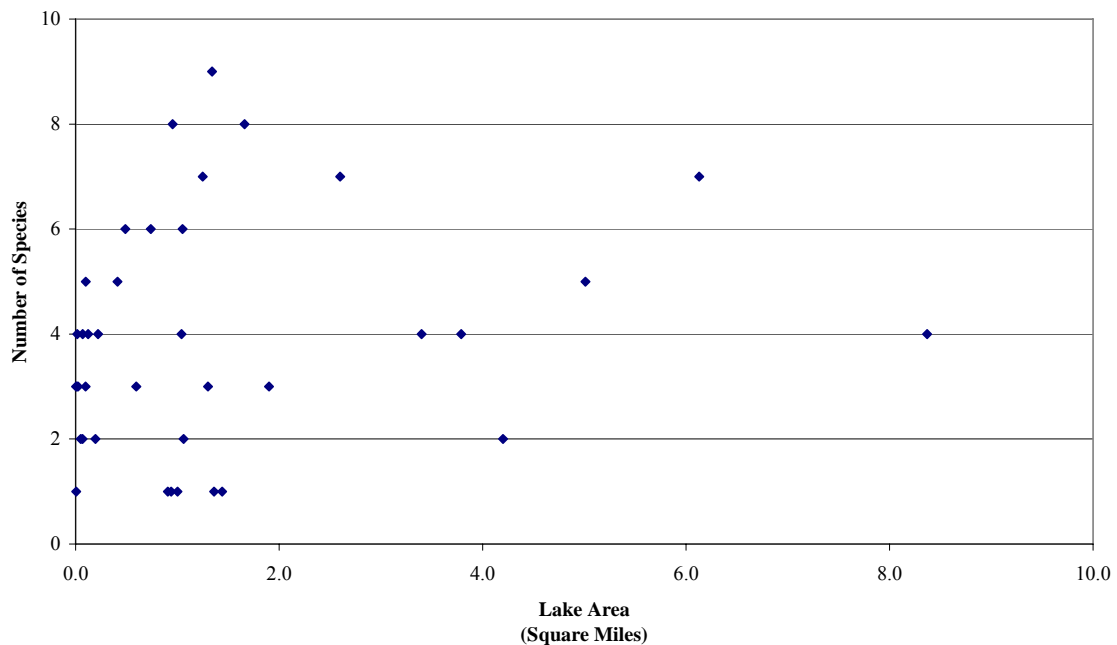
### Species Diversity Relative To Lake Area



Graph 4. Species Diversity Relative to Lake Area. Area in square miles (mi<sup>2</sup>).

An increasing gradient in the number of species relative to lake size is skewed by the few high area lakes sampled in the region (graph 4). Removing these points reveals no distinct trend, because several smaller (but low elevation) lakes appear to have high species diversity (Coville Lake, Brooks Lake, and Grosvenor Lake) while some large (but high elevation) lakes tend to have low species diversity (Kukaklek Lake, Nonvianuk Lake, and Chakachamna Lake). The relatively small number of large lakes in the SWAN network warranted further analysis of the smaller lakes (lakes  $\geq 10 \text{ mi}^2$ ) and reveals what appears to be a slight increase in species diversity with increasing area (graph 5)

### Species Diversity Relative To Lake Area (<10mi<sup>2</sup>)

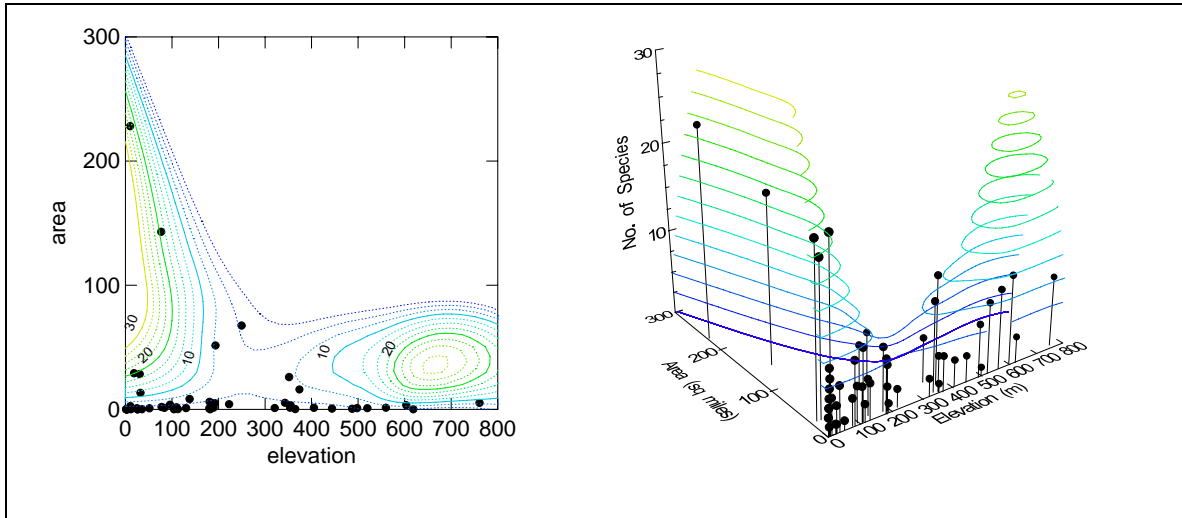


Graph 5. Species Diversity Relative To Lake Area (<10 mi<sup>2</sup>). All sampled lakes less than 10 mi<sup>2</sup> are included in the graph. Area in square miles.

Because there might be a correlation between both elevation and lake area with respect to species diversity, a 3-way analysis was performed to examine the relationships between the three components. An initial examination of the three way contour graph does not appear to indicate any diversity trend (graph 6), but trends were again difficult to establish because of the presence of outliers on the graph. Regression analyses indicate the primary component describing residuals is area ( $P \leq 0.005$ ). The cross of elevation by area is not significant ( $P = 0.423$ ) in determining species diversity, nor is elevation ( $P = 0.268$ ) (table 7).

An examination of flow rate relative to species diversity shows what initially appears to be an envelope with a peak in species diversity with increasing flow (graph 7) around eight to ten species. The lack of information, particularly with medium and high flow rivers (>50 cms), throughout the graph makes this examination difficult. However, the

single outlier with high species diversity and relatively low flow is Brooks River, which has a high visitation rate, and consequently has had the most sampling, yielding a greater likelihood of species capture and identification of species. If this point is removed, there is no clear indication of species diversity changes relative to flow rate.

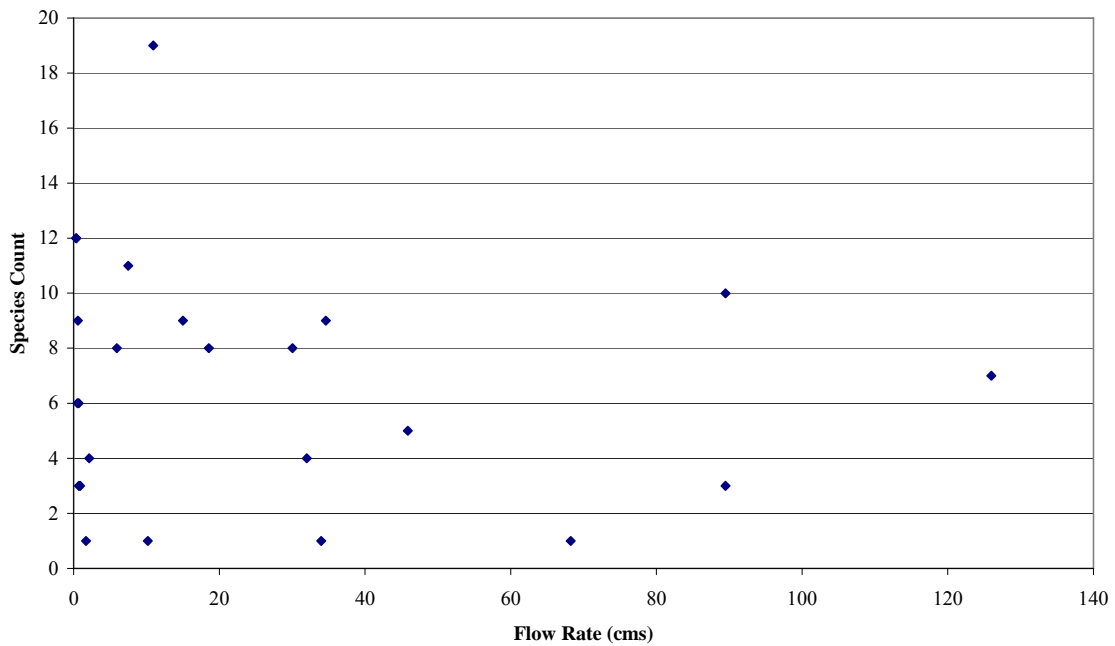


Graph 6. 3-D contour graph of lake area, elevation, and species diversity. Contours included for species count. Area in square miles, elevation in meters.

Table 7. Regression Analysis of diversity components. Significant results in bold.

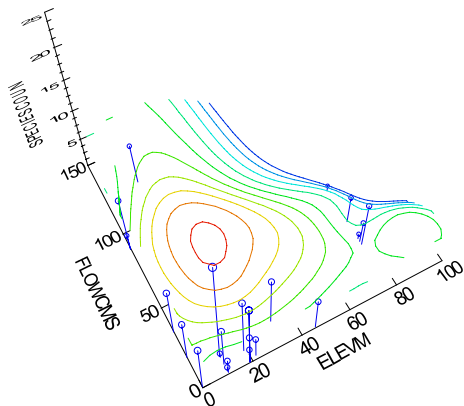
Effect	Coefficient	Std. error	Std. Coefficient	Tolerance	T	P (2 tail)
Diversity	4.401	0.708	0.000	.	6.217	0.000
Elevation	0.000	0.000	0.134	0.797	1.120	0.268
<b>Area</b>	0.098	0.016	0.703	0.890	6.223	<b>0.000</b>
Elevation	0.000	0.000	-0.098	0.769	-0.807	0.423
X						
Area						

## Species Diversity Relative to Flow Rate



Graph 7. Species diversity relative to flow rate. Flow rate is cubic meters per second.

Examining both flow rate and elevation relative to species diversity (graph 8) reveals no clear distributional patterns, caused primarily by the lack of data. The relatively few high flow points cause a high degree of bias in the analysis and making interpretation difficult and confounded when considering the lack of data. However, there does appear to be a peak diversity area at relatively low elevations and medium flows (50 – 100 cms).



Graph 8. 3-D contour graph of flow rate, elevation, and species diversity. Contours included for species count. Flow rate is cubic meters per second, elevation is in meters.

Irregardless of overall species diversity, several species identified in the freshwater fish inventories exhibited distributions that tended to indicate elevational restrictions (appendix 5) or geographical restrictions (appendix 6): Alaska blackfish (*Dallia pectoralis*) was not found in lakes above 32.6 m (107 ft) elevation, humpback whitefish (*Coregonus pidschian*) was not found in lakes above 96 m (315 ft) elevation, Pacific staghorn sculpin (*Leptocottus armatus*) was not found in lakes above 9.1 m (30.0 ft), pond smelt (*Hypomesus olidus*) were not found in lakes above 32.6 m (107 ft), and pink salmon (*Oncorhynchus gorbuscha*) was not found above 77.1 m (253 ft) in elevation.

### **Discussion:**

The success rate of the freshwater fish inventories can be partially explained by the sampling methods and timing. Gear selection is a critical component of effective capture and the gear types used in the freshwater fish inventory were adequate for many species, but were not selective for other targeted species. Also, while certain fishes were directly targeted for location, identification, and documentation, the sampling took place during restricted times of the year and many fish species exhibit varying spatio-temporal residencies. It is likely that the fishes that were not captured and identified during the inventory processes were not located because the sampling took place outside of their spatio-temporal residencies within the sampled waters and/or were not effectively fished for with the sampling gear used.

Another possible reason for lower than expected occurrence confirmations may be caused by low species diversity in the region. Missing individual species can account for a significant portion of the overall species diversity of a region proportional to the total numbers of species present.

Ecological and geological constraints may also play a significant role in determining the actual distributions of species. It is possible that the fish were not found because they are not present in the park boundaries. In the case of the AKNHP (2000) predicted species list, the list was generated by utilizing distributions of fishes in adjacent regions, while Mecklenburg et al. (2002) determined distributions through the extrapolation to area from point capture records. These may not be accurate methods of predicting fish species distributions in this region of Alaska because of the high degree of ecological constraints and geological processes such as glaciation and active volcanism which serve to shape the landscape and consequently the aquatic habitats. Relatively small parks (Aniakchak and the Alagnak) will be more susceptible to larger scale geological and ecological processes without the inherent buffering of larger parks with their more varied ecological subregions. It stands to reason, therefore, that there may be known or unknown processes which have affected the regional parks with unknown ecological consequences, one being the absence of predicted fish species.

Several species identified in the freshwater fish inventories exhibited distributions that tended to indicate elevational restrictions (appendix 5). The Alaska blackfish (*Dallia pectoralis*) was not found in lakes above 32.6 m (107 ft) elevation and the humpback



whitefish (*Coregonus pidschian*) was not found in lakes above 96 m (315 ft) elevation. Additionally, the Pacific staghorn sculpin (*Leptocottus armatus*) was not found in lakes above 9.1 m (30.0 ft) and pond smelt (*Hypomesus olidus*) were not found in lakes above 32.6 m (107 ft). Possibly the most interesting apparent elevation restriction was seen in pink salmon (*Oncorhynchus gorbuscha*) which were not found above 77.1 m (253 ft) in elevation. Pink salmon tend to spawn in coastal rivers and not in the lakes or rivers further upstream.

Island biogeography has shown strong influences of island area on species richness. In general, the larger the island, the more species present. Lakes function as aquatic islands, and in many places display the same pattern of species richness to area attributed to island ecosystems. In addition, elevation often impacts species richness, with fewer species at high elevations. In our study lakes, these patterns were very weak, despite a large number of sampled locations across the network. Lakes with larger area did have more species, but this was strongly impacted by the lakes that were high in area that have large rivers flowing in and out of them, connecting them to the ocean and other lakes. This connectivity, while not specifically inappropriate in island biogeographic terms, presents a special complication to normal assumptions about colonization where many of the species vary in their tolerance for saltwater migration routes, and there are very few species overall.

Elevation had no overall impact on species richness but there was the potential for greater species richness among lower elevation lakes. This was again possibly a feature of the connectivity of five lakes in the analysis. The rest of the lakes did not show any overall trend in species richness with elevation. With the five lakes included, the potential for high species richness declines with elevation, but at low elevations a broad range of species richness is observed among the various water bodies. These results suggest that the connectivity, which is in part reflective of large area lakes in the SWAN region, is one of the central features determining species richness. Short, large volume rivers connecting these lakes to one another at low elevation facilitate colonization and lead to high species richness in these lakes, while higher elevation lakes and lakes that are smaller in general are much more depauperate.

The number of sampling occurrences is extremely important in interpreting this data. Because many places were sampled only once and in a brief period of time, it is not only possible, but very likely that a significant number of species may have been missed in the freshwater inventory process. These missed species can have a significant effect on the analyses of species and diversity within the SWAN network. All sampling site locations for the freshwater inventory process in the SWAN network were recorded (appendix 6) along with the associated habitat information (appendix 7) for future comparison and analyses.

### **Recommendations:**

The freshwater fisheries inventory work across all of the SWAN parks has brought to light serious deficiencies in our existing water quality data for the entire SWAN region.

While some water quality data exists for all of these parks, information is lacking for significant portions of most of the SWAN parks. Only ALAG has sufficient water quality data to begin a thorough ecological assessments of the region. The LACL water quality report contains limited information relevant to the park, as less than half of the sampling stations in the report are located within park boundaries. None of the coastal watersheds of KATM have water quality data or assessments nor do the portions of the Egegik drainage basin contained within KATM. ANIA has limited water quality assessments, primarily within Surprise Lake, and only two rivers in all of KEFJ have water quality assessments completed. This lack of water quality data makes thorough ecological assessments impossible, and the authors strongly recommend that basic water quality data be collected for additional watersheds in SWAN parks.

Because of the likelihood of missed species in individual water bodies and the effect missed species can have on the analyses of biotic diversity, ecosystem complexity, ecological functioning, and population health within the SWAN network, continued sampling should be undertaken to further assess the ecological status of the freshwater fishes within SWAN parks. This sampling should address gaps in current geographical and geophysical data relating to freshwater fish species and both spatial and temporal residencies, as well as potential inadequacies of individual sampling methods, possibly by including other capture methods such as electrofishing and/or underwater video monitoring, while continuing to gather length, size, and abundance data using current techniques. This information will prove to be useful in determining future sampling methods to target specific fish populations and increase the efficiency of sampling procedures for targeted species assessments within the park.

### **Acknowledgements:**

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**Figures:**

**Figure 3) Alagnak Wild River Area Map**

**Figure 4) Aniakchak National Monument and Preserve Area Map**

**Figure 5) Katmai National Park and Preserve Area Map**

**Figure 6) Kenai Fjords National Park Area Map**

**Figure 7) Lake Clark National Park and Preserve Area Map**

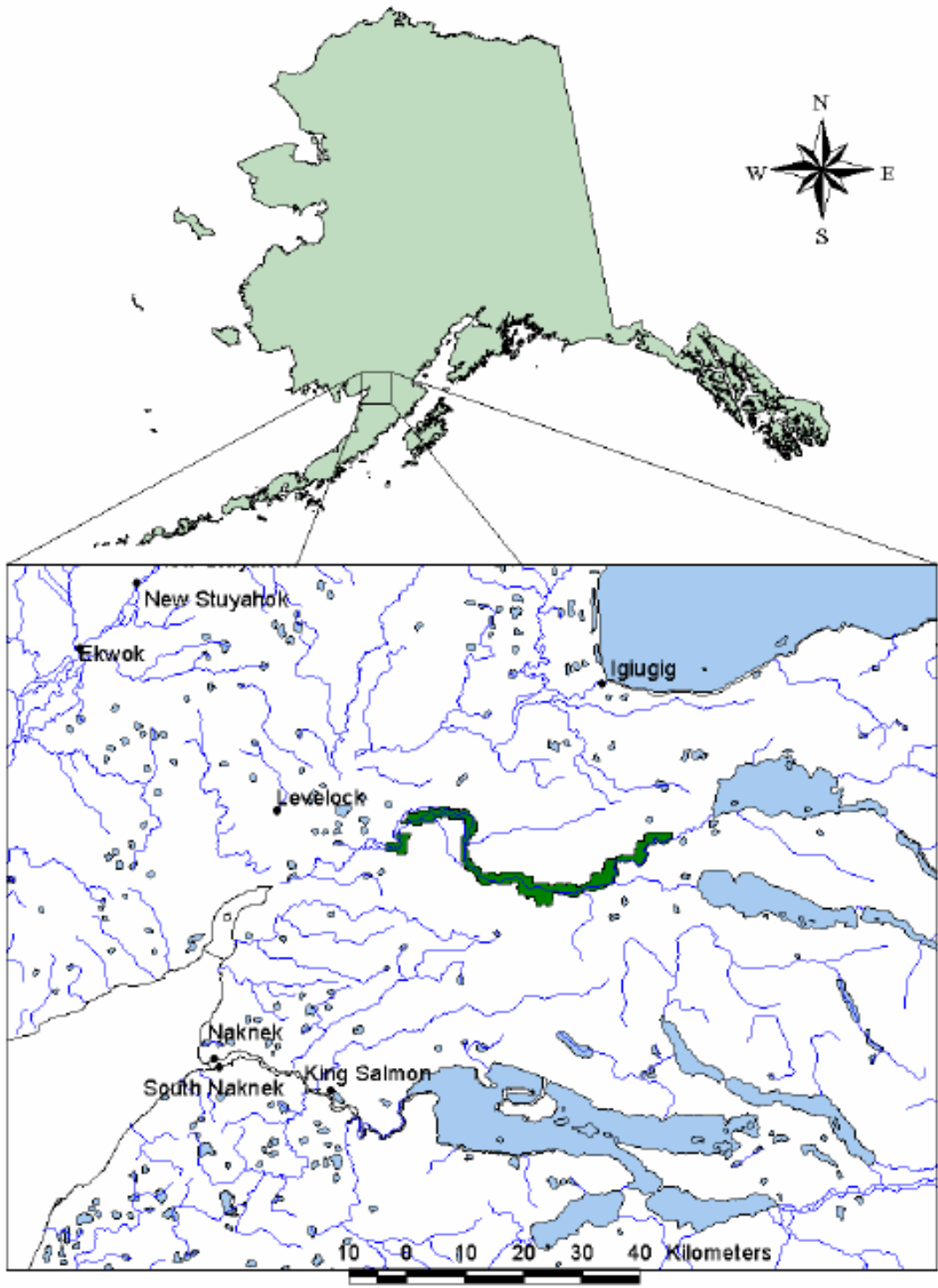


Figure 3. Alagnak Wild River location. Scale is in kilometers. Portion of the Alagnak River highlighted in green is the Alagnak Wild River.

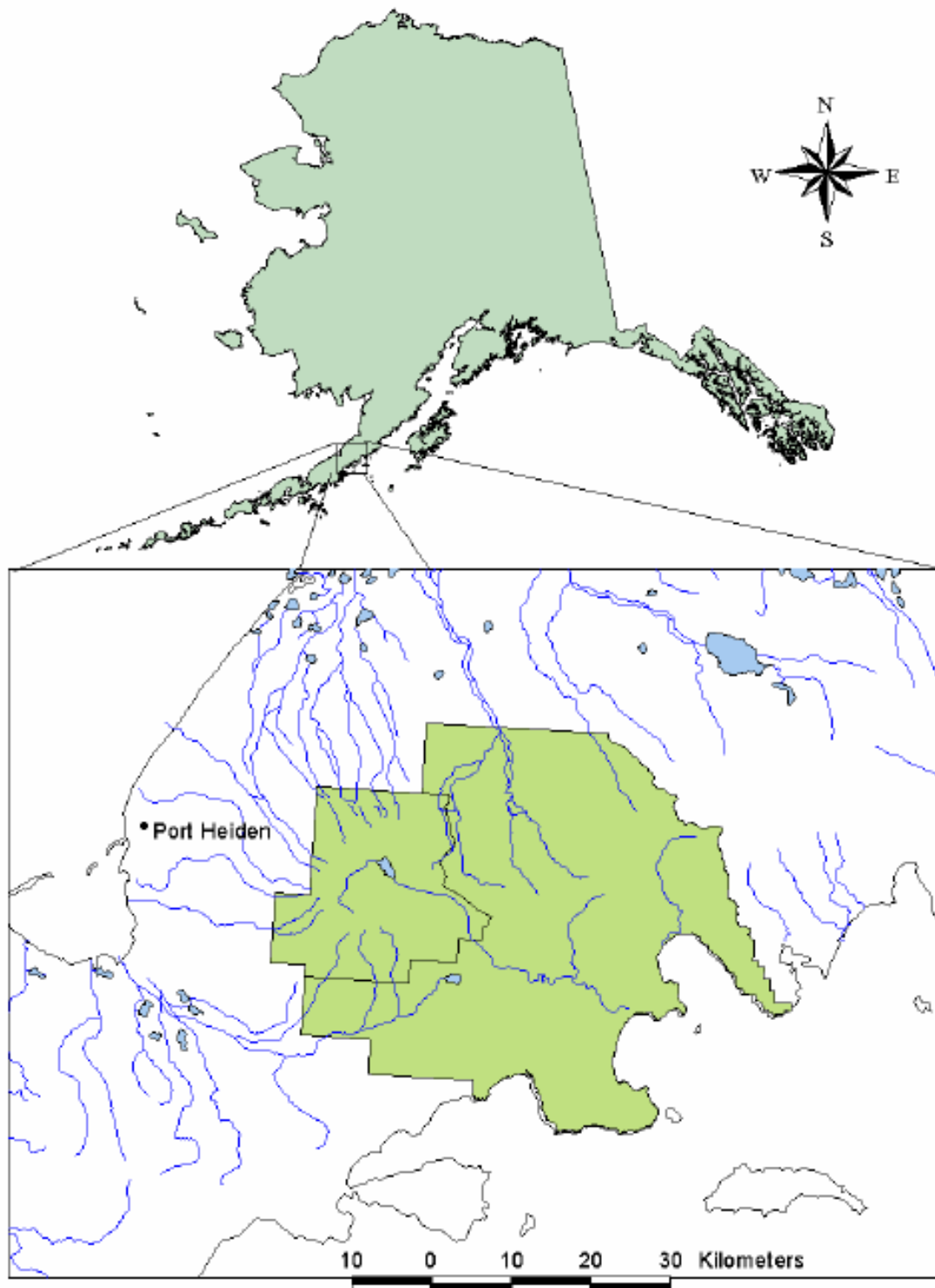


Figure 4. Aniakchak National Monument and Preserve location. Scale is in kilometers. Park is highlighted in green.



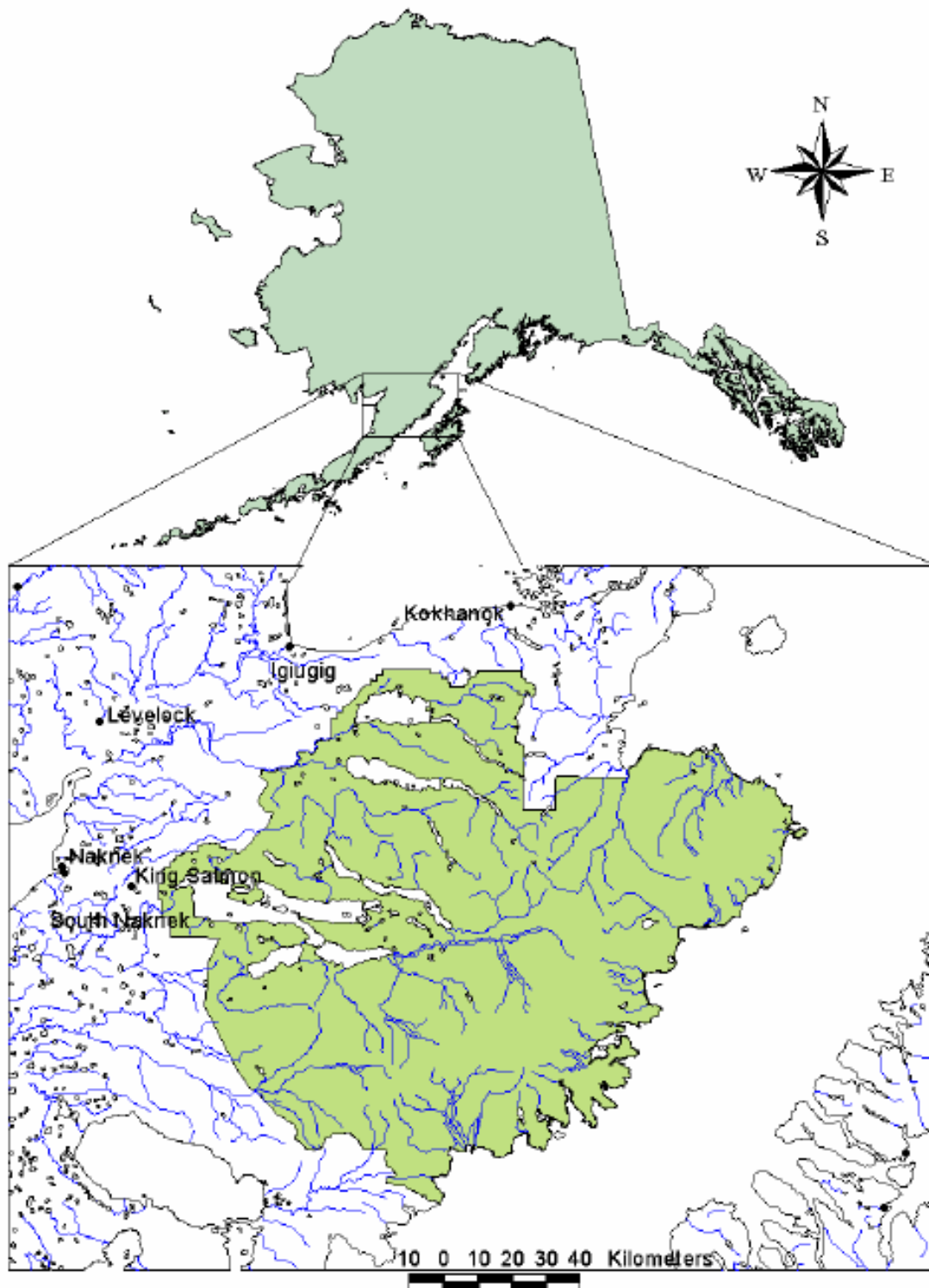


Figure 5. Katmai National Park and Preserve location. Scale is in kilometers. Park is highlighted in green.

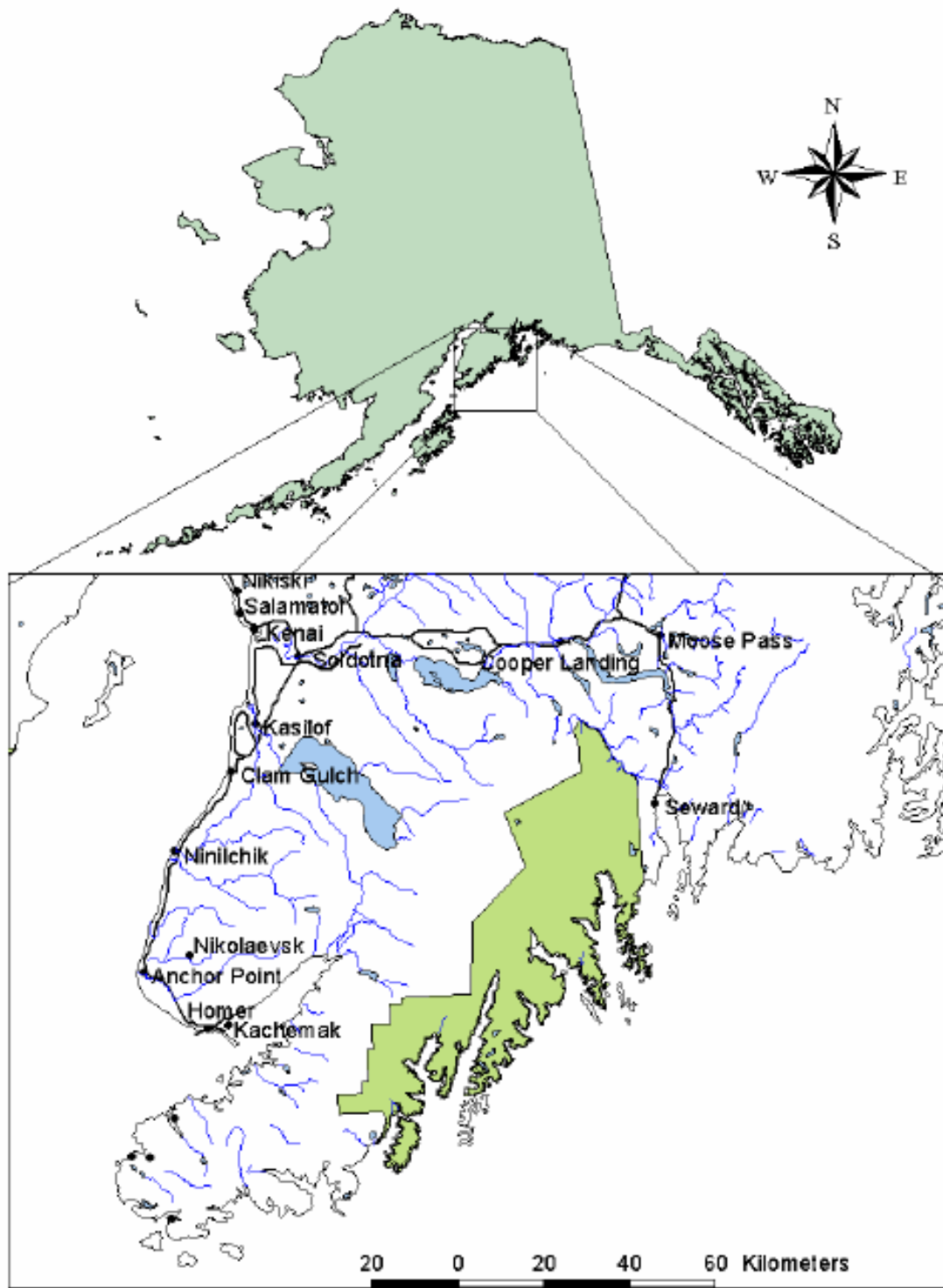


Figure 6. Kenai Fjords National Park location. Scale is in kilometers. Park is highlighted in green.

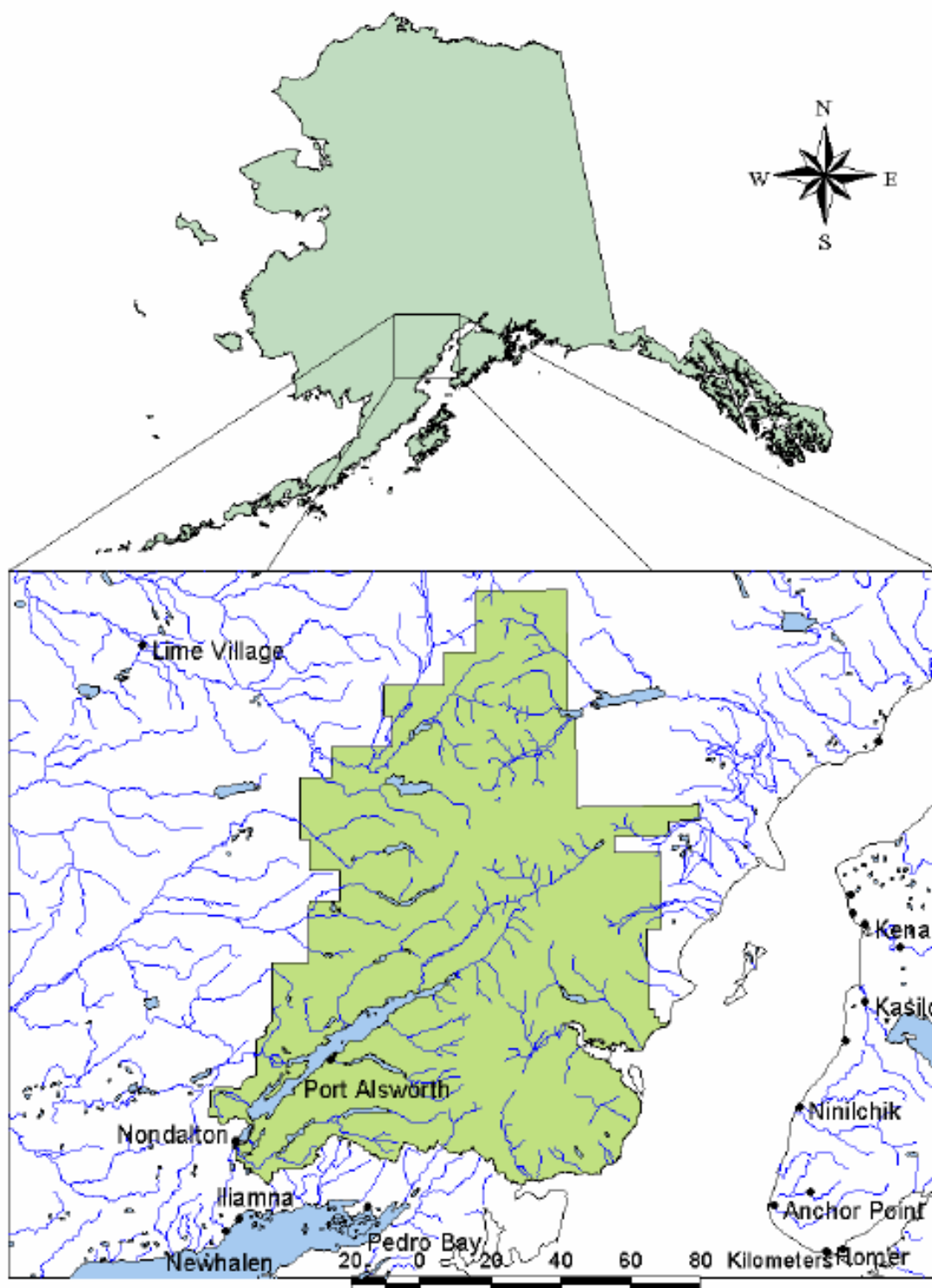


Figure 7. Lake Clark National Park and Preserve location. Scale is in kilometers. Park is highlighted in green.

**Appendices:**

**Appendix 1) Locations of all fish occurrences by species in all locations throughout the NPS SWAN network**

**Appendix 2) Species list of Alaska fishes potentially found within SWAN park unit boundaries**

**Appendix 3) Expected freshwater fish species list based on Mecklenburg et al. and the Alaska Natural Heritage Program**

**Appendix 4) Success rates of SWAN fish inventory surveys in SWAN park units**

**Appendix 5) Species location relative to elevation throughout all SWAN lakes**

**Appendix 6) Individual Species Confirmation Locations**

**Appendix 7) Geographical information regarding water bodies sampled in the SWAN fish inventory**

Appendix 1. Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Addison Lake	Alagnak River	Albert Johnson Creek	Alogogshak Creek
Alaska Blackfish	<i>Dallia pectoralis</i>		X		
Arctic Char	<i>Salvelinus alpinus</i>				
Arctic Grayling	<i>Thymallus arcticus</i>				
Arctic Lamprey	<i>Lampetra japonica</i>		X		
Burbot	<i>Lota lota</i>				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>				
Chum Salmon	<i>Oncorhynchus keta</i>				
Coastrange Sculpin	<i>Cottus aleuticus</i>		X		
Coho Salmon	<i>Oncorhynchus kisutch</i>			X	
Dolly Varden	<i>Salvelinus malma</i>			X	
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>				
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>				
Ninespine Stickleback	<i>Pungitius pungitius</i>		X	X	
Northern Pike	<i>Esox lucius</i>		X		
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbusha</i>	X			H
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>				
Round Whitefish	<i>Prosopium cylindraceum</i>		X		
Slimy Sculpin	<i>Cottus cognatus</i>		X		
Sockeye Salmon	<i>Oncorhynchus nerka</i>	X			
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	X		X	

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	American Creek	Amalik River	Aniakchak River	Beards Hollow Lagoon
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>	H			
Arctic Grayling	<i>Thymallus arcticus</i>				
Arctic Lamprey	<i>Lampetra japonica</i>				
Burbot	<i>Lota lota</i>				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	H			
Chum Salmon	<i>Oncorhynchus keta</i>	H			
Coastrange Sculpin	<i>Cottus aleuticus</i>			X	
Coho Salmon	<i>Oncorhynchus kisutch</i>			X	
Dolly Varden	<i>Salvelinus malma</i>			X	
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>				
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>	H			
Ninespine Stickleback	<i>Pungitius pungitius</i>			X	
Northern Pike	<i>Esox lucius</i>	H			
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>			X	
Pink Salmon	<i>Oncorhynchus gorbuscha</i>		H	X	
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>	H			
Round Whitefish	<i>Prosopium cylindraceum</i>	H			
Slimy Sculpin	<i>Cottus cognatus</i>	H			
Sockeye Salmon	<i>Oncorhynchus nerka</i>	H		X	X
Starry Flounder	<i>Platichthys stellatus</i>			X	
Threepine Stickleback	<i>Gasterosteus aculeatus</i>			X	X

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Big River	Boulder Creek Lakes	Brooks Lake	Brooks River	Caribou Lake
Alaska Blackfish	<i>Dallia pectoralis</i>			H		
Arctic Char	<i>Salvelinus alpinus</i>			H		R
Arctic Grayling	<i>Thymallus arcticus</i>			H	H G	R
Arctic Lamprey	<i>Lampetra japonica</i>			H G	H	
Burbot	<i>Lota lota</i>					
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>			H G	H G	
Chum Salmon	<i>Oncorhynchus keta</i>			H	H	
Coastrange Sculpin	<i>Cottus aleuticus</i>	H		H	H	
Coho Salmon	<i>Oncorhynchus kisutch</i>	H	X	H	H	
Dolly Varden	<i>Salvelinus malma</i>	H	X	H	H G	
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>					
Lake Trout	<i>Salvelinus namaycush</i>			H G	H	
Least Cisco	<i>Coregonus sardinella</i>				H	
Longnose Sucker	<i>Catostomus catostomus</i>				H	
Ninespine Stickleback	<i>Pungitius pungitius</i>	H		H G	H	
Northern Pike	<i>Esox lucius</i>			H	H	
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>					
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	H		H	H	
Pond Smelt	<i>Hypomesus olidus</i>				H	
Pygmy Whitefish	<i>Prosopium coulteri</i>			H		
Rainbow Trout	<i>Oncorhynchus mykiss</i>			H	H G	
Round Whitefish	<i>Prosopium cylindraceum</i>			H	H	
Slimy Sculpin	<i>Cottus cognatus</i>			H	H	R
Sockeye Salmon	<i>Oncorhynchus nerka</i>			H G	H G	
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	H	X	H G	H	

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Chakachamna Lake	Chilikadrotna River	Chokotonk River	Chulitna River
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>				
Arctic Grayling	<i>Thymallus arcticus</i>		R		R
Arctic Lamprey	<i>Lampetra japonica</i>				
Burbot	<i>Lota lota</i>		R		R
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>		R		
Chum Salmon	<i>Oncorhynchus keta</i>		R		
Coastrange Sculpin	<i>Cottus aleuticus</i>				
Coho Salmon	<i>Oncorhynchus kisutch</i>		R		
Dolly Varden	<i>Salvelinus malma</i>	R	R		
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				R
Lake Trout	<i>Salvelinus namaycush</i>	R	R		
Least Cisco	<i>Coregonus sardinella</i>				R
Longnose Sucker	<i>Catostomus catostomus</i>				R
Ninespine Stickleback	<i>Pungitius pungitius</i>				R
Northern Pike	<i>Esox lucius</i>				R
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbuscha</i>				
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>		R		
Round Whitefish	<i>Prosopium cylindraceum</i>	R	R		R
Slimy Sculpin	<i>Cottus cognatus</i>	R	R		R
Sockeye Salmon	<i>Oncorhynchus nerka</i>	R	R	R	R
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>				



Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Coville Lake	Coville River	Cozy Lake	Crescent Beach Creek	Crescent Lake
Alaska Blackfish	<i>Dallia pectoralis</i>	H				
Arctic Char	<i>Salvelinus alpinus</i>	H				R
Arctic Grayling	<i>Thymallus arcticus</i>					
Arctic Lamprey	<i>Lampetra japonica</i>	H	H			
Burbot	<i>Lota lota</i>	H				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>					R
Chum Salmon	<i>Oncorhynchus keta</i>					
Coastrange Sculpin	<i>Cottus aleuticus</i>	H		H		R
Coho Salmon	<i>Oncorhynchus kisutch</i>	H	H	H		
Dolly Varden	<i>Salvelinus malma</i>	H			X	R
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>	H G				
Lake Trout	<i>Salvelinus namaycush</i>	H G	H G			R
Least Cisco	<i>Coregonus sardinella</i>	H		H		
Longnose Sucker	<i>Catostomus catostomus</i>	H G	H			
Ninespine Stickleback	<i>Pungitius pungitius</i>	H G	H	H		
Northern Pike	<i>Esox lucius</i>	H G	H			
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				X	
Pink Salmon	<i>Oncorhynchus gorbuscha</i>		H			
Pond Smelt	<i>Hypomesus olidus</i>	H	H			
Pygmy Whitefish	<i>Prosopium coulteri</i>	H				
Rainbow Trout	<i>Oncorhynchus mykiss</i>	H G	H			
Round Whitefish	<i>Prosopium cylindraceum</i>	H G	H	H		
Slimy Sculpin	<i>Cottus cognatus</i>	H	H			
Sockeye Salmon	<i>Oncorhynchus nerka</i>	H		H	X	R
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	H G	H		X	R

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Dakavak Lake	Dakavak River	Delight Lake	Delight River	Delusion Creek
Alaska Blackfish	<i>Dallia pectoralis</i>					
Arctic Char	<i>Salvelinus alpinus</i>					
Arctic Grayling	<i>Thymallus arcticus</i>					
Arctic Lamprey	<i>Lampetra japonica</i>					
Burbot	<i>Lota lota</i>					
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>					
Chum Salmon	<i>Oncorhynchus keta</i>					
Coastrange Sculpin	<i>Cottus aleuticus</i>	X H		X	X	
Coho Salmon	<i>Oncorhynchus kisutch</i>			X	X	
Dolly Varden	<i>Salvelinus malma</i>	X H		X	X	X
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>					
Lake Trout	<i>Salvelinus namaycush</i>					
Least Cisco	<i>Coregonus sardinella</i>					
Longnose Sucker	<i>Catostomus catostomus</i>					
Ninespine Stickleback	<i>Pungitius pungitius</i>					
Northern Pike	<i>Esox lucius</i>					
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>			X	X	
Pink Salmon	<i>Oncorhynchus gorbuscha</i>		X H			
Pond Smelt	<i>Hypomesus olidus</i>					
Pygmy Whitefish	<i>Prosopium coulteri</i>					
Rainbow Trout	<i>Oncorhynchus mykiss</i>					
Round Whitefish	<i>Prosopium cylindraceum</i>					
Slimy Sculpin	<i>Cottus cognatus</i>					
Sockeye Salmon	<i>Oncorhynchus nerka</i>	X H		X	X	
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>			X	X	

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Desire Creek	Devils Cove Lake	Devils Cove River	Drop Off Beach River
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>				
Arctic Grayling	<i>Thymallus arcticus</i>				
Arctic Lamprey	<i>Lampetra japonica</i>				
Burbot	<i>Lota lota</i>				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>				
Chum Salmon	<i>Oncorhynchus keta</i>				
Coastrange Sculpin	<i>Cottus aleuticus</i>		H		
Coho Salmon	<i>Oncorhynchus kisutch</i>	X			
Dolly Varden	<i>Salvelinus malma</i>		H	H	
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>				
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>				
Ninespine Stickleback	<i>Pungitius pungitius</i>				
Northern Pike	<i>Esox lucius</i>				
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	X	H		X
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>				
Round Whitefish	<i>Prosopium cylindraceum</i>				
Slimy Sculpin	<i>Cottus cognatus</i>				
Sockeye Salmon	<i>Oncorhynchus nerka</i>		H		
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>				

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Exit Creek	Ferrum Creek	Fishtrap Lake	Grosvenor Lake	Grosvenor River
Alaska Blackfish	<i>Dallia pectoralis</i>				H	
Arctic Char	<i>Salvelinus alpinus</i>			R	H	
Arctic Grayling	<i>Thymallus arcticus</i>			R		
Arctic Lamprey	<i>Lampetra japonica</i>				H	H
Burbot	<i>Lota lota</i>			R		
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>					
Chum Salmon	<i>Oncorhynchus keta</i>					
Coastrange Sculpin	<i>Cottus aleuticus</i>					H
Coho Salmon	<i>Oncorhynchus kisutch</i>		X	R	H	H
Dolly Varden	<i>Salvelinus malma</i>	X	X			H
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>				H G	
Lake Trout	<i>Salvelinus namaycush</i>			R	H G	
Least Cisco	<i>Coregonus sardinella</i>				H	
Longnose Sucker	<i>Catostomus catostomus</i>				H	H
Ninespine Stickleback	<i>Pungitius pungitius</i>				H G	H
Northern Pike	<i>Esox lucius</i>				H	H
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>					
Pink Salmon	<i>Oncorhynchus gorbuscha</i>					
Pond Smelt	<i>Hypomesus olidus</i>				H	
Pygmy Whitefish	<i>Prosopium coulteri</i>				H	
Rainbow Trout	<i>Oncorhynchus mykiss</i>				H	H
Round Whitefish	<i>Prosopium cylindraceum</i>			R	H	H
Slimy Sculpin	<i>Cottus cognatus</i>			R	H	H
Sockeye Salmon	<i>Oncorhynchus nerka</i>		X	R	H	H
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>				H G	H

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Hammersly Lake	Half Cabin Lake	Hardscrabble Creek	Headwater Creek
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>	H			
Arctic Grayling	<i>Thymallus arcticus</i>		R		H
Arctic Lamprey	<i>Lampetra japonica</i>				H
Burbot	<i>Lota lota</i>				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>				H
Chum Salmon	<i>Oncorhynchus keta</i>				
Coastrange Sculpin	<i>Cottus aleuticus</i>				
Coho Salmon	<i>Oncorhynchus kisutch</i>			H	H
Dolly Varden	<i>Salvelinus malma</i>				
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>	H			
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>				
Ninespine Stickleback	<i>Pungitius pungitius</i>			H	H
Northern Pike	<i>Esox lucius</i>		R		
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbuscha</i>				H
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>	H			
Rainbow Trout	<i>Oncorhynchus mykiss</i>	H			H
Round Whitefish	<i>Prosopium cylindraceum</i>		R		H
Slimy Sculpin	<i>Cottus cognatus</i>	H			H
Sockeye Salmon	<i>Oncorhynchus nerka</i>	H	R	H	H
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>				H

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Hickerson Lake	Hidden Creek	Hoknede Lake	Hudson Lake	Idavain Creek
Alaska Blackfish	<i>Dallia pectoralis</i>					
Arctic Char	<i>Salvelinus alpinus</i>					
Arctic Grayling	<i>Thymallus arcticus</i>		H			
Arctic Lamprey	<i>Lampetra japonica</i>		H			
Burbot	<i>Lota lota</i>					
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>		H			
Chum Salmon	<i>Oncorhynchus keta</i>					
Coastrange Sculpin	<i>Cottus aleuticus</i>		H			
Coho Salmon	<i>Oncorhynchus kisutch</i>		H			
Dolly Varden	<i>Salvelinus malma</i>	R	H			
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>					
Lake Trout	<i>Salvelinus namaycush</i>				R	
Least Cisco	<i>Coregonus sardinella</i>			R		
Longnose Sucker	<i>Catostomus catostomus</i>					
Ninespine Stickleback	<i>Pungitius pungitius</i>		H	R	R	
Northern Pike	<i>Esox lucius</i>		H	R		
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>					
Pink Salmon	<i>Oncorhynchus gorbuscha</i>		H			
Pond Smelt	<i>Hypomesus olidus</i>					
Pygmy Whitefish	<i>Prosopium coulteri</i>					
Rainbow Trout	<i>Oncorhynchus mykiss</i>					
Round Whitefish	<i>Prosopium cylindraceum</i>		H		R	
Slimy Sculpin	<i>Cottus cognatus</i>		H	R	R	
Sockeye Salmon	<i>Oncorhynchus nerka</i>					H
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>		H			

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Idavain Lake	Iris Creek	James Lagoon River	Johnson River	Jojo Lake
Alaska Blackfish	<i>Dallia pectoralis</i>					X
Arctic Char	<i>Salvelinus alpinus</i>	X H G				
Arctic Grayling	<i>Thymallus arcticus</i>					
Arctic Lamprey	<i>Lampetra japonica</i>					
Burbot	<i>Lota lota</i>					
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>				R	
Chum Salmon	<i>Oncorhynchus keta</i>				R	
Coastrange Sculpin	<i>Cottus aleuticus</i>		X		R	
Coho Salmon	<i>Oncorhynchus kisutch</i>		X	X	R	
Dolly Varden	<i>Salvelinus malma</i>		X		R	
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>					
Lake Trout	<i>Salvelinus namaycush</i>					
Least Cisco	<i>Coregonus sardinella</i>					G
Longnose Sucker	<i>Catostomus catostomus</i>					
Ninespine Stickleback	<i>Pungitius pungitius</i>				R	X
Northern Pike	<i>Esox lucius</i>					X G
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>					
Pink Salmon	<i>Oncorhynchus gorbuscha</i>			X	R	
Pond Smelt	<i>Hypomesus olidus</i>					
Pygmy Whitefish	<i>Prosopium coulteri</i>					
Rainbow Trout	<i>Oncorhynchus mykiss</i>		X			
Round Whitefish	<i>Prosopium cylindraceum</i>					
Slimy Sculpin	<i>Cottus cognatus</i>	X H				X
Sockeye Salmon	<i>Oncorhynchus nerka</i>			X		X G
Starry Flounder	<i>Platichthys stellatus</i>		X			
Threepine Stickleback	<i>Gasterosteus aculeatus</i>		X	X	R	X

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Kaflia Bay Lake	Kaguyak Crater	Katmai River	Kijik Lake	Kijik River
Alaska Blackfish	<i>Dallia pectoralis</i>					
Arctic Char	<i>Salvelinus alpinus</i>				R	R
Arctic Grayling	<i>Thymallus arcticus</i>				R	R
Arctic Lamprey	<i>Lampetra japonica</i>					
Burbot	<i>Lota lota</i>					
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>					
Chum Salmon	<i>Oncorhynchus keta</i>					
Coastrange Sculpin	<i>Cottus aleuticus</i>	H				
Coho Salmon	<i>Oncorhynchus kisutch</i>	H				
Dolly Varden	<i>Salvelinus malma</i>		H			
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>					
Lake Trout	<i>Salvelinus namaycush</i>				R	
Least Cisco	<i>Coregonus sardinella</i>					
Longnose Sucker	<i>Catostomus catostomus</i>				R	
Ninespine Stickleback	<i>Pungitius pungitius</i>	H		H	R	
Northern Pike	<i>Esox lucius</i>					
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>			H		
Pink Salmon	<i>Oncorhynchus gorbuscha</i>			H		
Pond Smelt	<i>Hypomesus olidus</i>					
Pygmy Whitefish	<i>Prosopium coulteri</i>					
Rainbow Trout	<i>Oncorhynchus mykiss</i>					
Round Whitefish	<i>Prosopium cylindraceum</i>				R	R
Slimy Sculpin	<i>Cottus cognatus</i>				R	
Sockeye Salmon	<i>Oncorhynchus nerka</i>	H			R	R
Starry Flounder	<i>Platichthys stellatus</i>			H		
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	H		H		



Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	King Salmon River	Kontrashnibuna Lake	Kukaklek Lake	Kuliak Bay Creek
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>		R		
Arctic Grayling	<i>Thymallus arcticus</i>				
Arctic Lamprey	<i>Lampetra japonica</i>				
Burbot	<i>Lota lota</i>			X	
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>				
Chum Salmon	<i>Oncorhynchus keta</i>				
Coastrange Sculpin	<i>Cottus aleuticus</i>				
Coho Salmon	<i>Oncorhynchus kisutch</i>				
Dolly Varden	<i>Salvelinus malma</i>				H
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>		R		
Least Cisco	<i>Coregonus sardinella</i>	H			
Longnose Sucker	<i>Catostomus catostomus</i>				
Ninespine Stickleback	<i>Pungitius pungitius</i>			X	
Northern Pike	<i>Esox lucius</i>				
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbuscha</i>				H
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>		R		
Rainbow Trout	<i>Oncorhynchus mykiss</i>				
Round Whitefish	<i>Prosopium cylindraceum</i>			X	
Slimy Sculpin	<i>Cottus cognatus</i>		R	X	
Sockeye Salmon	<i>Oncorhynchus nerka</i>				H
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>			X	

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Lachbuna Lake	Lake Clark	Little Kijik River	Long Lake	Loon Lake
Alaska Blackfish	<i>Dallia pectoralis</i>					
Arctic Char	<i>Salvelinus alpinus</i>	R	R	R		
Arctic Grayling	<i>Thymallus arcticus</i>		R	R		R
Arctic Lamprey	<i>Lampetra japonica</i>					
Burbot	<i>Lota lota</i>		R			
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>		R			
Chum Salmon	<i>Oncorhynchus keta</i>					
Coastrange Sculpin	<i>Cottus aleuticus</i>		R			
Coho Salmon	<i>Oncorhynchus kisutch</i>					
Dolly Varden	<i>Salvelinus malma</i>		R			
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>		R		R	
Lake Trout	<i>Salvelinus namaycush</i>	R	R			
Least Cisco	<i>Coregonus sardinella</i>		R			
Longnose Sucker	<i>Catostomus catostomus</i>		R	R	R	
Ninespine Stickleback	<i>Pungitius pungitius</i>		R	R		
Northern Pike	<i>Esox lucius</i>		R		R	R
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>					
Pink Salmon	<i>Oncorhynchus gorbuscha</i>		R			
Pond Smelt	<i>Hypomesus olidus</i>					
Pygmy Whitefish	<i>Prosopium coulteri</i>		R			
Rainbow Trout	<i>Oncorhynchus mykiss</i>		R			
Round Whitefish	<i>Prosopium cylindraceum</i>		R	R		
Slimy Sculpin	<i>Cottus cognatus</i>	R	R	R	R	R
Sockeye Salmon	<i>Oncorhynchus nerka</i>		R	R		R
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>		R			

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Margot Creek	Martin Creek	Meshik Lake	Meshik River	Miller Creek
Alaska Blackfish	<i>Dallia pectoralis</i>				X	
Arctic Char	<i>Salvelinus alpinus</i>	H				
Arctic Grayling	<i>Thymallus arcticus</i>					R
Arctic Lamprey	<i>Lampetra japonica</i>					
Burbot	<i>Lota lota</i>					R
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>					
Chum Salmon	<i>Oncorhynchus keta</i>					
Coastrange Sculpin	<i>Cottus aleuticus</i>					
Coho Salmon	<i>Oncorhynchus kisutch</i>	H		X	X	
Dolly Varden	<i>Salvelinus malma</i>	G	H	X	X	R
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>					
Lake Trout	<i>Salvelinus namaycush</i>					
Least Cisco	<i>Coregonus sardinella</i>					
Longnose Sucker	<i>Catostomus catostomus</i>					
Ninespine Stickleback	<i>Pungitius pungitius</i>	H		X	X	
Northern Pike	<i>Esox lucius</i>					
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>					
Pink Salmon	<i>Oncorhynchus gorbuscha</i>					
Pond Smelt	<i>Hypomesus olidus</i>					
Pygmy Whitefish	<i>Prosopium coulteri</i>					
Rainbow Trout	<i>Oncorhynchus mykiss</i>	H				
Round Whitefish	<i>Prosopium cylindraceum</i>					
Slimy Sculpin	<i>Cottus cognatus</i>	H				R
Sockeye Salmon	<i>Oncorhynchus nerka</i>	H		X	X	
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	H		X	X	

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Mulchatna River	Muriel Lake	Murray Lake	Naknek Lake	Naknek River
Alaska Blackfish	<i>Dallia pectoralis</i>				H	
Arctic Char	<i>Salvelinus alpinus</i>	R			H	
Arctic Grayling	<i>Thymallus arcticus</i>	R			H	
Arctic Lamprey	<i>Lampetra japonica</i>	R			H	H
Burbot	<i>Lota lota</i>	R			H	
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	R			H G	H G
Chum Salmon	<i>Oncorhynchus keta</i>	R			H G	H G
Coastrange Sculpin	<i>Cottus aleuticus</i>				H	
Coho Salmon	<i>Oncorhynchus kisutch</i>	R			H G	H G
Dolly Varden	<i>Salvelinus malma</i>	R			H	
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>	R			H G	
Lake Trout	<i>Salvelinus namaycush</i>	R		H	H G	
Least Cisco	<i>Coregonus sardinella</i>	R			H G	
Longnose Sucker	<i>Catostomus catostomus</i>	R			H	
Ninespine Stickleback	<i>Pungitius pungitius</i>	R			H G	
Northern Pike	<i>Esox lucius</i>	R	G		H	
Pacific Cod	<i>Gadus macrocephalus</i>					G
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>					
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	R			H G	H G
Pond Smelt	<i>Hypomesus olidus</i>				H	
Pygmy Whitefish	<i>Prosopium coulteri</i>	R			H	
Rainbow Trout	<i>Oncorhynchus mykiss</i>	R			H G	G
Round Whitefish	<i>Prosopium cylindraceum</i>	R			H G	
Slimy Sculpin	<i>Cottus cognatus</i>	R			H	
Sockeye Salmon	<i>Oncorhynchus nerka</i>	R			H G	H G
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>				H G	

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Naknek River Lakes	Necons River	Nonvianuk Lake	North Aialik Lagoon
Alaska Blackfish	<i>Dallia pectoralis</i>	X			
Arctic Char	<i>Salvelinus alpinus</i>				
Arctic Grayling	<i>Thymallus arcticus</i>				
Arctic Lamprey	<i>Lampetra japonica</i>				
Burbot	<i>Lota lota</i>				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>				
Chum Salmon	<i>Oncorhynchus keta</i>				
Coastrange Sculpin	<i>Cottus aleuticus</i>			X	
Coho Salmon	<i>Oncorhynchus kisutch</i>				
Dolly Varden	<i>Salvelinus malma</i>				
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>				
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>				
Ninespine Stickleback	<i>Pungitius pungitius</i>			X	
Northern Pike	<i>Esox lucius</i>				
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				X
Pink Salmon	<i>Oncorhynchus gorbuscha</i>				
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>				
Round Whitefish	<i>Prosopium cylindraceum</i>			X	
Slimy Sculpin	<i>Cottus cognatus</i>			X	
Sockeye Salmon	<i>Oncorhynchus nerka</i>		R		X
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>			X	X

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Northwester Fjord River	Nuka River	One-Shot Creek	Otter Lake
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>				
Arctic Grayling	<i>Thymallus arcticus</i>				
Arctic Lamprey	<i>Lampetra japonica</i>			H	
Burbot	<i>Lota lota</i>				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>		X		
Chum Salmon	<i>Oncorhynchus keta</i>		X		
Coastrange Sculpin	<i>Cottus aleuticus</i>			H	
Coho Salmon	<i>Oncorhynchus kisutch</i>		X	H	
Dolly Varden	<i>Salvelinus malma</i>	X	X	H G	
Eulachon	<i>Thaleichthys pacificus</i>		X		
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>				
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>				R
Ninespine Stickleback	<i>Pungitius pungitius</i>				R
Northern Pike	<i>Esox lucius</i>				
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>		X		
Pink Salmon	<i>Oncorhynchus gorbuscha</i>		X	H	
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>				
Round Whitefish	<i>Prosopium cylindraceum</i>				
Slimy Sculpin	<i>Cottus cognatus</i>			H	
Sockeye Salmon	<i>Oncorhynchus nerka</i>		X		
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	X	X		

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Paguna Creek	Pederson Creek	Pickeral Lakes	Pike Lake	Portage Creek
Alaska Blackfish	<i>Dallia pectoralis</i>					
Arctic Char	<i>Salvelinus alpinus</i>					
Arctic Grayling	<i>Thymallus arcticus</i>			R		
Arctic Lamprey	<i>Lampetra japonica</i>					
Burbot	<i>Lota lota</i>					
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>					
Chum Salmon	<i>Oncorhynchus keta</i>					
Coastrange Sculpin	<i>Cottus aleuticus</i>					
Coho Salmon	<i>Oncorhynchus kisutch</i>					
Dolly Varden	<i>Salvelinus malma</i>					R
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>			R		
Lake Trout	<i>Salvelinus namaycush</i>					
Least Cisco	<i>Coregonus sardinella</i>			R		
Longnose Sucker	<i>Catostomus catostomus</i>					
Ninespine Stickleback	<i>Pungitius pungitius</i>					
Northern Pike	<i>Esox lucius</i>			R	G	
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>					
Pink Salmon	<i>Oncorhynchus gorbuscha</i>		X			
Pond Smelt	<i>Hypomesus olidus</i>					
Pygmy Whitefish	<i>Prosopium coulteri</i>					
Rainbow Trout	<i>Oncorhynchus mykiss</i>					
Round Whitefish	<i>Prosopium cylindraceum</i>			R		
Slimy Sculpin	<i>Cottus cognatus</i>			R		R
Sockeye Salmon	<i>Oncorhynchus nerka</i>		X	R		
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	X	X			

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Portage Lake	Quicksand Beach Lagoon	Resurrection River	Savonoski River
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>	R			
Arctic Grayling	<i>Thymallus arcticus</i>				
Arctic Lamprey	<i>Lampetra japonica</i>				
Burbot	<i>Lota lota</i>				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>				
Chum Salmon	<i>Oncorhynchus keta</i>				
Coastrange Sculpin	<i>Cottus aleuticus</i>		X		
Coho Salmon	<i>Oncorhynchus kisutch</i>		X	X	
Dolly Varden	<i>Salvelinus malma</i>			X	
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>	R			
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>				
Ninespine Stickleback	<i>Pungitius pungitius</i>				H
Northern Pike	<i>Esox lucius</i>				
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbuscha</i>		X		
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>				
Round Whitefish	<i>Prosopium cylindraceum</i>				
Slimy Sculpin	<i>Cottus cognatus</i>	R			
Sockeye Salmon	<i>Oncorhynchus nerka</i>		X	X	
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>				



Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Shelter Cove Lake	Snipe Lake	Split Glacier Creek	Surprise Lake
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>		R		
Arctic Grayling	<i>Thymallus arcticus</i>		R		
Arctic Lamprey	<i>Lampetra japonica</i>				
Burbot	<i>Lota lota</i>		R		
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>		R		
Chum Salmon	<i>Oncorhynchus keta</i>				
Coastrange Sculpin	<i>Cottus aleuticus</i>				
Coho Salmon	<i>Oncorhynchus kisutch</i>		R		
Dolly Varden	<i>Salvelinus malma</i>		R	X	X
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>		R		
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>				
Ninespine Stickleback	<i>Pungitius pungitius</i>				
Northern Pike	<i>Esox lucius</i>				
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbuscha</i>				
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>				
Round Whitefish	<i>Prosopium cylindraceum</i>		R		
Slimy Sculpin	<i>Cottus cognatus</i>		R		
Sockeye Salmon	<i>Oncorhynchus nerka</i>	X			X
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	X			

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Swikshak River	Takayato Creek	Tanalian River	Tazimina Lake
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>				R
Arctic Grayling	<i>Thymallus arcticus</i>			R	R
Arctic Lamprey	<i>Lampetra japonica</i>				
Burbot	<i>Lota lota</i>			R	
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>		H		
Chum Salmon	<i>Oncorhynchus keta</i>				
Coastrange Sculpin	<i>Cottus aleuticus</i>				
Coho Salmon	<i>Oncorhynchus kisutch</i>				
Dolly Varden	<i>Salvelinus malma</i>			R	R
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>				
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>				
Ninespine Stickleback	<i>Pungitius pungitius</i>		H		
Northern Pike	<i>Esox lucius</i>				
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	H			
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>				
Round Whitefish	<i>Prosopium cylindraceum</i>			R	
Slimy Sculpin	<i>Cottus cognatus</i>		H		R
Sockeye Salmon	<i>Oncorhynchus nerka</i>	H		R	
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>				X

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Tazimina River	Telaquana Lake	Telaquana River	Tlikakila River
Alaska Blackfish	<i>Dallia pectoralis</i>				
Arctic Char	<i>Salvelinus alpinus</i>	R	R		
Arctic Grayling	<i>Thymallus arcticus</i>	R	R	R	
Arctic Lamprey	<i>Lampetra japonica</i>				
Burbot	<i>Lota lota</i>				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>				
Chum Salmon	<i>Oncorhynchus keta</i>		R		
Coastrange Sculpin	<i>Cottus aleuticus</i>				
Coho Salmon	<i>Oncorhynchus kisutch</i>				
Dolly Varden	<i>Salvelinus malma</i>		R		
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>		R		
Least Cisco	<i>Coregonus sardinella</i>		R		
Longnose Sucker	<i>Catostomus catostomus</i>	R	R		
Ninespine Stickleback	<i>Pungitius pungitius</i>		R		
Northern Pike	<i>Esox lucius</i>		R		
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbuscha</i>				
Pond Smelt	<i>Hypomesus olidus</i>				
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>	R			
Round Whitefish	<i>Prosopium cylindraceum</i>	R	R		
Slimy Sculpin	<i>Cottus cognatus</i>	R	R	R	
Sockeye Salmon	<i>Oncorhynchus nerka</i>	R	R	R	R
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	X			

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

<b>Common Name</b>	<b>Genus Species</b>	Turquoise Lake	Twin Lakes	Two Lakes	Ukak River	Up-a-Tree Creek
Alaska Blackfish	<i>Dallia pectoralis</i>					
Arctic Char	<i>Salvelinus alpinus</i>	R	R	R		
Arctic Grayling	<i>Thymallus arcticus</i>	R	R			
Arctic Lamprey	<i>Lampetra japonica</i>	R				H
Burbot	<i>Lota lota</i>	R	R			
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>					
Chum Salmon	<i>Oncorhynchus keta</i>					
Coastrange Sculpin	<i>Cottus aleuticus</i>				H	
Coho Salmon	<i>Oncorhynchus kisutch</i>					
Dolly Varden	<i>Salvelinus malma</i>	R	R	R		H
Eulachon	<i>Thaleichthys pacificus</i>					
Humpback Whitefish	<i>Coregonus pidschian</i>					
Lake Trout	<i>Salvelinus namaycush</i>	R	R	R		
Least Cisco	<i>Coregonus sardinella</i>					
Longnose Sucker	<i>Catostomus catostomus</i>		R	R	H	
Ninespine Stickleback	<i>Pungitius pungitius</i>			R		
Northern Pike	<i>Esox lucius</i>			R		
Pacific Cod	<i>Gadus macrocephalus</i>					
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>					
Pink Salmon	<i>Oncorhynchus gorbuscha</i>					H
Pond Smelt	<i>Hypomesus olidus</i>					
Pygmy Whitefish	<i>Prosopium coulteri</i>		R	R		
Rainbow Trout	<i>Oncorhynchus mykiss</i>					
Round Whitefish	<i>Prosopium cylindraceum</i>	R	R	R		
Slimy Sculpin	<i>Cottus cognatus</i>	R	R	R	H	
Sockeye Salmon	<i>Oncorhynchus nerka</i>		R	R		
Starry Flounder	<i>Platichthys stellatus</i>					
Threepine Stickleback	<i>Gasterosteus aculeatus</i>					

Appendix 1 (continued). Locations of all fish occurrences by species in all locations throughout the NPS SWAN network. Identifying Sources: X = Recent I&M freshwater fishes inventory program (Miller 2003, Miller and Markis 2004, Miller et.al 2005, Jones et. al 2005), R = Russell (1980), H = Heard (1969), G = Greenbank (1954).

Common Name	Genus Species	Upper Margot Valley Lakes	Verdant Lagoon	West Creek	Willow Creek
Alaska Blackfish	<i>Dallia pectoralis</i>			H	
Arctic Char	<i>Salvelinus alpinus</i>				
Arctic Grayling	<i>Thymallus arcticus</i>			H	
Arctic Lamprey	<i>Lampetra japonica</i>			H	
Burbot	<i>Lota lota</i>				
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>				
Chum Salmon	<i>Oncorhynchus keta</i>				
Coastrange Sculpin	<i>Cottus aleuticus</i>			H	X
Coho Salmon	<i>Oncorhynchus kisutch</i>			H	
Dolly Varden	<i>Salvelinus malma</i>				X
Eulachon	<i>Thaleichthys pacificus</i>				
Humpback Whitefish	<i>Coregonus pidschian</i>				
Lake Trout	<i>Salvelinus namaycush</i>				
Least Cisco	<i>Coregonus sardinella</i>				
Longnose Sucker	<i>Catostomus catostomus</i>				
Ninespine Stickleback	<i>Pungitius pungitius</i>	X		H	
Northern Pike	<i>Esox lucius</i>			H	
Pacific Cod	<i>Gadus macrocephalus</i>				
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>				
Pink Salmon	<i>Oncorhynchus gorbuscha</i>				
Pond Smelt	<i>Hypomesus olidus</i>			H	
Pygmy Whitefish	<i>Prosopium coulteri</i>				
Rainbow Trout	<i>Oncorhynchus mykiss</i>	X		H	
Round Whitefish	<i>Prosopium cylindraceum</i>			H	
Slimy Sculpin	<i>Cottus cognatus</i>			H	
Sockeye Salmon	<i>Oncorhynchus nerka</i>				
Starry Flounder	<i>Platichthys stellatus</i>				
Threepine Stickleback	<i>Gasterosteus aculeatus</i>	X	X	H	X

Appendix 2. Species list of Alaska fishes potentially found within SWAN park unit boundaries (AKNHP 2000, Mecklenberg et. al 2002). ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve. X - potentially present. \* - indicates marine fishes potentially found in tidepools (% for estuaries) on park unit coastal boundaries. Shading indicates species identified in inventory surveys. ? - New species identified after Heard (1969) inventory, Mecklenberg et. al (2002) claims Heard found this species

Common name	Species	Who Described	Year Described	ALAG	ANIA	KATM	KEFJ	LACL
Alaska Blackfish	<i>Dallia pectoralis</i>	Bean	1880	X	X	X		X
American Shad	<i>Alosa sapidissima</i>	Wilson	1811			X	X	
Arctic char	<i>Salvelinus alpinus</i>	Linnaeus	1758	X	X	X	X	X
Arctic grayling	<i>Thymallus arcticus</i>	Pallas	1776	X	X	X	X	X
Arctic Lamprey	<i>Lampetra camtschatica</i>	Tilesius	1811	X	X	X	X	X
Black prickleback*	<i>Xiphister atropurpureus</i>	Kittlitz	1858				X	
Brook Lamprey	<i>Lampetra alaskense</i>	Vladykov & Kott	1978			X ?		
Buffalo sculpin*	<i>Enophrys bison</i>	Girard	1854			X	X	X
Burbot	<i>Lota lota</i>	Linnaeus	1758	X	X	X	X	X
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	Walbaum	1792	X	X	X	X	X
Chum Salmon	<i>Oncorhynchus keta</i>	Walbaum	1792	X	X	X	X	X
Coastrange sculpin	<i>Cottus aleuticus</i>	Gilbert	1896	X	X	X	X	X
Coho Salmon	<i>Oncorhynchus kisutch</i>	Walbaum	1792	X	X	X	X	X
Crescent gunnel*	<i>Pholis laeta</i>	Cope	1873		X	X	X	X
Cutthroat trout	<i>Oncorhynchus clarkii</i>	Richardson	1836				X	
Dolly Varden	<i>Salvelinus malma</i>	Walbaum	1792	X	X	X	X	X
Eulachon	<i>Thaleichthys pacificus</i>	Richardson	1836	X	X	X	X	X
Graveldiver*	<i>Scytalina cerdale</i>	Jordan & Gilbert	1880		X	X	X	X
High cockscomb*	<i>Anoplarchus purpureus</i>	Gill	1861		X	X	X	X
Humpback whitefish	<i>Coregonus pidschian</i>	Gmelin	1789	X		X		X
Lake trout	<i>Salvelinus namaycush</i>	Walbaum	1792	X	X	X	X	X
Least cisco	<i>Coregonus sardinella</i>	Valenciennes	1848	X		X		X
Lesser prickleback*	<i>Alectridium aurantiacum</i>	Gilbert & Burke	1912		X	X	X	X
Longfin smelt	<i>Spirinchus thaleichthys</i>	Ayers	1860					X

Appendix 2 (continued). Species list of Alaska fishes potentially found within SWAN park unit boundaries (Mecklenberg et. al 2002). ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve. X - potentially present. \* - indicates marine fishes potentially found in tidepools (% for estuaries) on park unit coastal boundaries. Shading indicates species identified in inventory surveys. ? - New species identified after Heard (1969) inventory, Mecklenberg et. al (2002) claims Heard found this species

Common name	Species	Who Described	Year Described	ALAG	ANIA	KATM	KEFJ	LACL
Longnose sucker	<i>Catostomus catostomus</i>	Forster	1773	X	X	X	X	X
Manacled sculpin*	<i>Synchirus gilli</i>	Bean	1890			X	X	X
Mosshead warbonnet*	<i>Chirlophis nugator</i>	Jordan & Williams	1895		X	X	X	X
Ninespine stickleback	<i>Pungitius Pungitius</i>	Linnaeus	1758	X	X	X	X	X
Northern pike	<i>Esox lucius</i>	Linnaeus	1758	X	X	X		X
Pacific herring %	<i>Clupea pallasii</i>	Valenciennes	1847		X	X	X	
Pacific Lamprey	<i>Lampetra tridentata</i>	Richardson	1836	X	X	X	X	X
Pacific sand lance*	<i>Ammodytes hexapterus</i>	Pallas	1814		X	X	X	X
Pacific sandfish*	<i>Trichodon trichodon</i>	Tilesius	1813		X	X	X	X
Pacific staghorn sculpin	<i>Leptocottus armatus</i>	Girard	1854		X	X	X	X
Padded sculpin*	<i>Artedius fenestralis</i>	Jordan & Gilbert	1883		X	X	X	X
Penpoint gunnel*	<i>Apodichthys flavidus</i>	Girard	1854				X	
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	Walbaum	1792	X	X	X	X	X
Plain sculpin*	<i>Myoxocephalus joak</i>	Cuvier	1829		X	X	X	X
Pond Smelt	<i>Hypomesus olidus</i>	Pallas	1814	X	X	X	X	X
Prickly sculpin	<i>Cottus asper</i>	Richardson	1836		X		X	
Pygmy whitefish	<i>Prosopium coulterii</i>	Eigenmann & Eigenmann	1892		X	X		X
Rainbow smelt	<i>Osmerus mordax</i>	Mitchill	1814	X	X	X	X	X
Rainbow trout	<i>Oncorhynchus mykiss</i>	Walbaum	1792	X	X	X	X	X
Ribbon prickleback*	<i>Phytichthys chirus</i>	Jordan & Gilbert	1880		X	X	X	X
Ribbon snailfish*	<i>Liparis cyclopus</i>	Günther	1861		X	X	X	X
Round whitefish	<i>Prosopium cylindraceum</i>	Pallas	1784	X	X	X	X	X
Sailfin sculpin*	<i>Nautichtys oculofasciatus</i>	Girard	1858			X	X	X
Scalyhead sculpin*	<i>Artedius harringtoni</i>	Starks	1896				X	X

Appendix 2 (continued). Species list of Alaska fishes potentially found within SWAN park unit boundaries (Mecklenberg et. al 2002). ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve. X - potentially present. \* - indicates marine fishes potentially found in tidepools (% for estuaries) on park unit coastal boundaries. Shading indicates species identified in inventory surveys. ? - New species identified after Heard (1969) inventory, Mecklenberg et. al (2002) claims Heard found this species

Common name	Species	Who Described	Year Described	ALAG	ANIA	KATM	KEFJ	LACL
Sharpnose sculpin*	<i>Clinocottus acuticeps</i>	Gilbert	1896		X	X	X	X
Slender cockscomb*	<i>Anoplarchus insignis</i>	Gilbert & Burke	1912		X	X	X	X
Slender eelblenny*	<i>Lumpenus fabricii</i>	Reinhardt	1836		X	X	X	X
Slimy sculpin	<i>Cottus cognatus</i>	Richardson	1836	X	X	X	X	X
Slipskin snailfish*	<i>Liparis fucensis</i>	Gilbert	1896		X	X	X	X
Smallmouth ronquill*	<i>Bathymaster leurolepis</i>	McPhail	1965		X	X	X	
Smoothhead sculpin*	<i>Artedius lateralis</i>	Girard	1854		X	X	X	X
Sockeye Salmon	<i>Oncorhynchus nerka</i>	Walbaum	1792	X	X	X	X	X
Spotted snailfish*	<i>Liparis callyodon</i>	Pallas	1814		X	X	X	X
Starry flounder	<i>Platichthys stellatus</i>	Pallas	1787		X	X	X	X
Surf Smelt	<i>Hypomesus pretiosus</i>	Girard	1855					X
Threespine stickleback	<i>Gasterosteus aculeatus</i>	Linnaeus	1758	X	X	X	X	X
Tidepool sculpin*	<i>Oligocottus maculosus</i>	Girard	1856		X	X	X	X
Tidepool snailfish*	<i>Liparis florum</i>	Jordan & Starks	1895				X	
Tubenose poacher*	<i>Pallasina barbata</i>	Steindachner	1876		X	X	X	X
White Sturgeon	<i>Acipenser transmontanus</i>	Richardson	1836				X	



Appendix 3. Expected freshwater fish species list based on Mecklenberg et al. (2002) and the Alaska Natural Heritage Program (2000). ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve. A - AKNHP expected species, M - Mecklenberg expected species. Shading indicates species presence confirmed in Swan park boundaries. \* relative to expected species

Common name	Species	ALAG		ANIA		KATM		KEFJ		LACL	
		A	M	A	M	A	M	A	M	A	M
Alaska Blackfish	<i>Dallia pectoralis</i>	X	X	X		X	X				X
American Shad	<i>Alosa sapidissima</i>						X		X		
Arctic char	<i>Salvelinus alpinus</i>		X		X	X	X		X	X	X
Arctic grayling	<i>Thymallus arcticus</i>	X	X	X	X	X	X		X	X	X
Arctic Lamprey	<i>Lampetra camtschatica</i>	X	X	X	X	X	X		X	X	X
Brook Lamprey	<i>Lampetra alaskense</i>						X				
Burbot	<i>Lota lota</i>	X	X		X	X	X	X	X	X	X
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	X	X	X	X	X	X	X	X	X	X
Chum Salmon	<i>Oncorhynchus keta</i>	X	X	X	X	X	X	X	X	X	X
Coastrange sculpin	<i>Cottus aleuticus</i>	X	X		X	X	X	X	X	X	X
Coho Salmon	<i>Oncorhynchus kisutch</i>	X	X	X	X	X	X	X	X	X	X
Cutthroat trout	<i>Oncorhynchus clarkii</i>								X		
Dolly Varden	<i>Salvelinus malma</i>	X	X	X	X	X	X	X	X	X	X
Eulachon	<i>Thaleichthys pacificus</i>		X	X	X		X	X	X	X	X
Humpback whitefish	<i>Coregonus pidschian</i>	X	X			X	X			X	X
Lake trout	<i>Salvelinus namaycush</i>	X	X		X	X	X		X	X	X
Least cisco	<i>Coregonus sardinella</i>	X	X			X	X			X	X
Longfin Smelt	<i>Spirinchus thaleichthys</i>										X
Longnose sucker	<i>Catostomus catostomus</i>	X	X	X	X	X	X	X	X	X	X
Ninespine stickleback	<i>Pungitius Pungitius</i>	X	X	X	X	X	X		X	X	X
Northern Pike	<i>Esox lucius</i>	X	X		X	X	X			X	X
Pacific Lamprey	<i>Lampetra tridentata</i>		X	X	X		X	X	X	X	X
Pacific staghorn sculpin	<i>Leptocottus armatus</i>	X			X		X		X		X
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	X	X	X	X	X	X	X	X	X	X
Pond Smelt	<i>Hypomesus olidus</i>	X	X		X	X	X		X		X
Prickly Sculpin	<i>Cottus asper</i>			X					X		
Pygmy whitefish	<i>Prosopium coulterii</i>	X			X	X	X				X
Rainbow smelt	<i>Osmerus mordax</i>		X		X	X	X		X		X
Rainbow trout	<i>Oncorhynchus mykiss</i>	X	X		X	X	X	X	X	X	X
Round whitefish	<i>Prosopium cylindraceum</i>	X	X	X	X	X	X	X	X	X	X
Slimy sculpin	<i>Cottus cognatus</i>	X	X		X	X	X	X	X	X	X
Sockeye Salmon	<i>Oncorhynchus nerka</i>	X	X	X	X	X	X	X	X	X	X
Starry flounder	<i>Platichthys stellatus</i>				X		X		X		X
Surf Smelt	<i>Hypomesus pretiosus</i>										X
Threespine stickleback	<i>Gasterosteus aculeatus</i>	X	X	X	X	X	X	X	X	X	X
White Sturgeon	<i>Acipenser transmontanus</i>								X		
Total Expected Species		24	26	16	26	25	31	16	27	26	28
Total Confirmed Species*		16	16	9	12	24	27	13	13	25	21
Success Rate (%)		67	62	56	46	96	87	81	48	96	75

Appendix 4. Success rates of SWAN fish inventory surveys in SWAN park units. ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve.

\*expected but not confirmed freshwater fish species targeted by current inventory research. † - compiled using Mecklenberg et al. (2002) and AKNHP (2000). SWAN regional success rate based on AKNHP (2000) species predicted and found.

Total number of potential fish species in the entire SWAN region	64	<table border="1"> <thead> <tr> <th colspan="2">Overall SWAN Success Rate*</th> </tr> </thead> <tbody> <tr> <td>Predicted Species --</td> <td>33</td> </tr> <tr> <td>Confirmed Species --</td> <td>28</td> </tr> <tr> <td>Success rate ---</td> <td>84.8%</td> </tr> </tbody> </table>					Overall SWAN Success Rate*		Predicted Species --	33	Confirmed Species --	28	Success rate ---	84.8%
Overall SWAN Success Rate*														
Predicted Species --	33													
Confirmed Species --	28													
Success rate ---	84.8%													
Total number of targeted* freshwater fish species	19													
Total number of potential tidepool species in the entire SWAN region	28													
Total number of freshwater fish species in the entire SWAN region	36													
Total number of fish species found within the SWAN fish species inventory process	31													
Total number of targeted* fish species confirmed within the entire SWAN region	17													
Percentage of fish species identified within the SWAN fish species inventory process relative to the total potential number of fish species in the entire SWAN region	48.4													
Percentage of fish species identified within the SWAN fish species inventory process relative to the total potential number of freshwater fish species in the entire SWAN region	86.1													
Percentage of targeted* fish species confirmed within the SWAN inventory process relative to the total potential number of targeted freshwater fish species in the entire SWAN region	89.5													
		<b>ALAG</b>	<b>ANIA</b>	<b>KATM</b>	<b>KEFJ</b>	<b>LACL</b>								
Number of all potential species in each park unit†	28	49	55	56	54									
Number of target* species in each park unit	15	9	1	4	1									
Number of species identified in current inventory effort	7	11	27	10	22									
Number of target*species identified in current inventory effort	4	2	0	1	0									
Percent of species identified in each unit relative to all potential fishes	25.0	22.4	49.1	17.9	40.7									
Percent of target* species identified in each unit relative to targeted* fishes	26.7	22.2	0.0	25.0	0.0									
Number of potential freshwater fish species in each park unit	28	28	31	28	31									
Number of AKNHP (2000) predicted freshwater species in each park	24	16	25	16	26									
Number of AKNHP (2000) predicted freshwater species identified in each park	16	9	24	13	25									
Number of freshwater fish species identified in current inventory effort	7	11	27	10	22									
Percent of freshwater fish species identified in each unit relative to all potential freshwater fishes	25.0	39.3	87.1	35.7	71.0									
Number of potential species in each park unit minus salmon & tidepool species	21	23	26	23	25									
Number of species identified in current inventory effort minus salmon & tidepool fishes	7	8	22	5	17									
Percent of species identified in each unit relative to potential fishes minus salmon & tidepool species	33.3	34.8	84.6	21.7	68.0									
Percent of target* species with confirmed presence in each SWAN unit relative to all AKNMH (2000) predicted fish species within each park unit	66.7	56.3	96.0	81.3	96.2									

Appendix 5. Species location relative to elevation throughout all SWAN lakes (excludes rivers).

<b>Elevation (m)</b>	<b>Elevation (ft)</b>	<i>Dallia pectoralis</i>	<i>Salvelinus alpinus</i>	<i>Thymallus arcticus</i>	<i>Lampetra camtschatica</i>	<i>Lota lota</i>	<i>Oncorhynchus tshawytscha</i>
761.1	2497.0		X	X	X	X	
618.7	2030.0		X	X			
603.5	1980.0		X	X		X	
559.9	1837.0		X	X		X	X
520.0	1706.0		X	X		X	
498.0	1634.0						
487.4	1599.0		X				
444.1	1457.0		X				
405.1	1329.0		X				
374.0	1227.0		X	X			
365.2	1198.0			X			
355.1	1165.0			X			
353.9	1161.0						
352.0	1155.0						
342.9	1125.0		X				
321.0	1053.0						
249.9	820.0					X	
223.1	732.0		X				
193.9	636.0						
192.3	631.0		X	X			
189.9	623.0						
182.3	598.0						
181.1	594.0		X				X
180.4	592.0						
138.1	453.0		X				
130.5	428.0						
113.1	371.0						
110.0	361.0		X	X			
104.5	343.0						
96.0	315.0						
84.1	276.0			X			
78.0	256.0						
77.1	253.0		X	X		X	X
51.8	170.0						
36.0	118.0						
32.6	107.0	X	X		X	X	
31.1	102.0	X	X		X		
26.2	86.0						
26.2	86.0	X					
25.3	83.0						
18.9	62.0	X	X	X	X		X
11.9	39.0						
11.0	36.0	X					
10.4	34.0	X	X	X	X	X	X
9.1	30.0						
6.1	20.0						
4.0	13.0						
4.0	13.0						
4.0	13.0						
3.0	10.0						
2.4	8.0						
1.5	5.0						

<b>Elevation (m)</b>	<b>Elevation (ft)</b>	<i>Oncorhynchus keta</i>	<i>Cottus aleuticus</i>	<i>Oncorhynchus kisutch</i>	<i>Salvelinus malma</i>	<i>Thaleichthys pacificus</i>
761.1	2497.0				X	
618.7	2030.0					
603.5	1980.0				X	
559.9	1837.0			X	X	
520.0	1706.0			X		
498.0	1634.0					
487.4	1599.0					
444.1	1457.0					
405.1	1329.0					
374.0	1227.0	X			X	
365.2	1198.0					
355.1	1165.0					
353.9	1161.0				X	
352.0	1155.0				X	
342.9	1125.0				X	
321.0	1053.0				X	
249.9	820.0					
223.1	732.0					
193.9	636.0		X			
192.3	631.0				X	
189.9	623.0				X	
182.3	598.0					
181.1	594.0		X		X	
180.4	592.0		X	X		
138.1	453.0					
130.5	428.0					
113.1	371.0					
110.0	361.0					
104.5	343.0					
96.0	315.0					
84.1	276.0					
78.0	256.0		X		X	
77.1	253.0		X		X	
51.8	170.0					
36.0	118.0			X	X	
32.6	107.0		X	X	X	
31.1	102.0			X		
26.2	86.0			X	X	
26.2	86.0					
25.3	83.0					
18.9	62.0	X	X	X	X	
11.9	39.0		X		X	
11.0	36.0					
10.4	34.0	X	X	X	X	
9.1	30.0		X	X	X	
6.1	20.0		X	X		
4.0	13.0		X	X		
4.0	13.0					
4.0	13.0					
3.0	10.0					
2.4	8.0					
1.5	5.0					

<b>Elevation (m)</b>	<b>Elevation (ft)</b>	<i>Coregonus pidschian</i>	<i>Salvelinus namaycush</i>	<i>Coregonus sardinella</i>	<i>Catostomus catostomus</i>	<i>Pungitius pungitius</i>	<i>Esox lucius</i>
761.1	2497.0		X				
618.7	2030.0						
603.5	1980.0		X		X		
559.9	1837.0		X				
520.0	1706.0		X				
498.0	1634.0		X				
487.4	1599.0		X				
444.1	1457.0		X				
405.1	1329.0		X				
374.0	1227.0		X	X	X	X	X
365.2	1198.0						X
355.1	1165.0						X
353.9	1161.0						
352.0	1155.0		X				
342.9	1125.0		X		X	X	X
321.0	1053.0						
249.9	820.0					X	
223.1	732.0					X	
193.9	636.0					X	
192.3	631.0						
189.9	623.0						
182.3	598.0					X	
181.1	594.0		X				
180.4	592.0			X		X	
138.1	453.0		X				
130.5	428.0			X		X	X
113.1	371.0				X	X	
110.0	361.0		X		X	X	
104.5	343.0		X			X	
96.0	315.0	X			X		X
84.1	276.0	X		X			X
78.0	256.0						
77.1	253.0	X	X	X	X	X	X
51.8	170.0						X
36.0	118.0					X	
32.6	107.0	X	X	X	X	X	X
31.1	102.0	X	X	X	X	X	X
26.2	86.0						
26.2	86.0						
25.3	83.0						X
18.9	62.0		X			X	X
11.9	39.0						
11.0	36.0			X		X	X
10.4	34.0	X	X	X	X	X	X
9.1	30.0						
6.1	20.0					X	
4.0	13.0						
4.0	13.0						
4.0	13.0						
3.0	10.0						
2.4	8.0						
1.5	5.0						

Appendix 5. Species location relative to elevation throughout all SWAN lakes (excludes rivers).

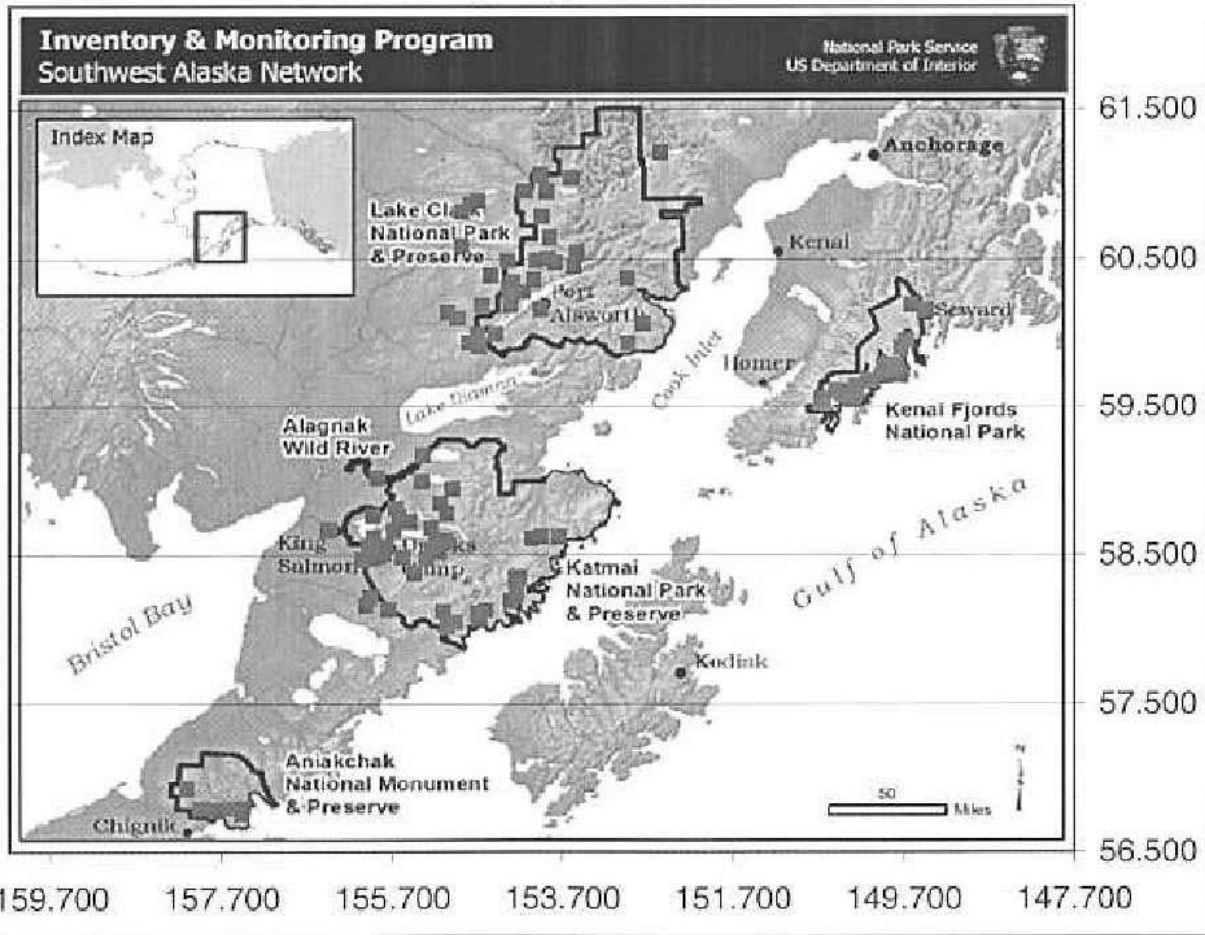
<b>Elevation (m)</b>	<b>Elevation (ft)</b>	<i>Gadus macrocephalus</i>	<i>Leptocottus armatus</i>	<i>Oncorhynchus gorbuscha</i>	<i>Hypomesus olidus</i>	<i>Prosopium coulterii</i>
761.1	2497.0					
618.7	2030.0					
603.5	1980.0					X
559.9	1837.0					
520.0	1706.0					
498.0	1634.0					
487.4	1599.0					X
444.1	1457.0					
405.1	1329.0					
374.0	1227.0					
365.2	1198.0					
355.1	1165.0					
353.9	1161.0					
352.0	1155.0					
342.9	1125.0					X
321.0	1053.0					
249.9	820.0					
223.1	732.0					
193.9	636.0					
192.3	631.0					
189.9	623.0					
182.3	598.0					
181.1	594.0					
180.4	592.0					
138.1	453.0					X
130.5	428.0					
113.1	371.0					
110.0	361.0					
104.5	343.0					
96.0	315.0					
84.1	276.0					
78.0	256.0					
77.1	253.0			X		X
51.8	170.0					
36.0	118.0					
32.6	107.0				X	X
31.1	102.0				X	X
26.2	86.0					
26.2	86.0					
25.3	83.0					
18.9	62.0			X		X
11.9	39.0			X		
11.0	36.0					
10.4	34.0			X	X	X
9.1	30.0		X			
6.1	20.0					
4.0	13.0			X		
4.0	13.0			X		
4.0	13.0					
3.0	10.0		X			
2.4	8.0					
1.5	5.0					

<b>Elevation (m)</b>	<b>Elevation (ft)</b>	<i>Oncorhynchus mykiss</i>	<i>Prosopium cylindraceum</i>	<i>Cottus cognatus</i>	<i>Oncorhynchus nerka</i>	<i>Platichthys stellatus</i>
761.1	2497.0		X	X		
618.7	2030.0			X		
603.5	1980.0		X	X	X	
559.9	1837.0		X	X		
520.0	1706.0		X	X	X	
498.0	1634.0					
487.4	1599.0	X		X	X	
444.1	1457.0			X		
405.1	1329.0			X		
374.0	1227.0		X	X	X	
365.2	1198.0			X	X	
355.1	1165.0		X		X	
353.9	1161.0					
352.0	1155.0		X	X	X	
342.9	1125.0		X	X	X	
321.0	1053.0				X	
249.9	820.0		X	X		
223.1	732.0			X		
193.9	636.0		X	X		
192.3	631.0			X		
189.9	623.0					
182.3	598.0	X				
181.1	594.0				X	
180.4	592.0		X		X	
138.1	453.0			X		
130.5	428.0			X		
113.1	371.0					
110.0	361.0		X	X	X	
104.5	343.0		X	X		
96.0	315.0			X		
84.1	276.0		X	X	X	
78.0	256.0				X	
77.1	253.0	X	X	X	X	
51.8	170.0					
36.0	118.0				X	
32.6	107.0	X	X	X	X	
31.1	102.0	X	X	X	X	
26.2	86.0					
26.2	86.0					
25.3	83.0					
18.9	62.0	X	X	X	X	
11.9	39.0				X	
11.0	36.0			X	X	
10.4	34.0	X	X	X	X	
9.1	30.0				X	
6.1	20.0				X	
4.0	13.0				X	
4.0	13.0				X	
4.0	13.0					
3.0	10.0				X	
2.4	8.0				X	
1.5	5.0				X	

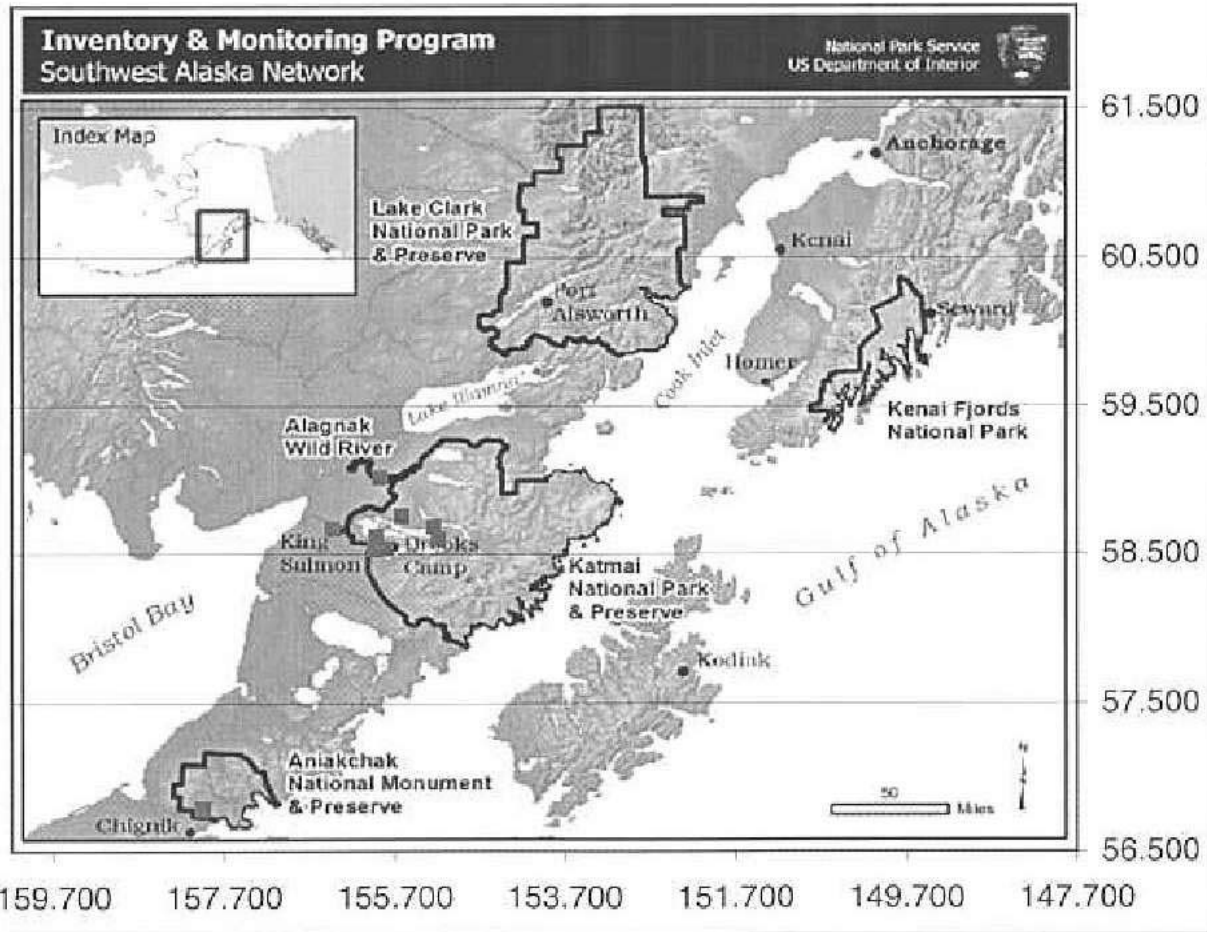
<b>Elevation (m)</b>	<b>Elevation (ft)</b>	<i>Gasterosteus aculeatus</i>
761.1	2497.0	
618.7	2030.0	
603.5	1980.0	
559.9	1837.0	
520.0	1706.0	
498.0	1634.0	
487.4	1599.0	
444.1	1457.0	
405.1	1329.0	
374.0	1227.0	
365.2	1198.0	
355.1	1165.0	
353.9	1161.0	
352.0	1155.0	
342.9	1125.0	
321.0	1053.0	
249.9	820.0	X
223.1	732.0	
193.9	636.0	X
192.3	631.0	X
189.9	623.0	
182.3	598.0	X
181.1	594.0	X
180.4	592.0	
138.1	453.0	
130.5	428.0	
113.1	371.0	
110.0	361.0	
104.5	343.0	
96.0	315.0	
84.1	276.0	
78.0	256.0	
77.1	253.0	X
51.8	170.0	
36.0	118.0	X
32.6	107.0	X
31.1	102.0	X
26.2	86.0	X
26.2	86.0	
25.3	83.0	
18.9	62.0	X
11.9	39.0	
11.0	36.0	X
10.4	34.0	X
9.1	30.0	X
6.1	20.0	X
4.0	13.0	
4.0	13.0	X
4.0	13.0	X
3.0	10.0	X
2.4	8.0	X
1.5	5.0	X



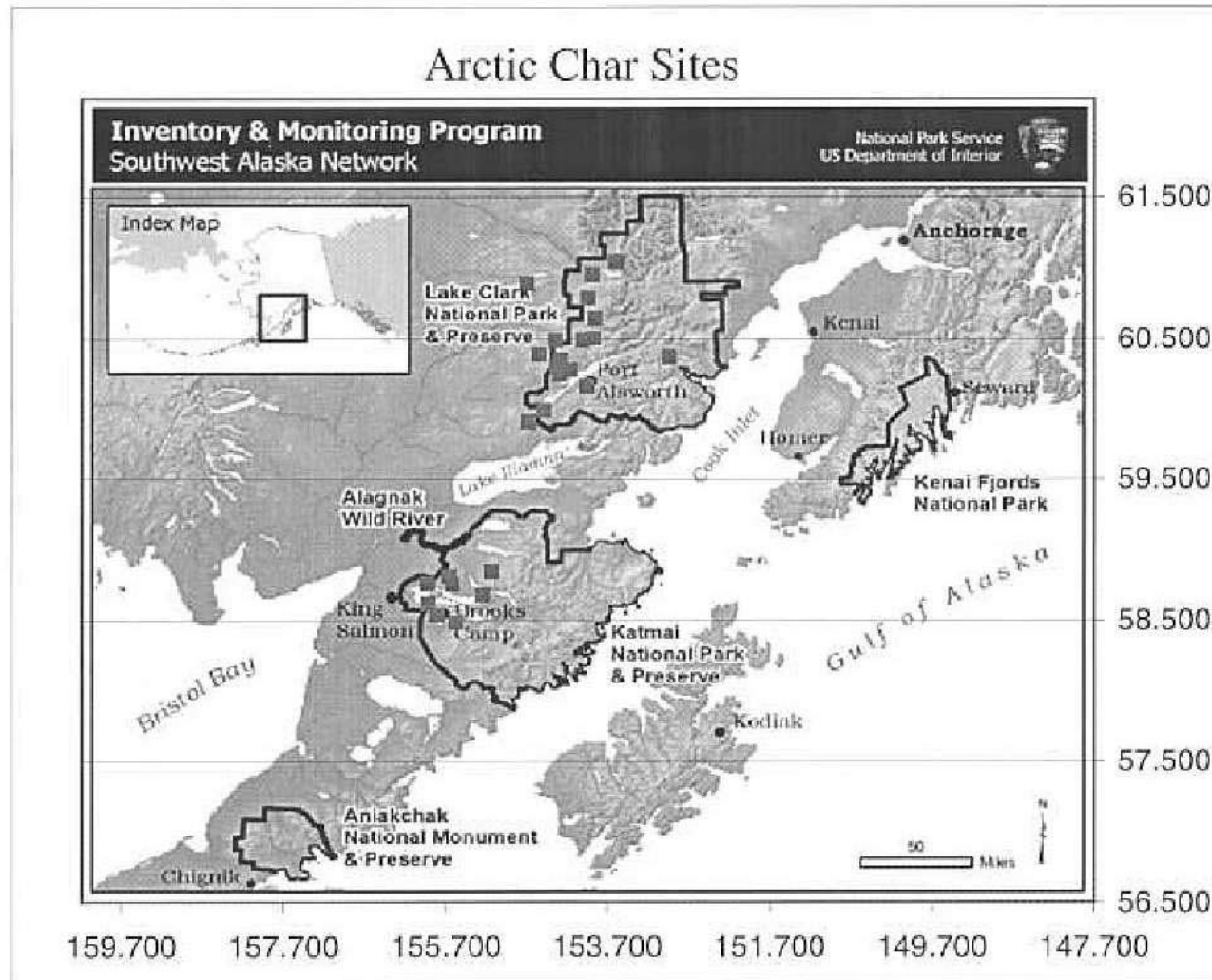
# Sampling Sites



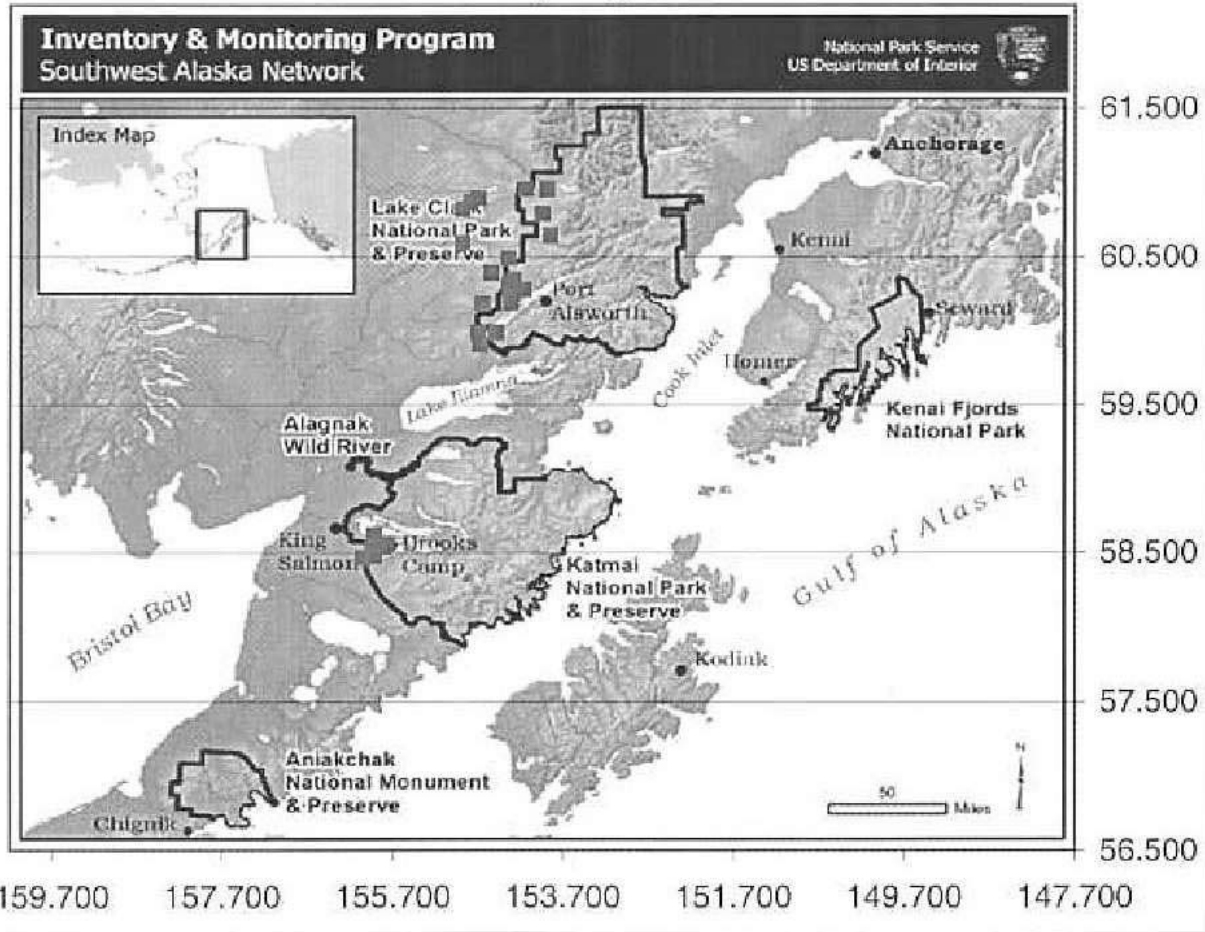
# Alaska Blackfish Sites



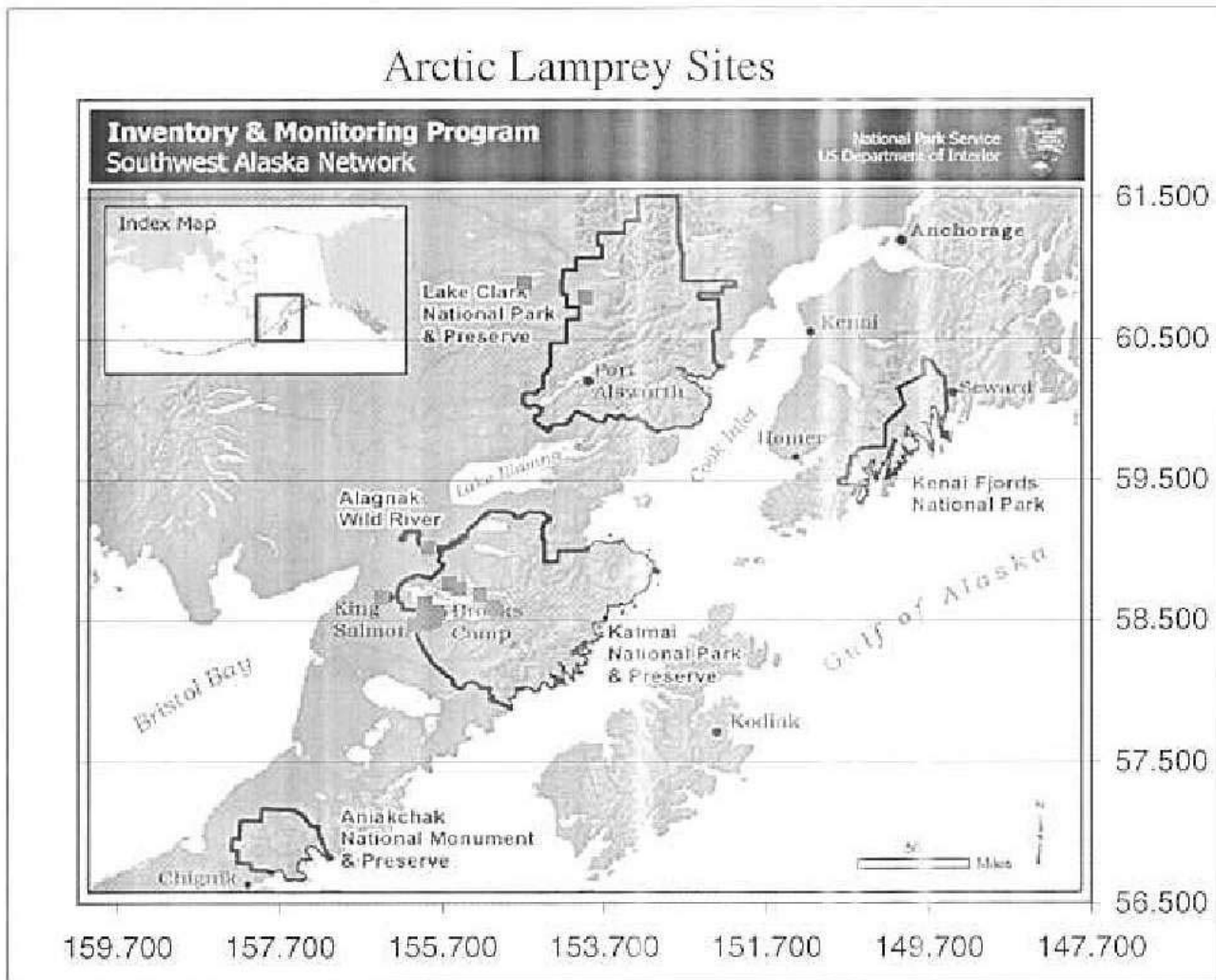
# Arctic Char Sites



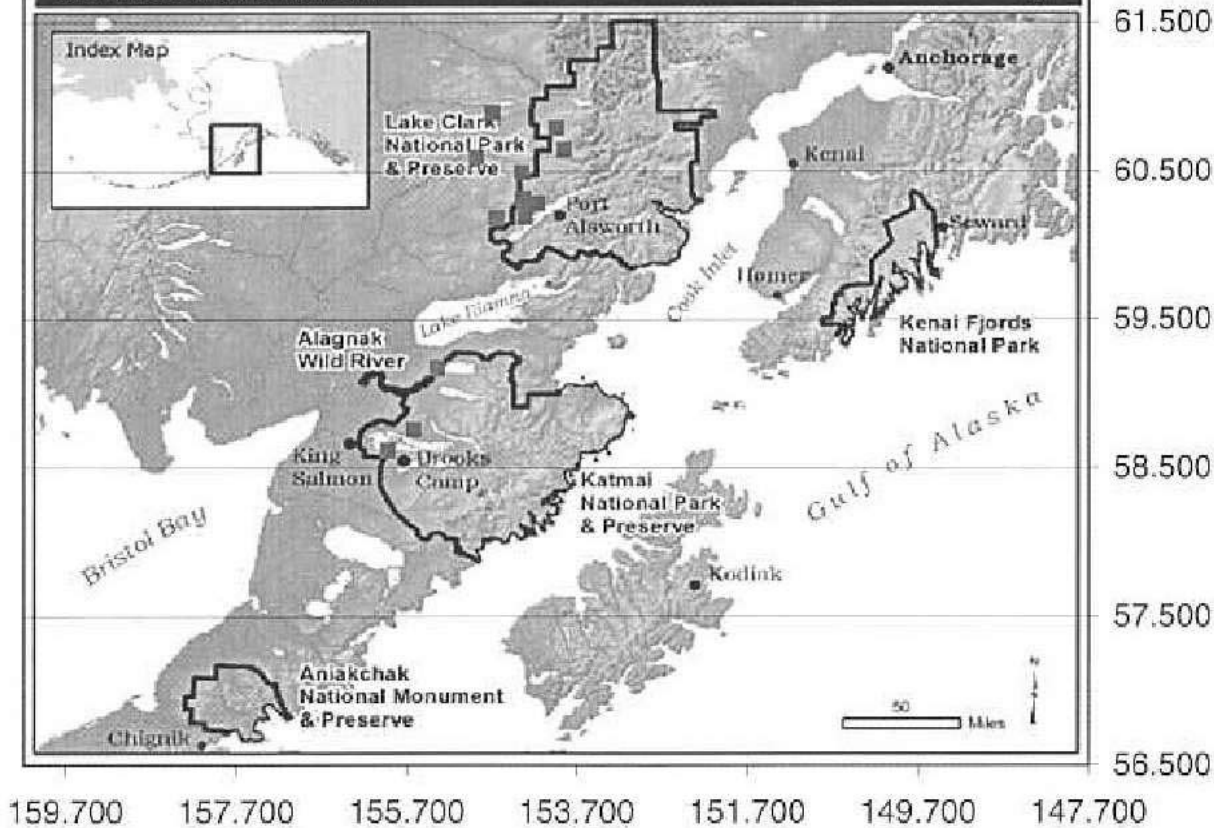
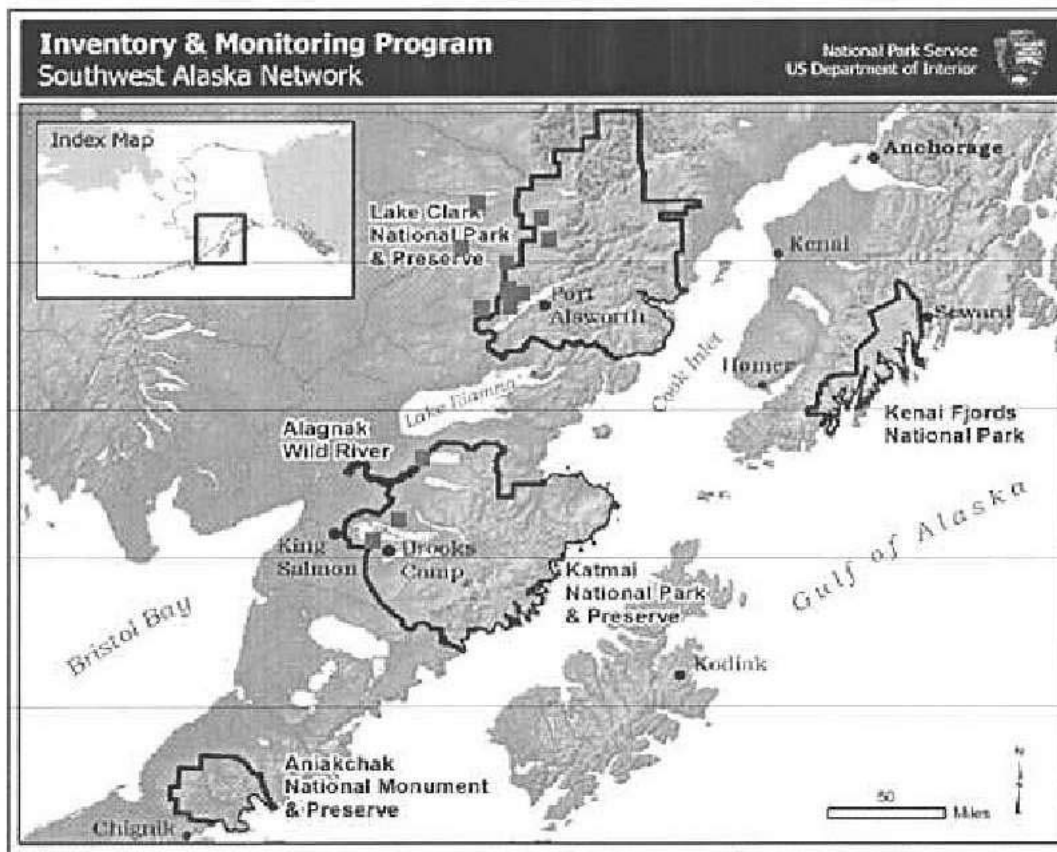
# Arctic Grayling Sites



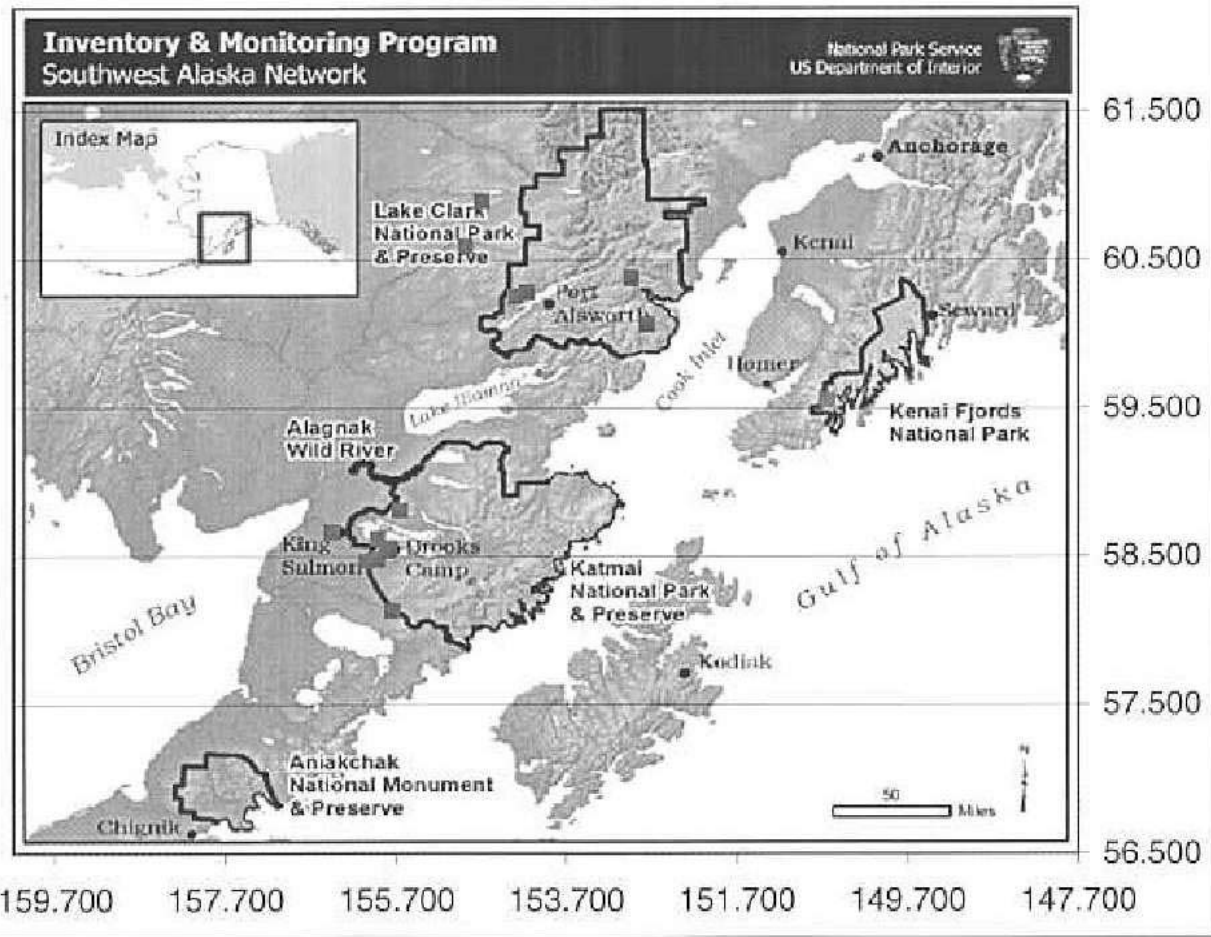
# Arctic Lamprey Sites



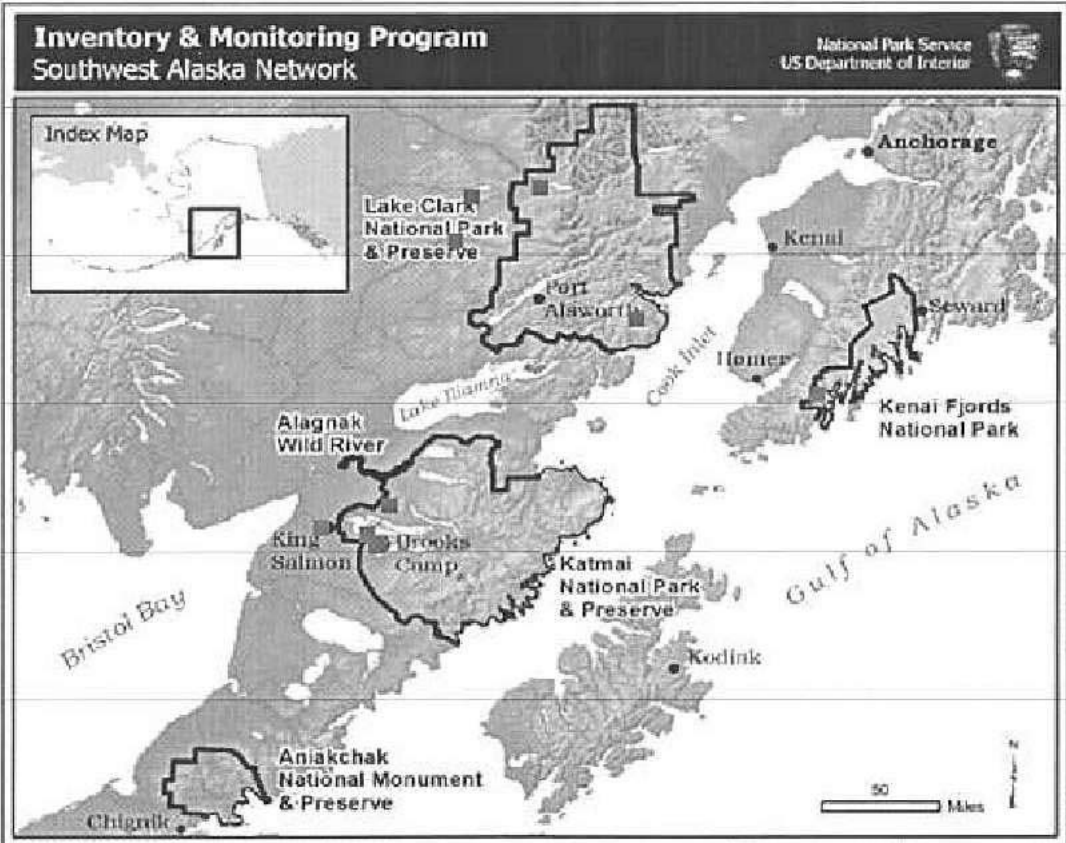
# Lota Iota Sites



# Chinook Sites

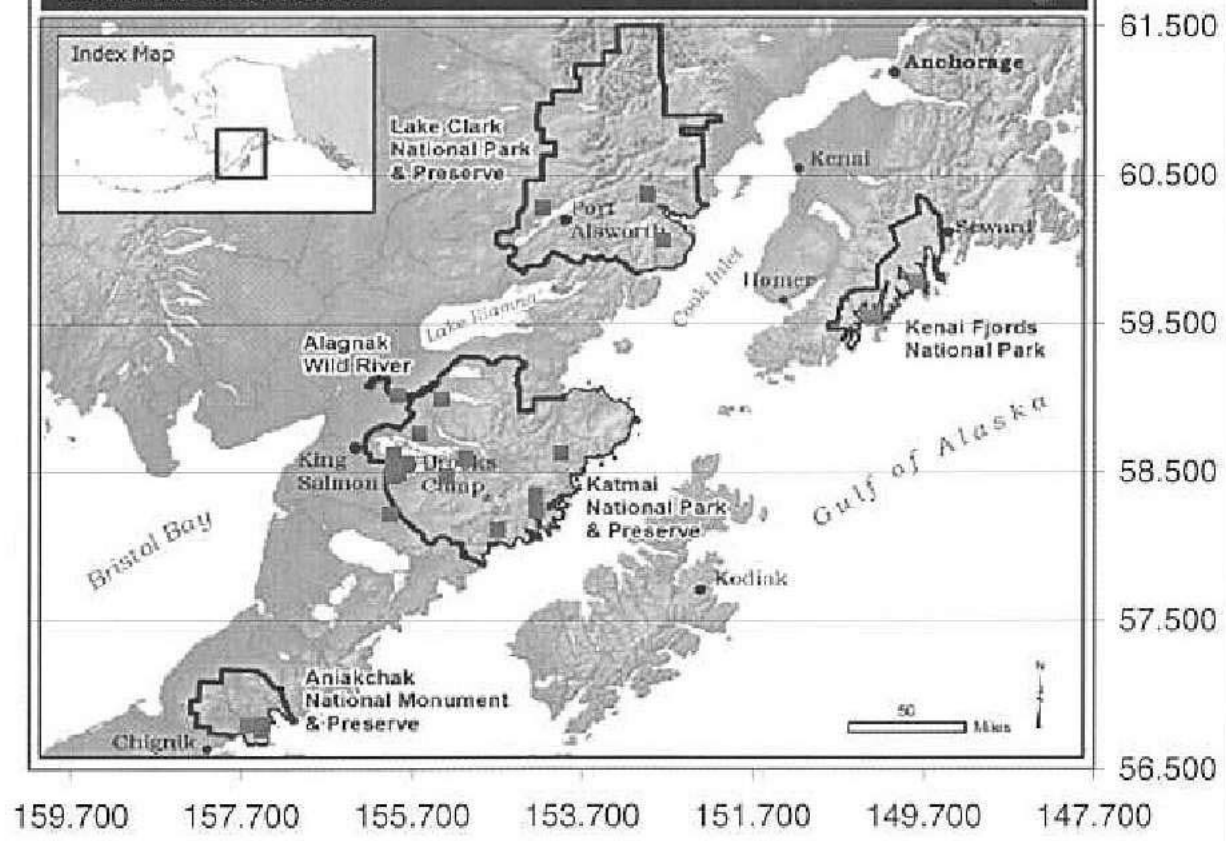
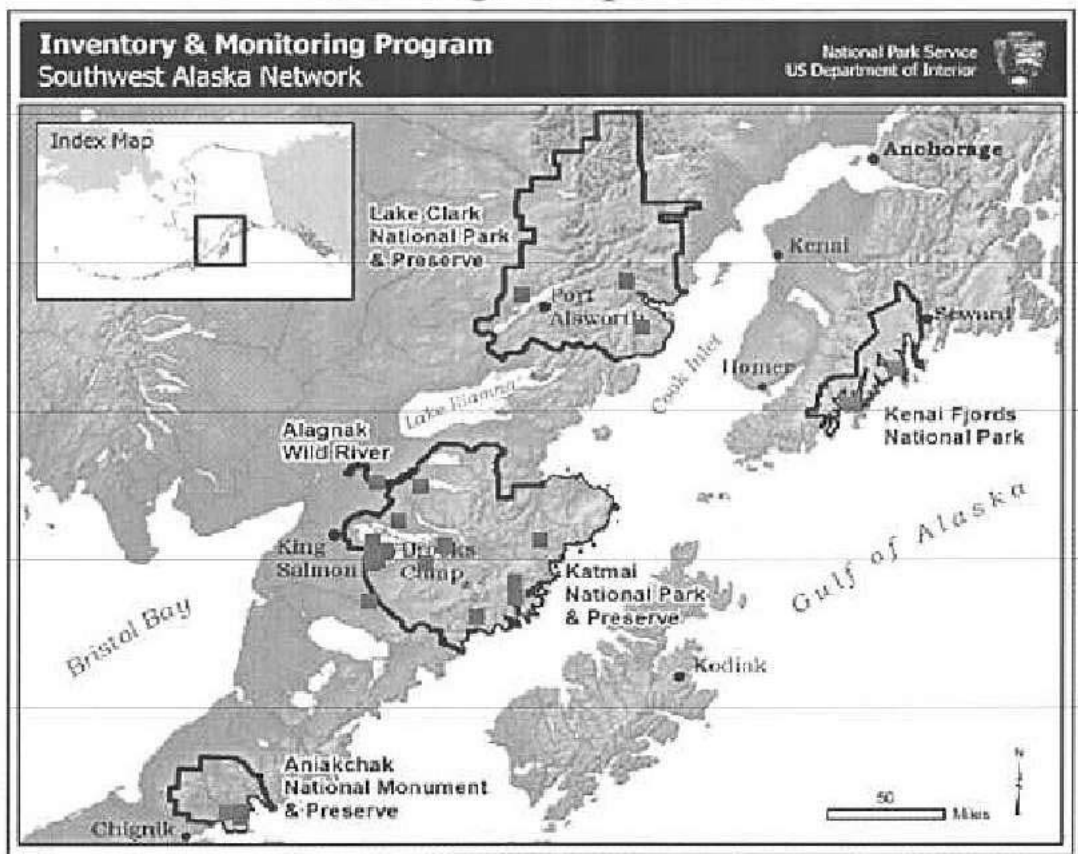


# Chum Sites

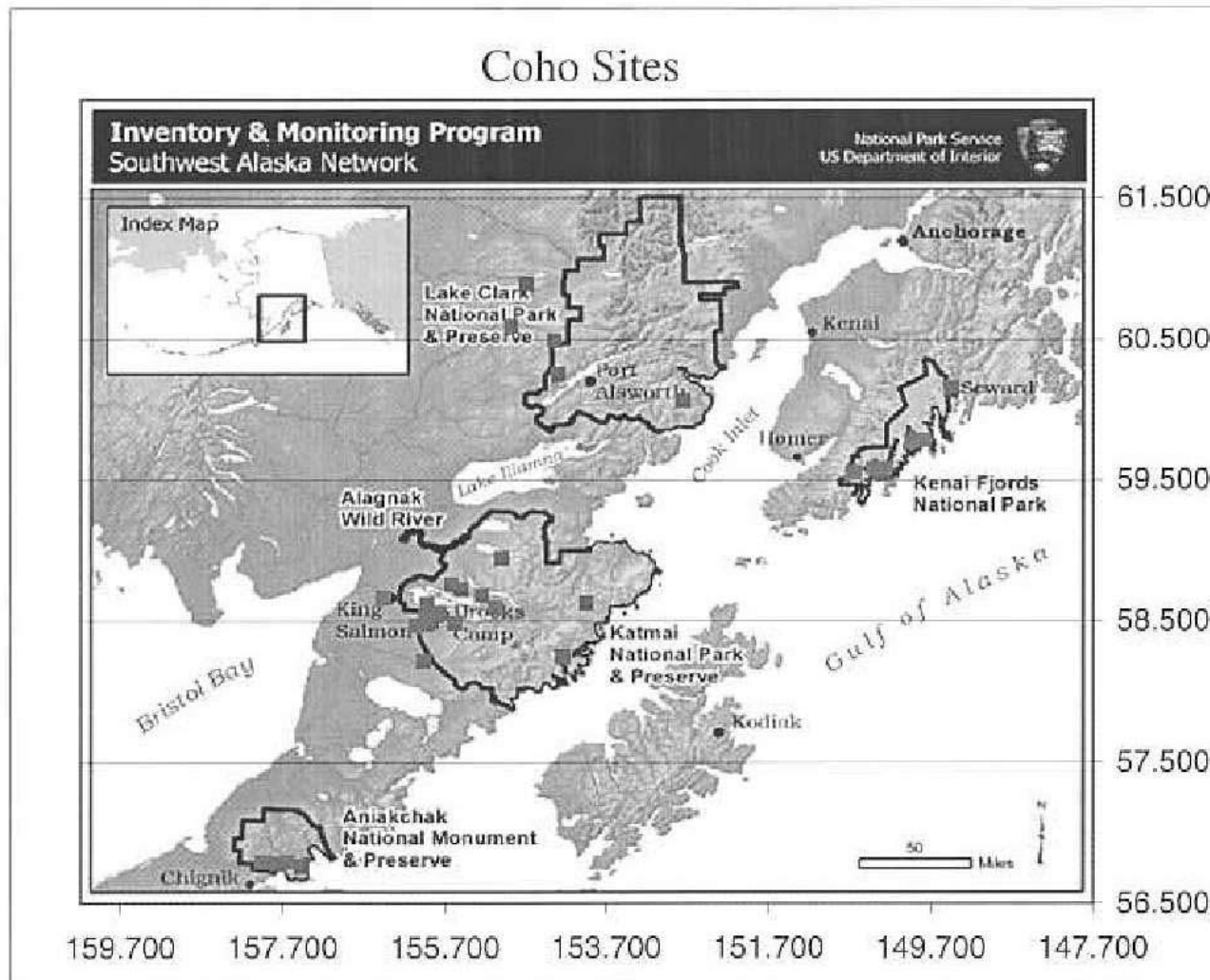




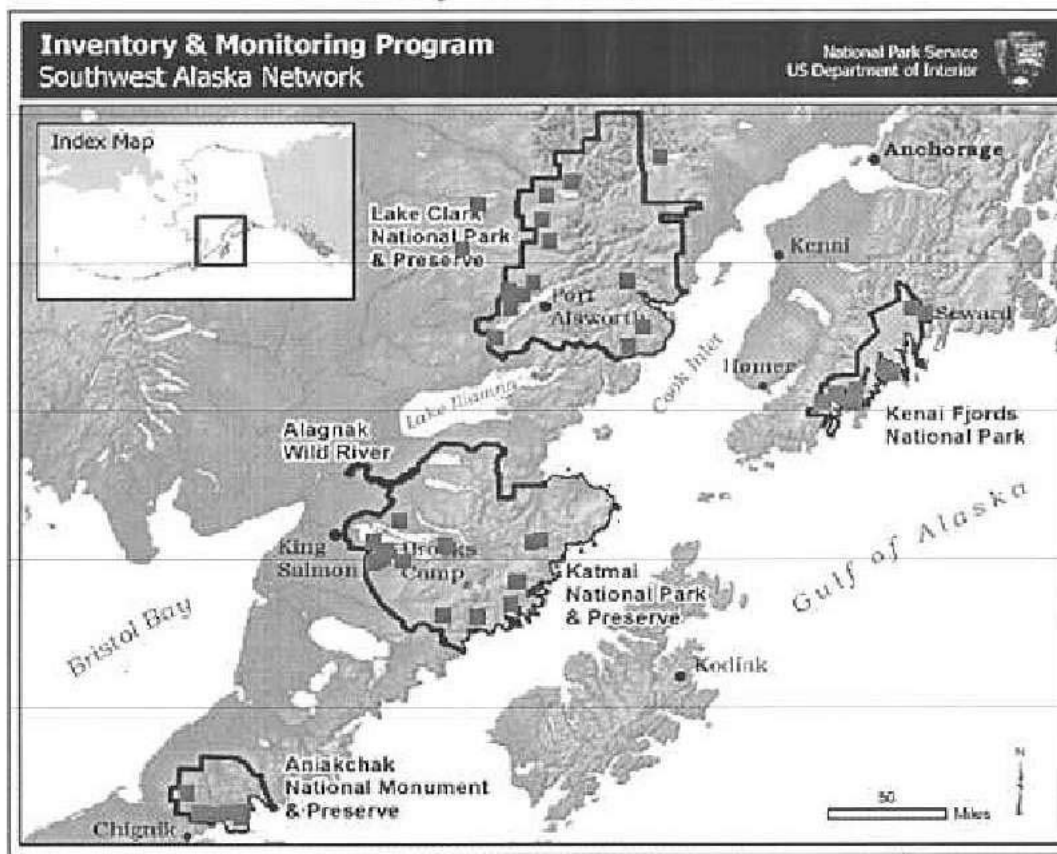
# Coastrange sculpin Sites



# Coho Sites

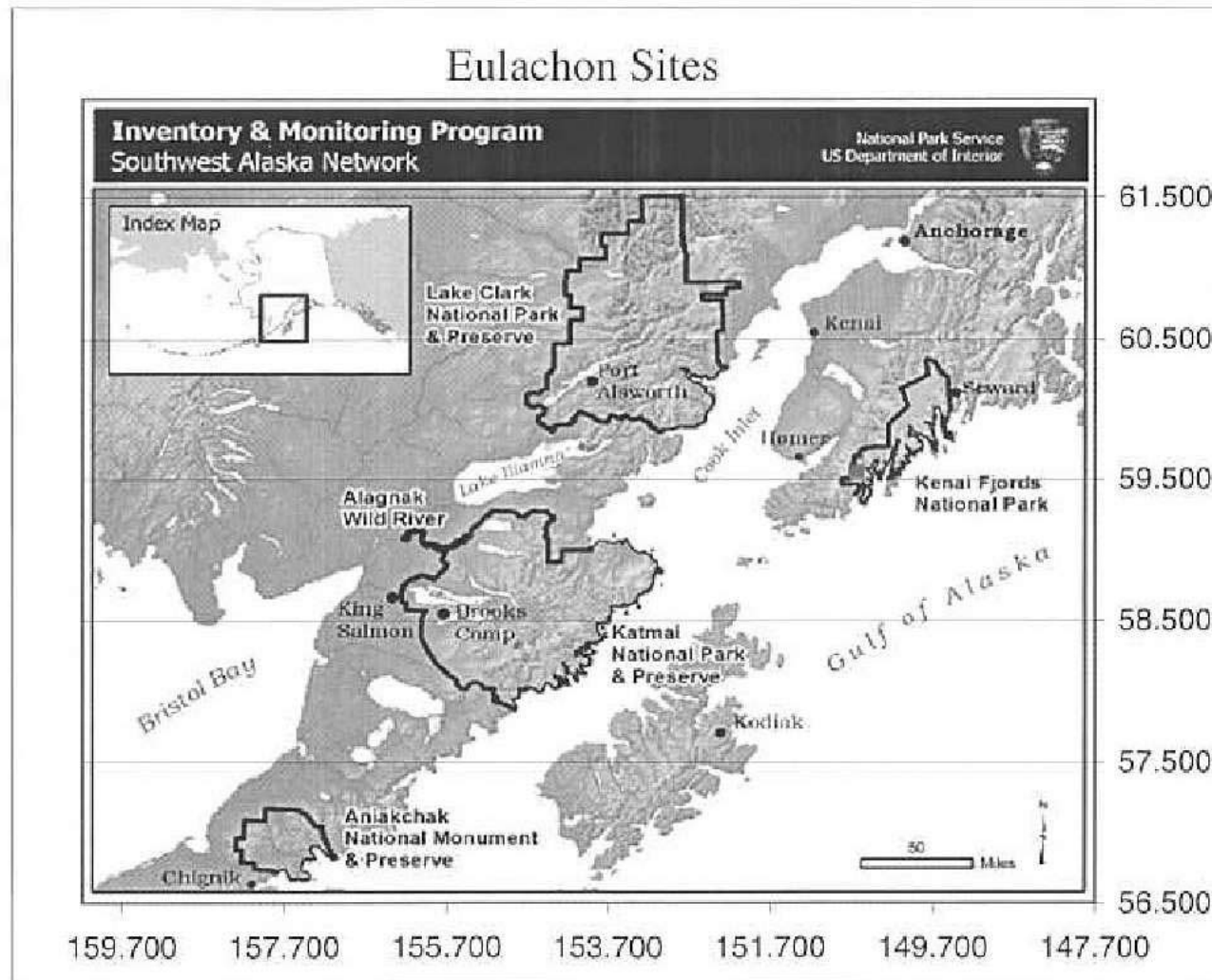


# Dolly Varden Sites

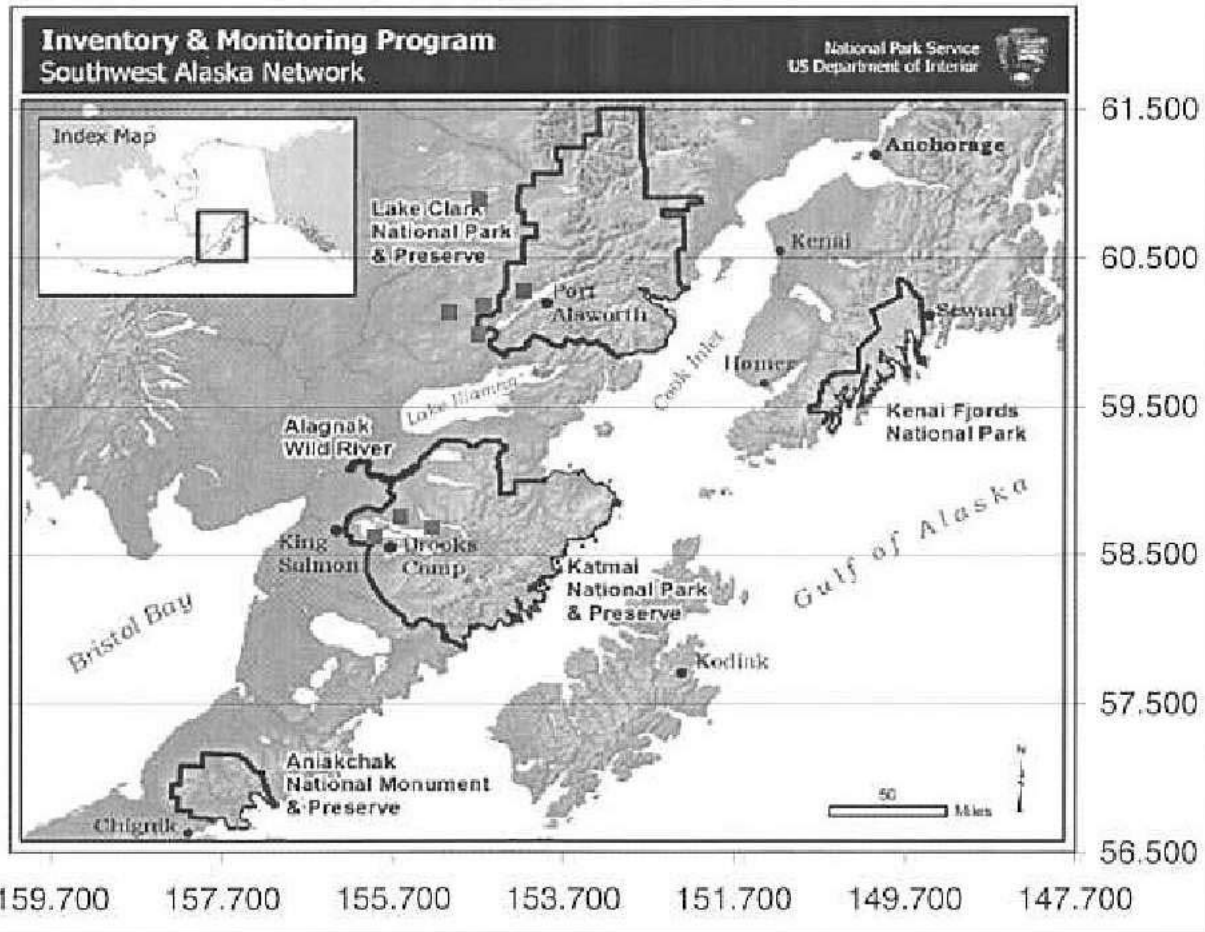


159.700 157.700 155.700 153.700 151.700 149.700 147.700

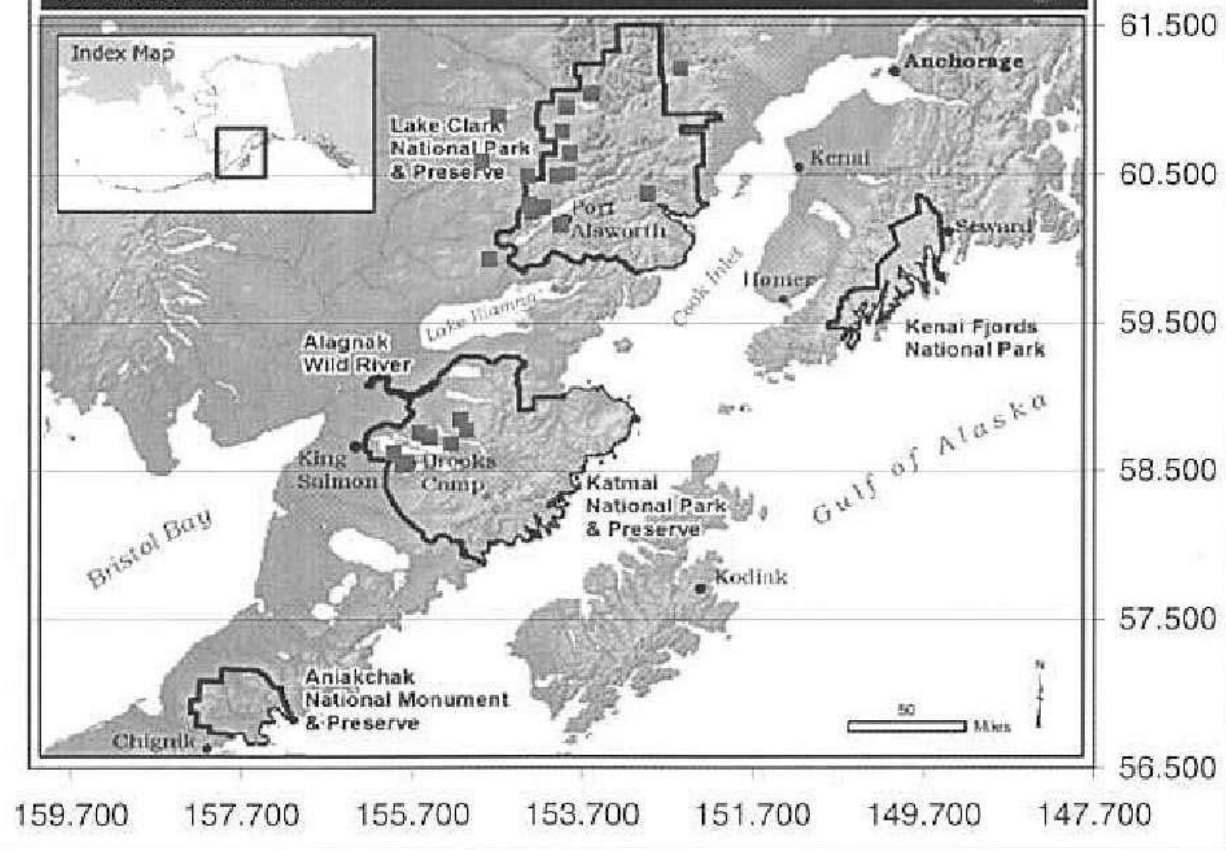
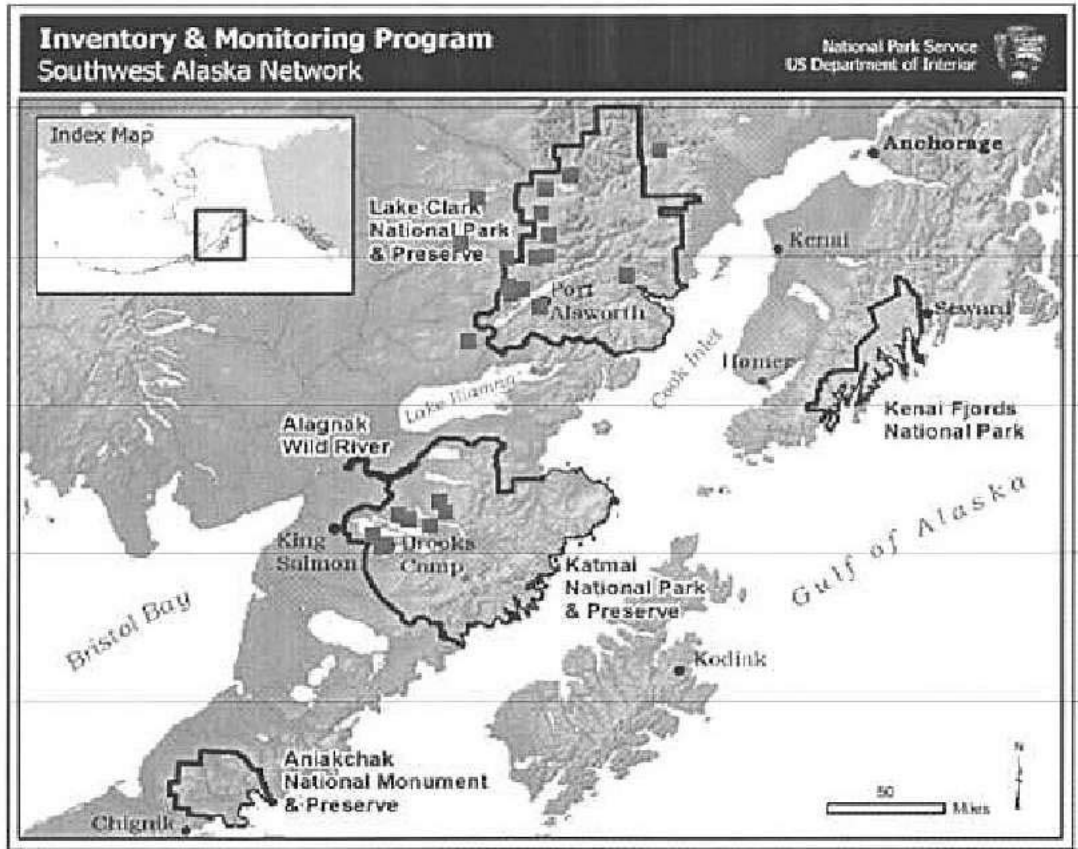
# Eulachon Sites



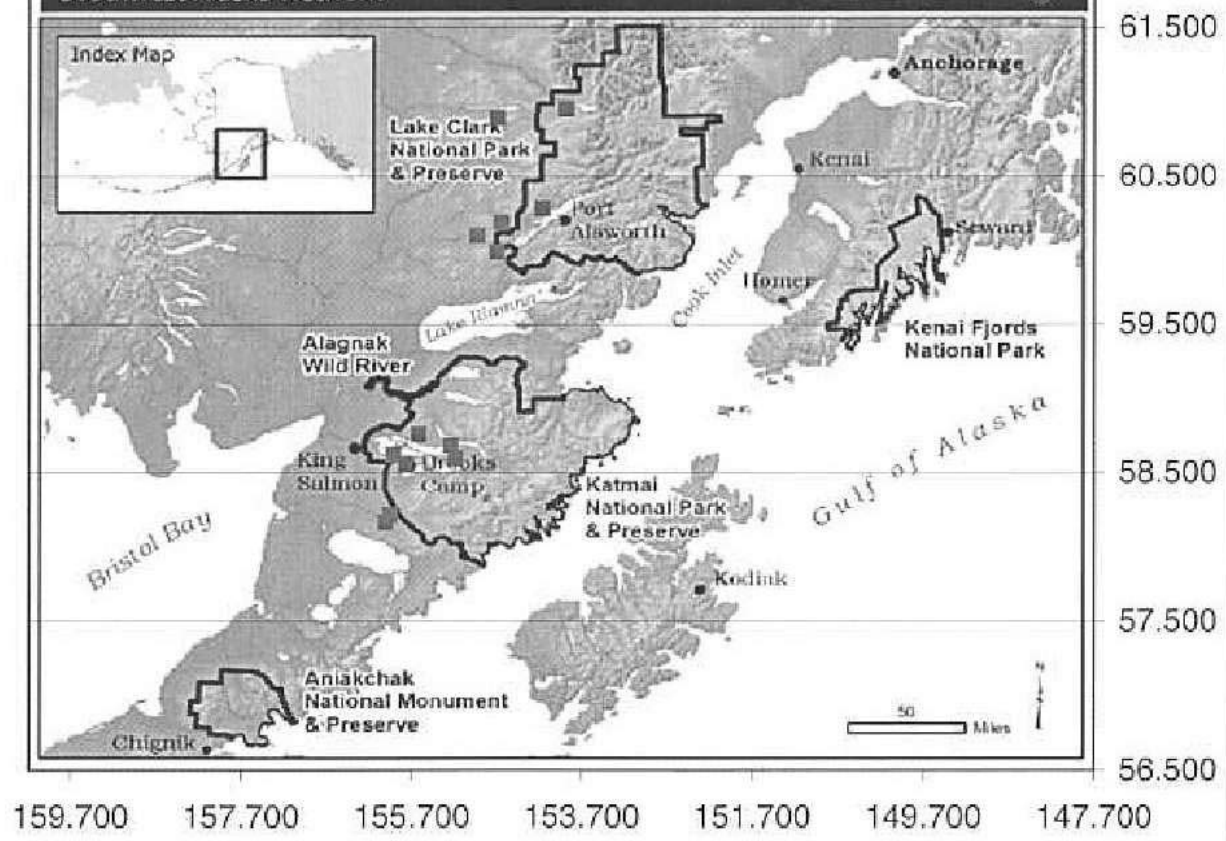
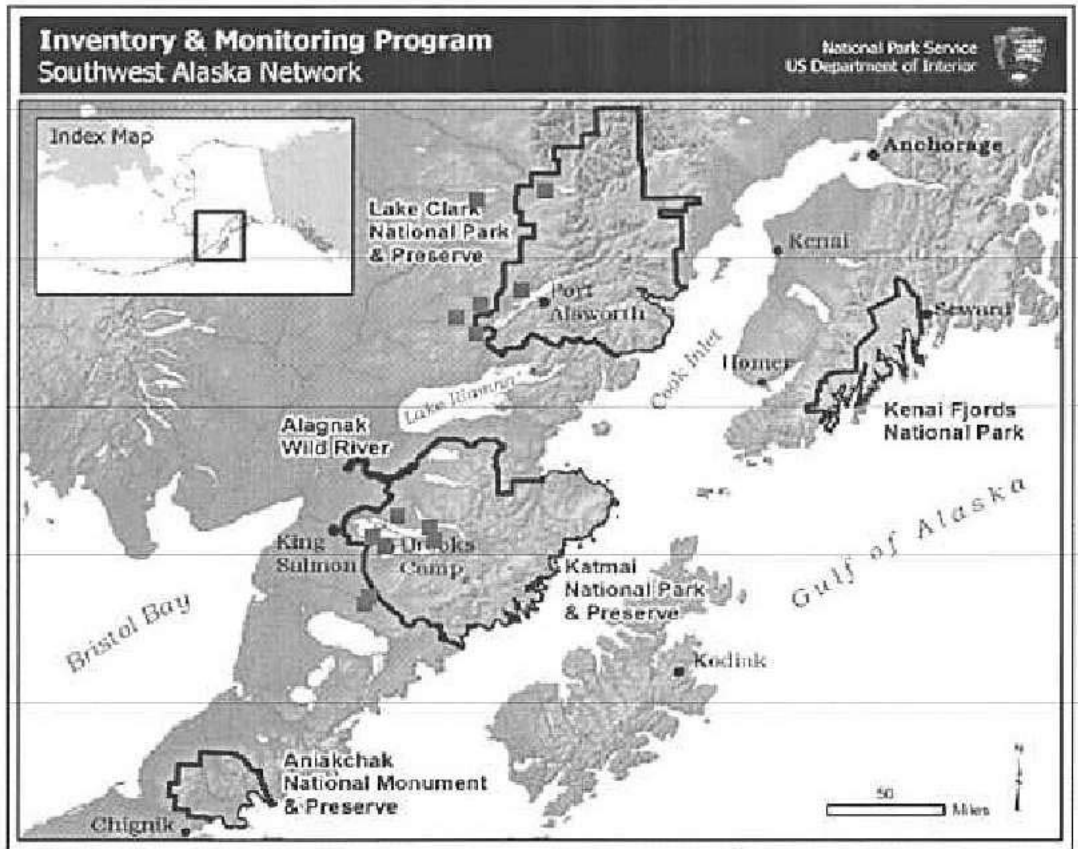
# Humpback Whitefish Sites



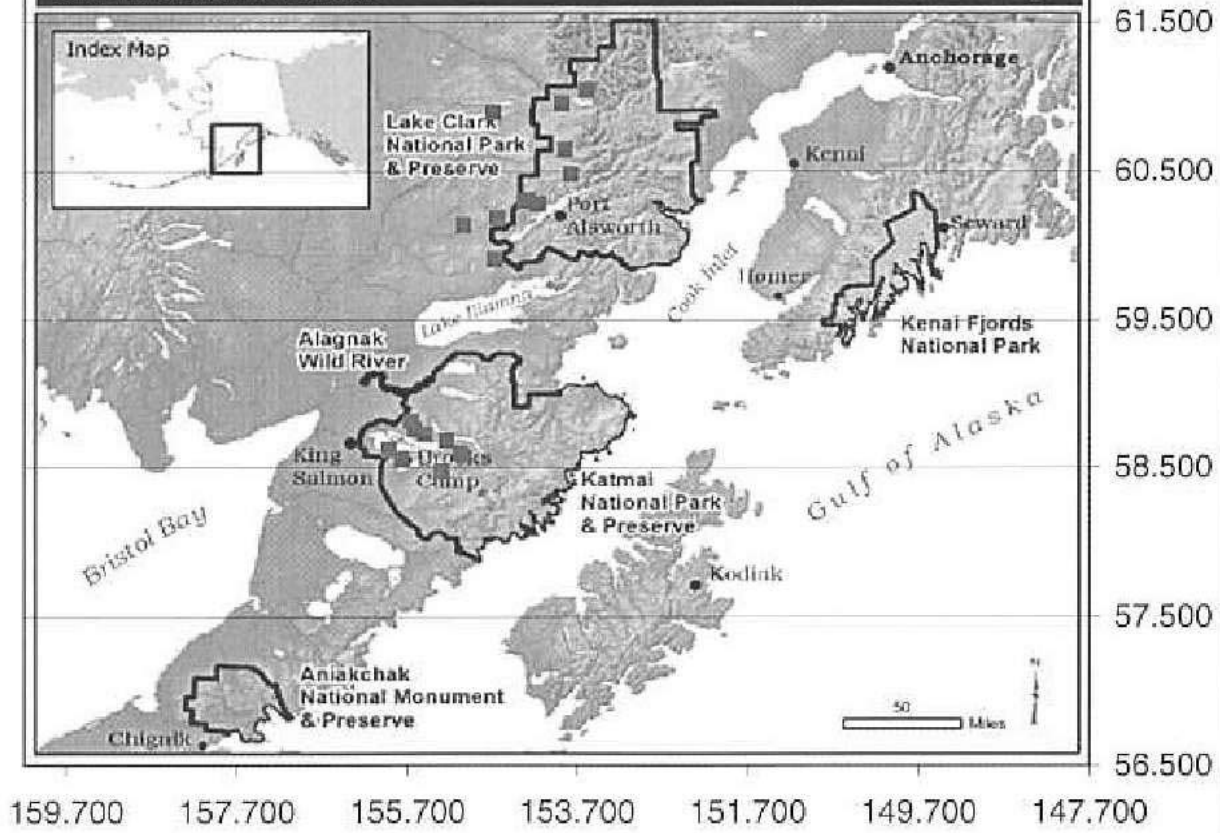
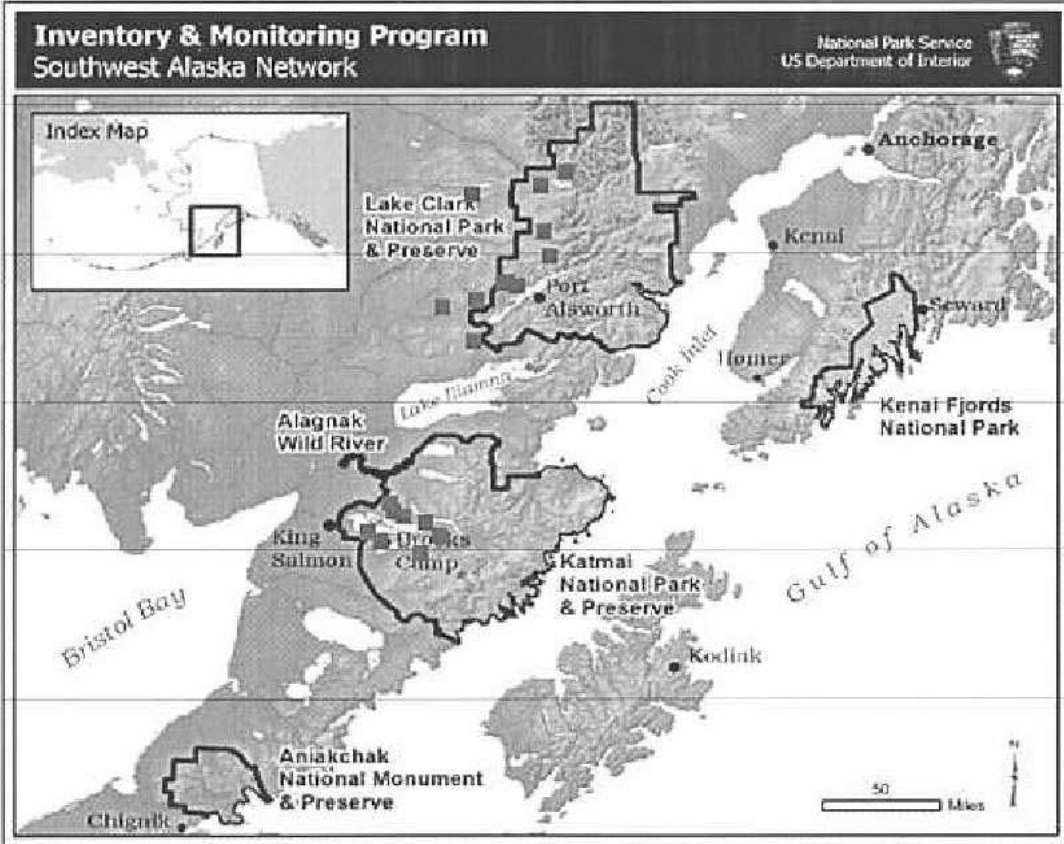
# Lake trout Sites



# Least cisco Sites



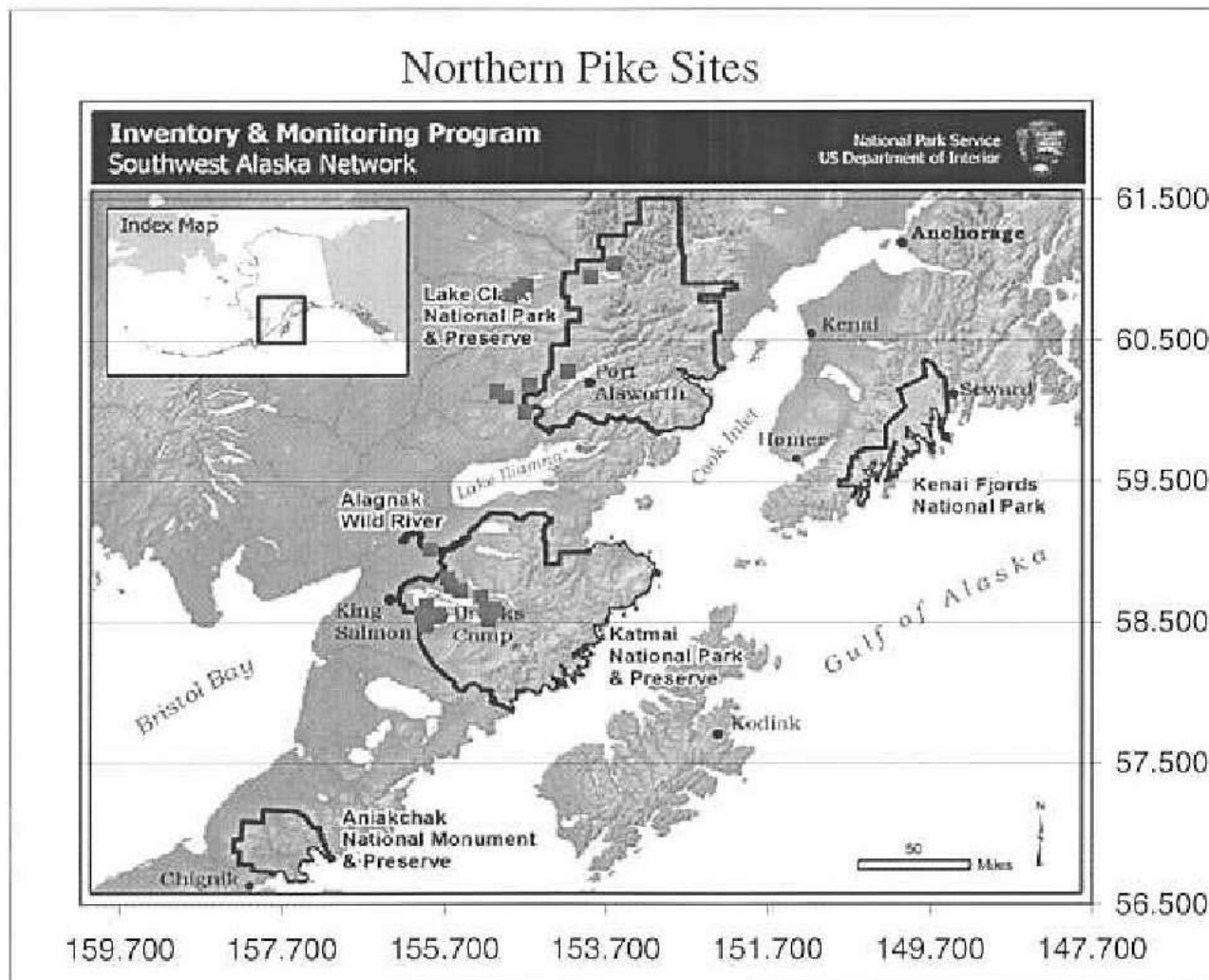
# Longnose sucker Sites



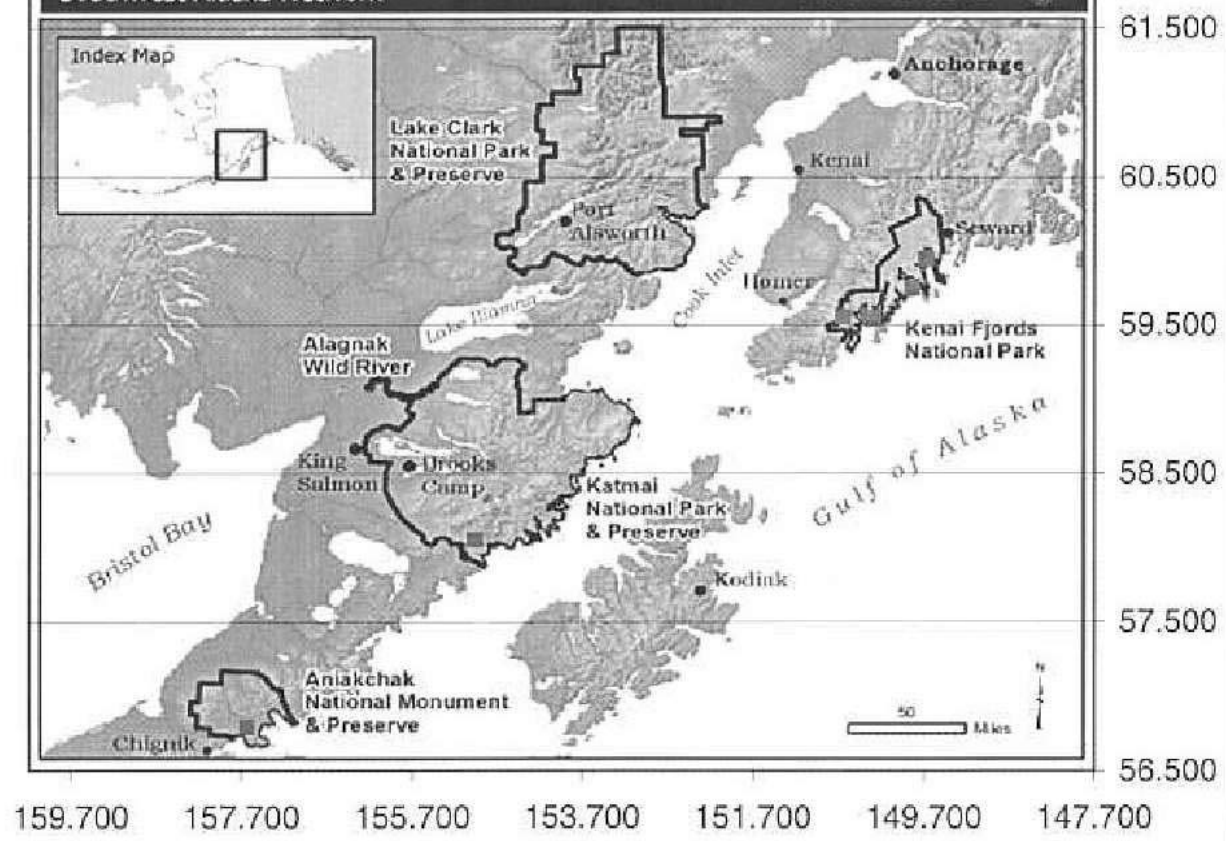
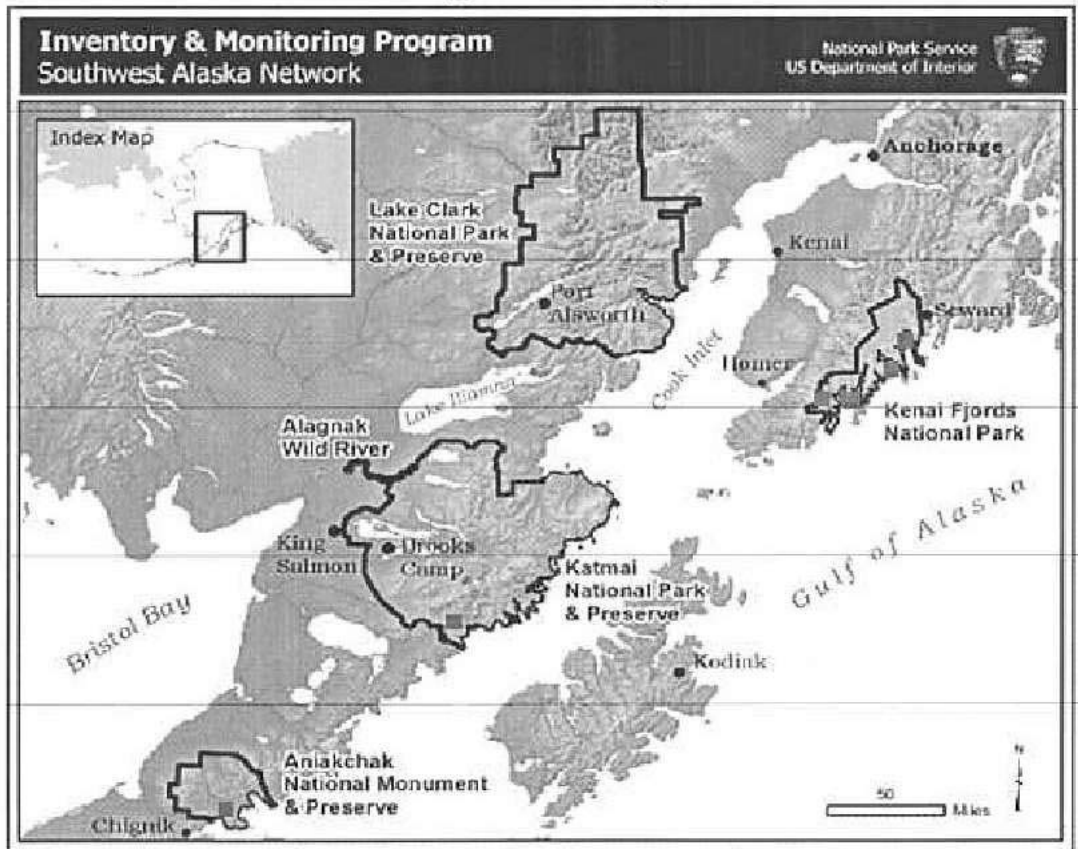




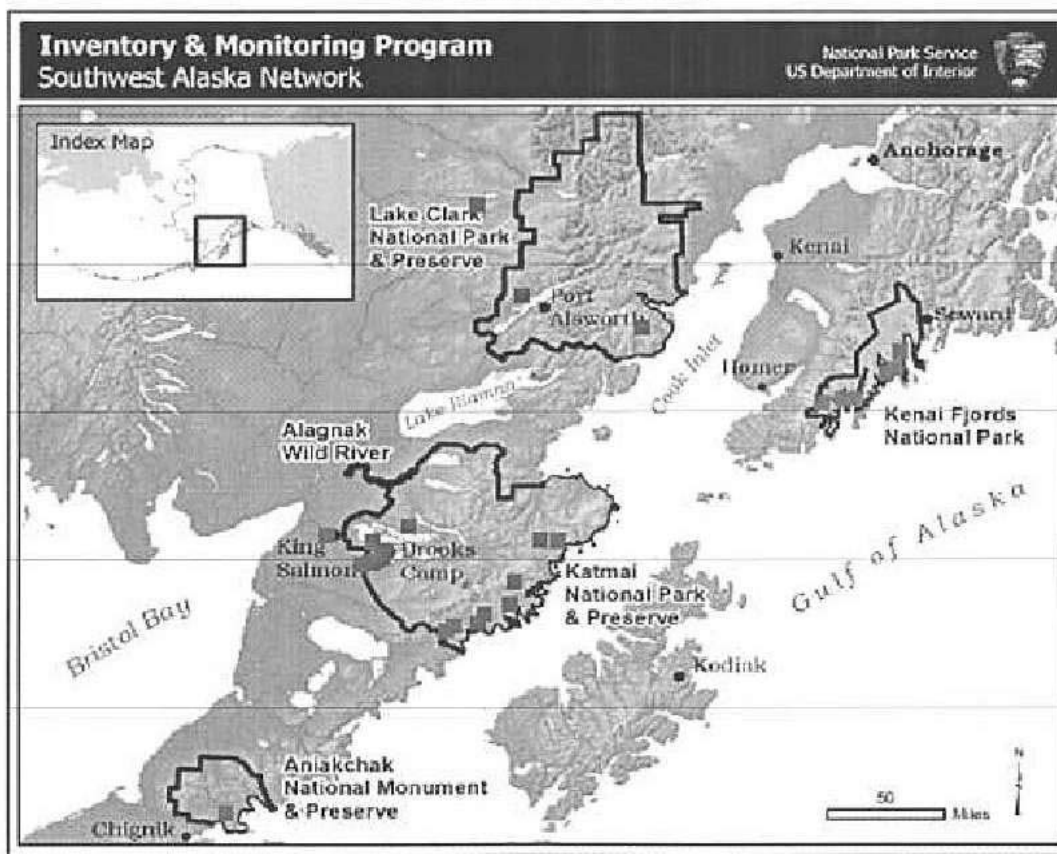
# Northern Pike Sites



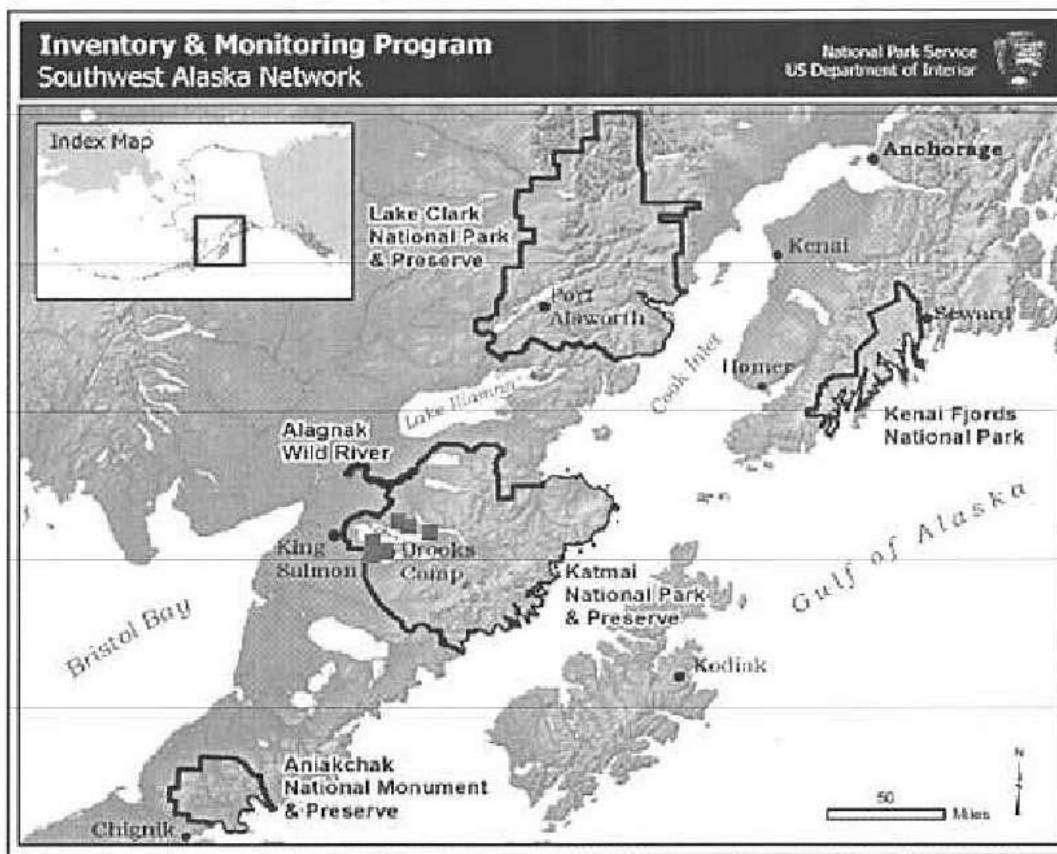
# Pacific staghorn sculpin Sites



# Pink salmon Sites



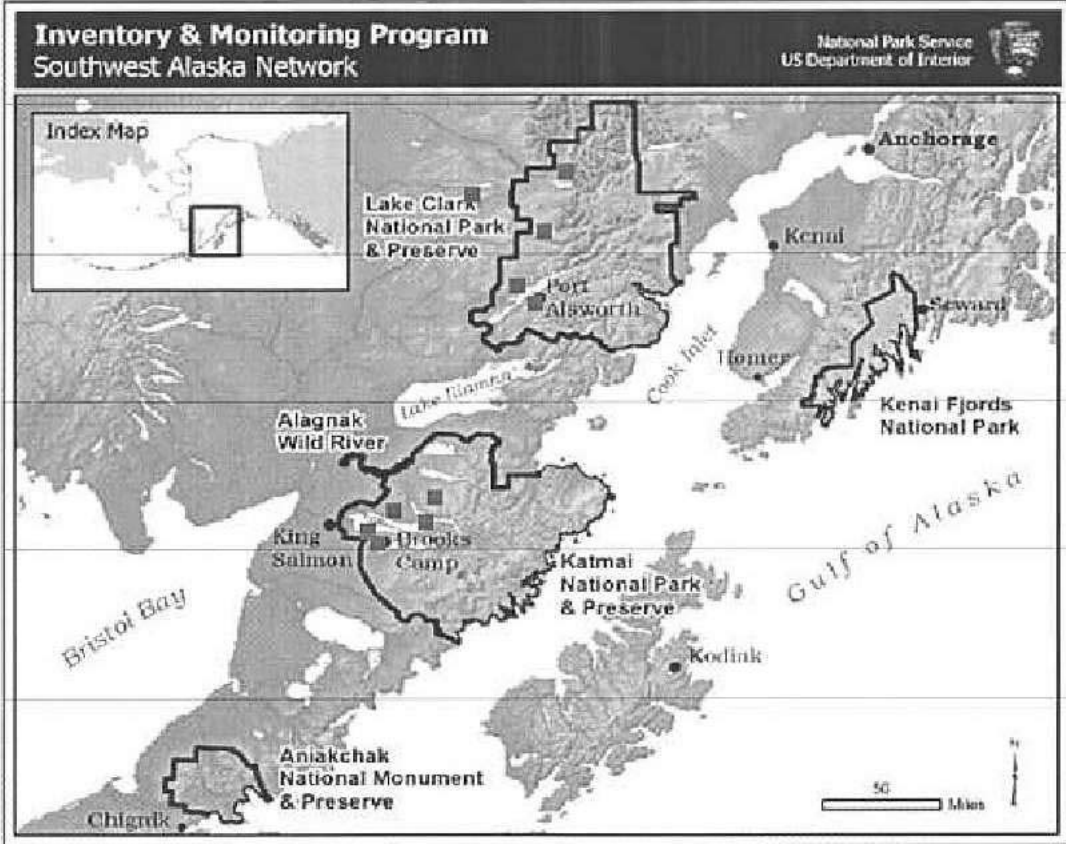
# Pond smelt Sites



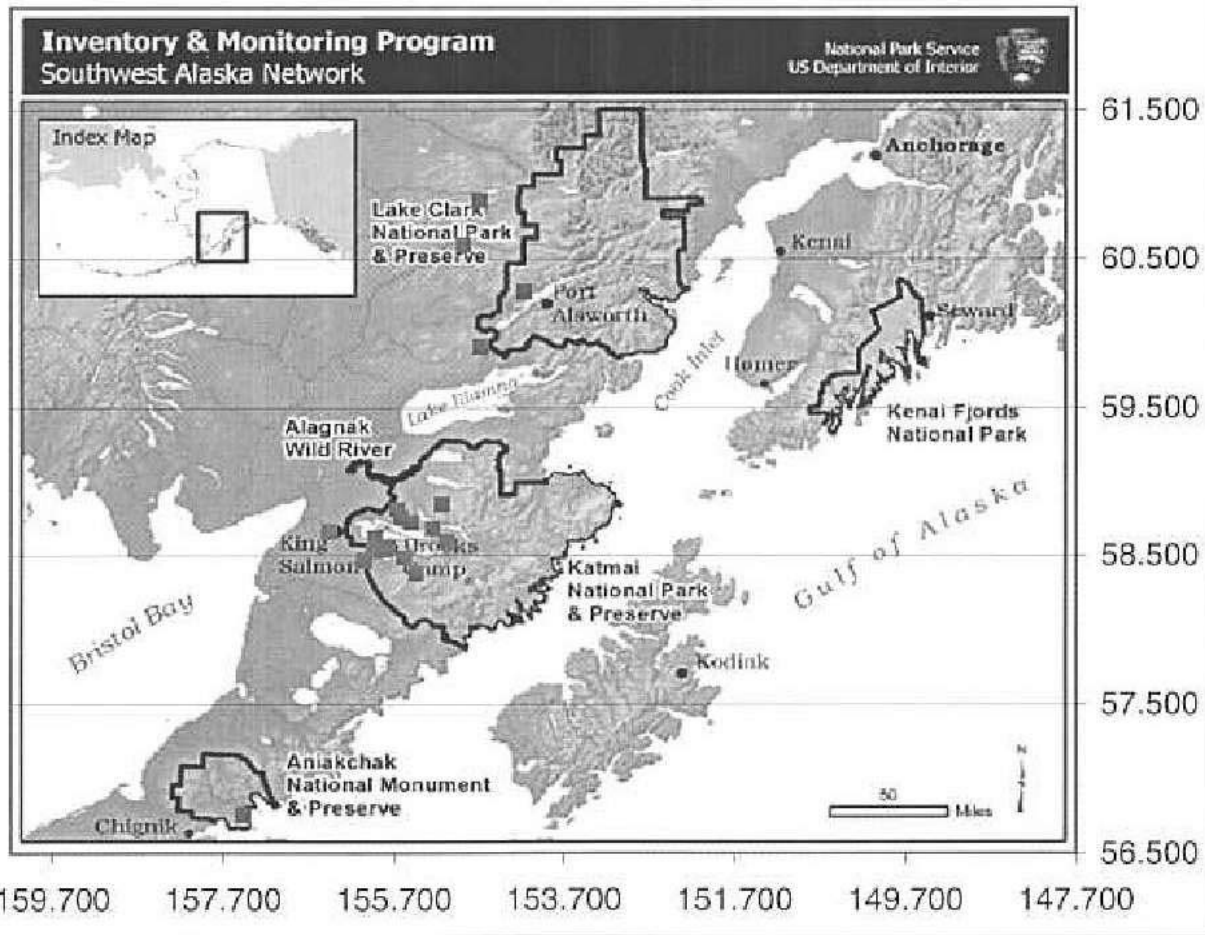
61.500  
60.500  
59.500  
58.500  
57.500  
56.500

159.700 157.700 155.700 153.700 151.700 149.700 147.700

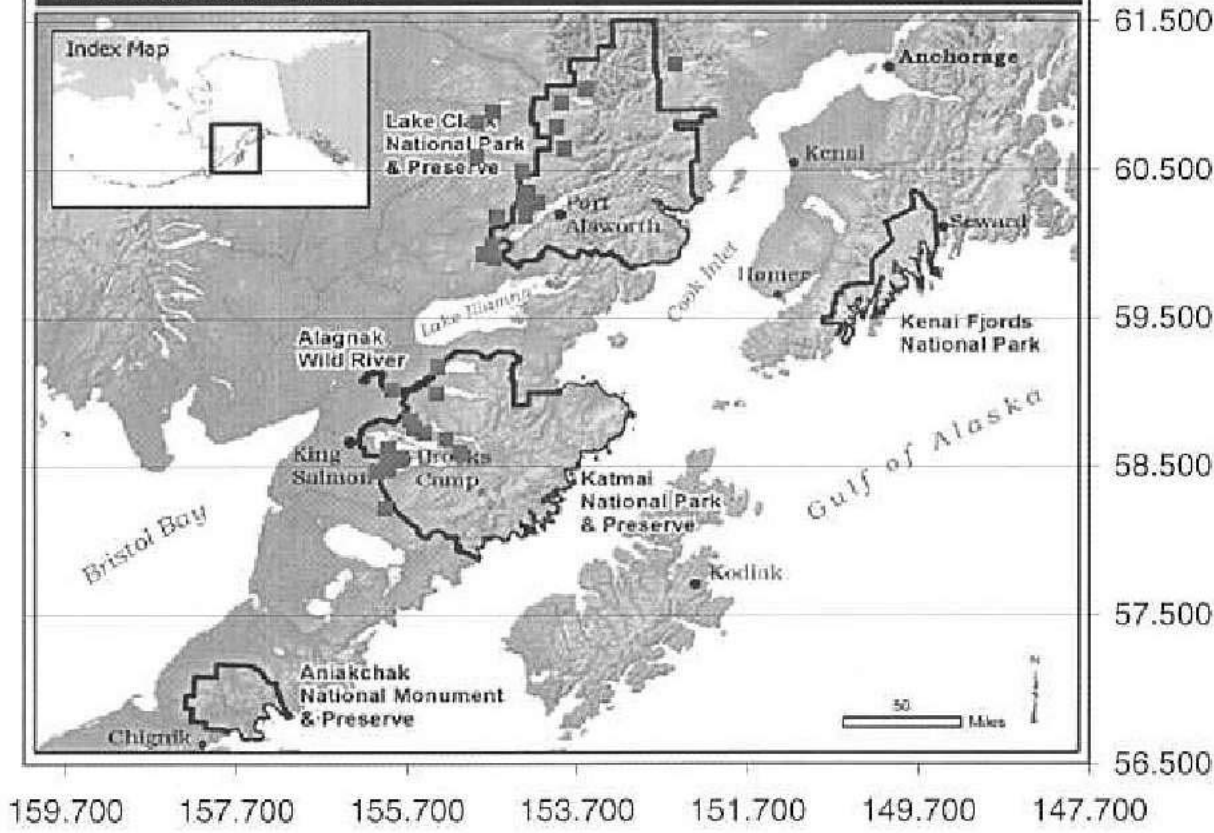
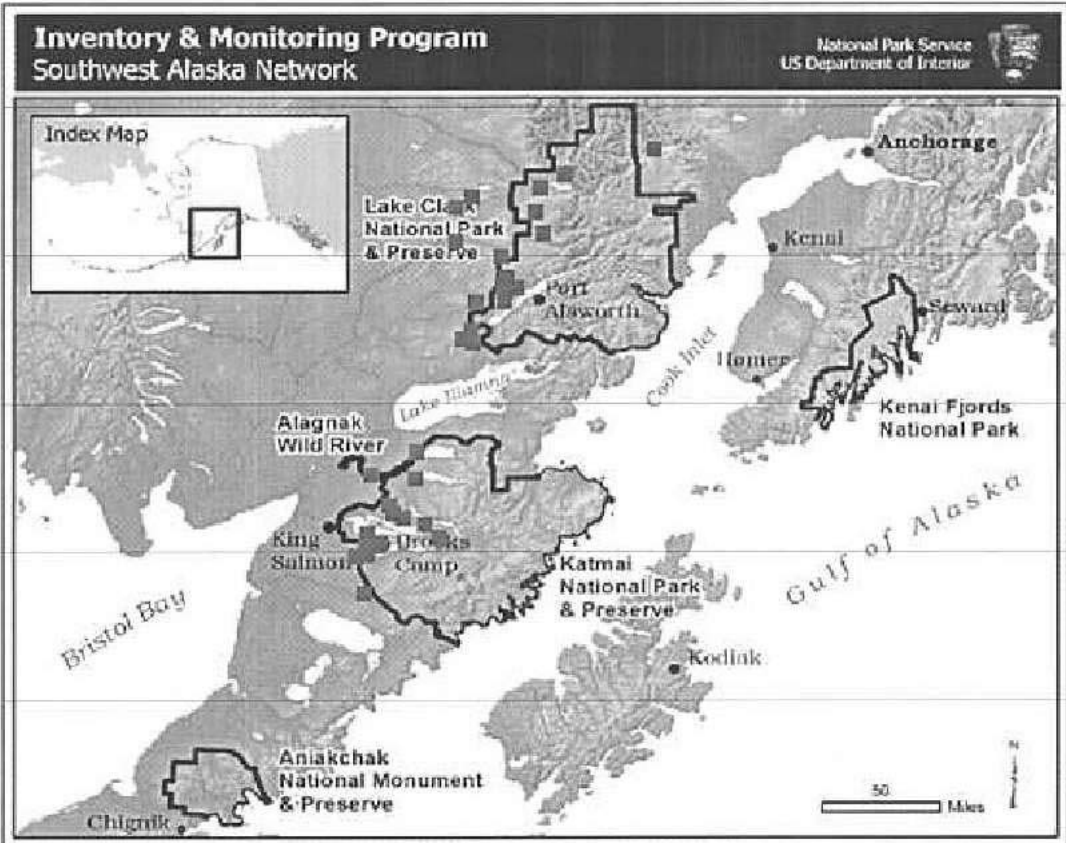
# Pygmy whitefish Sites



# Rainbow trout Sites

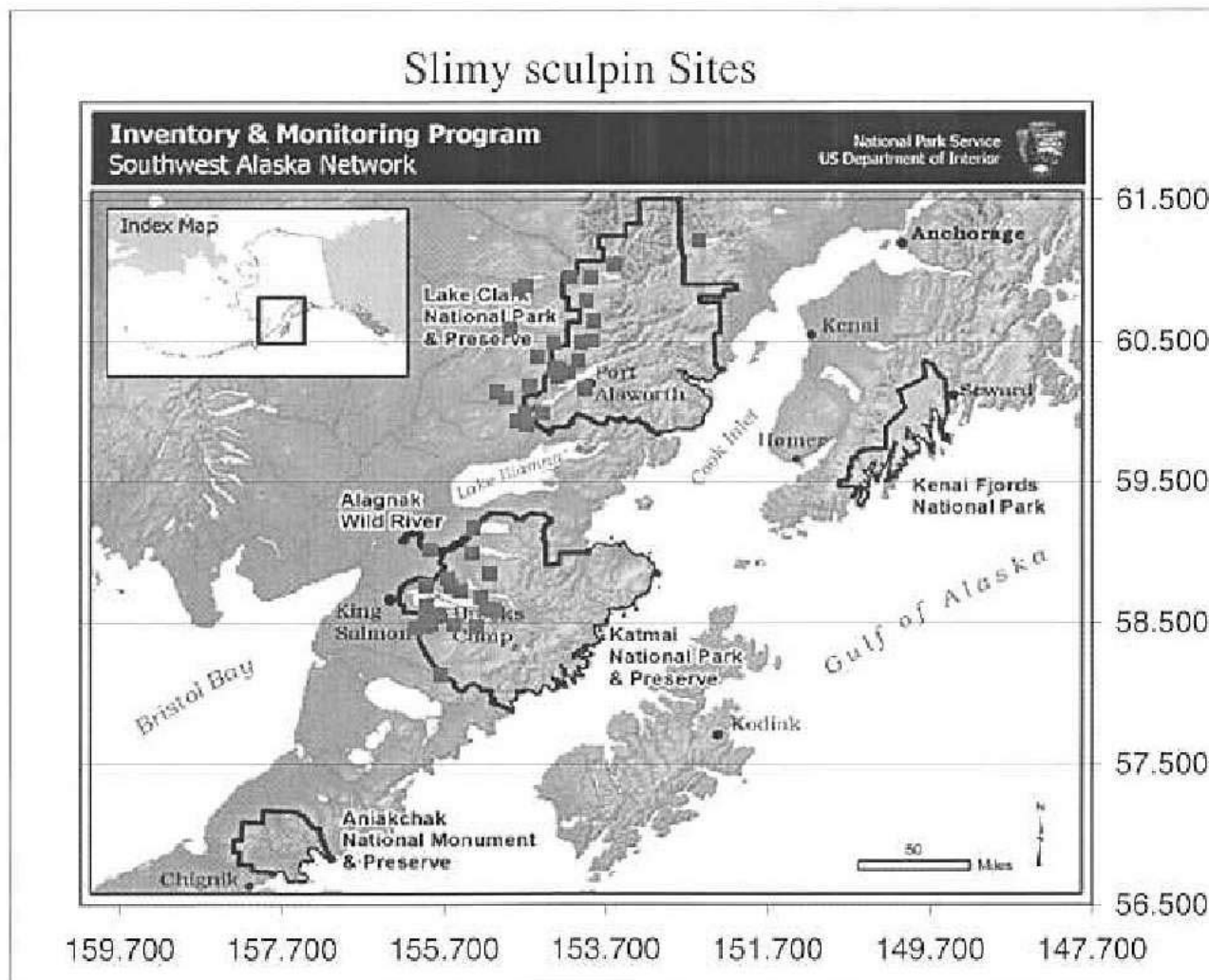


# Round Whitefish Sites

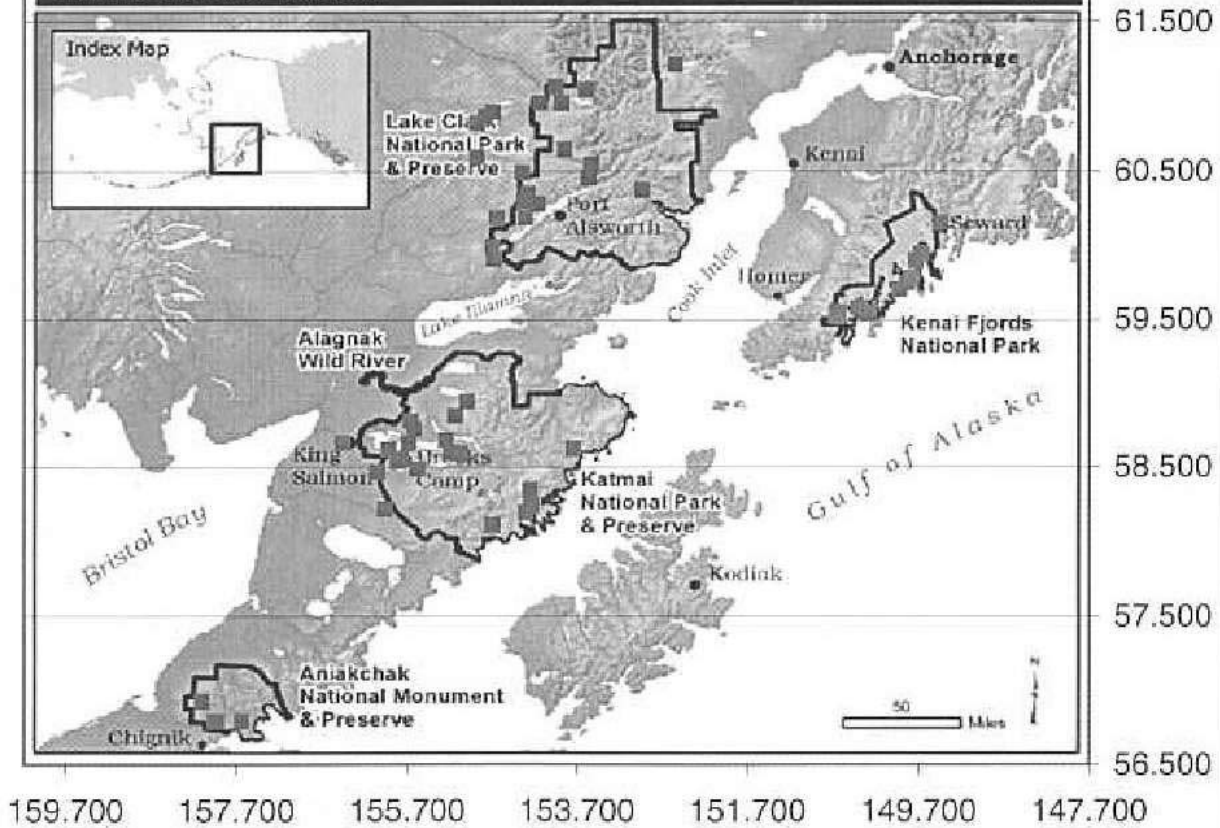
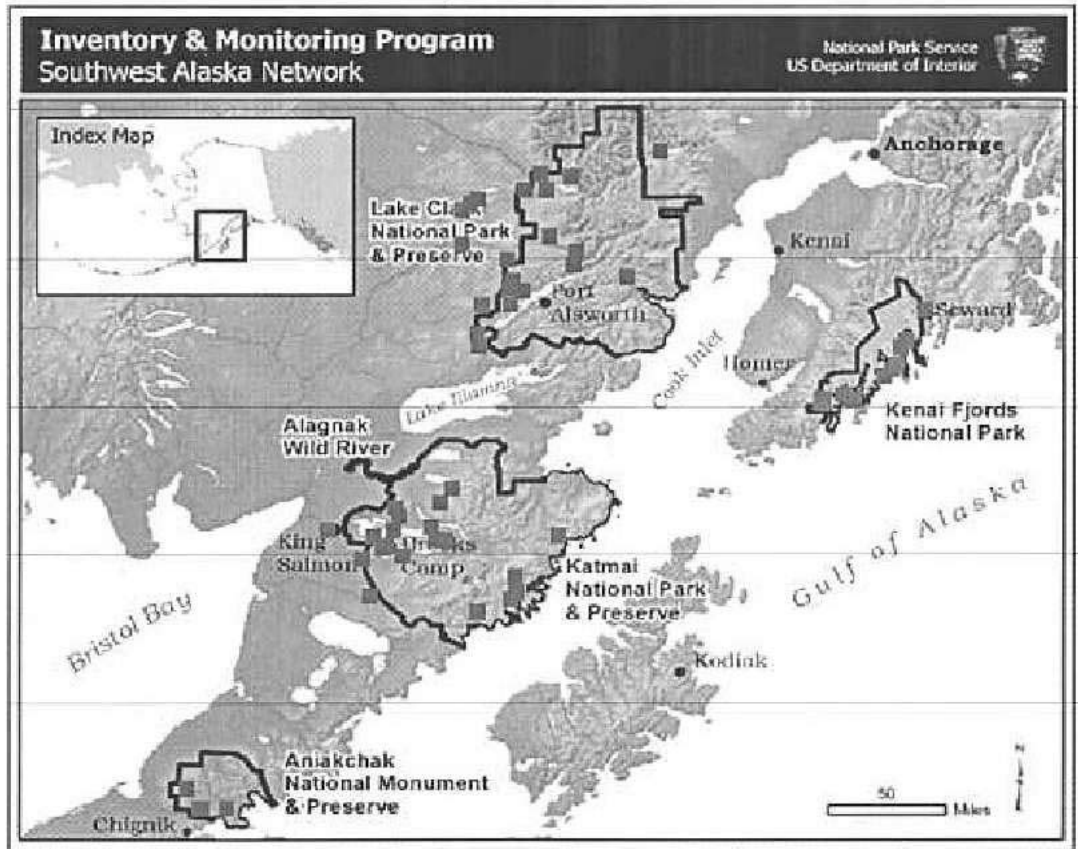




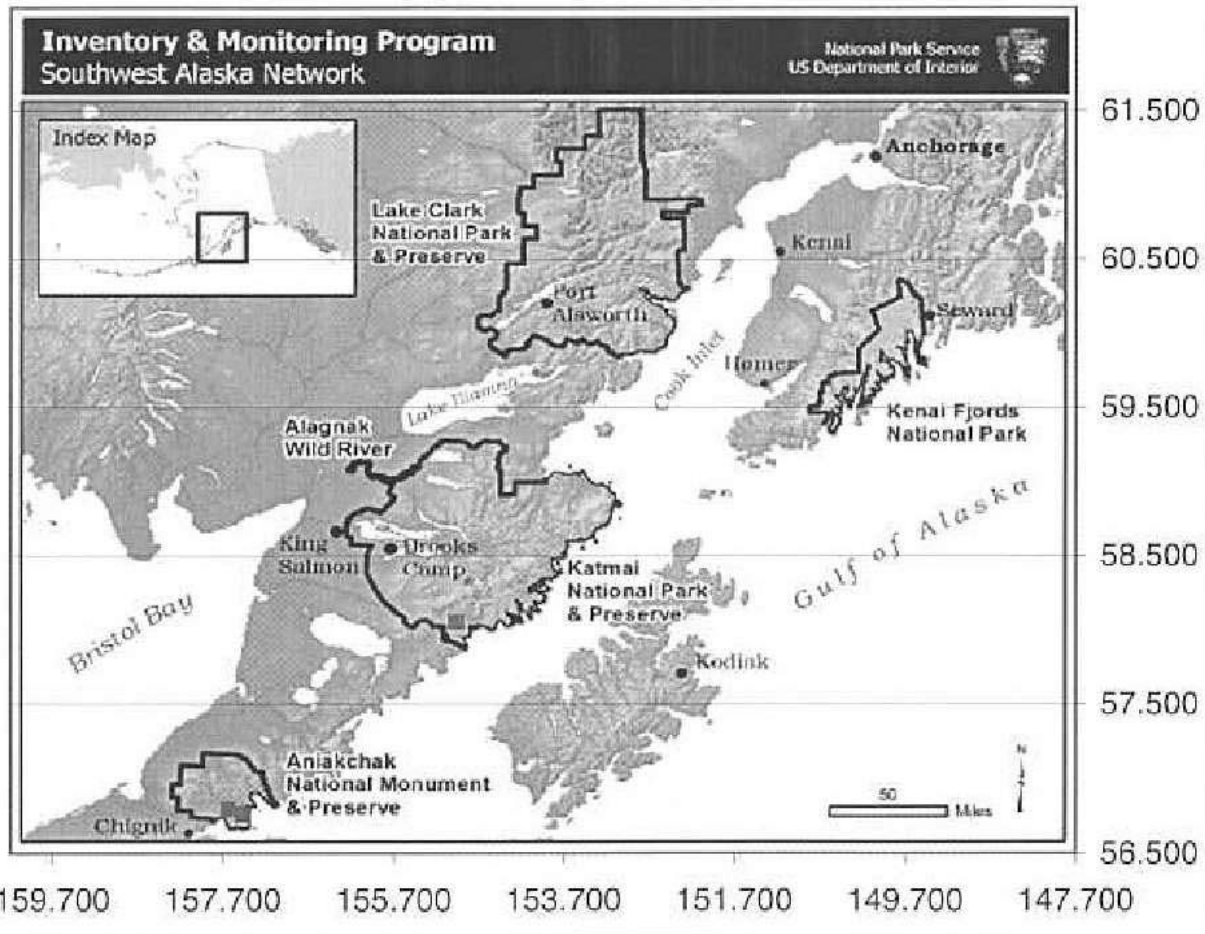
# Slimy sculpin Sites



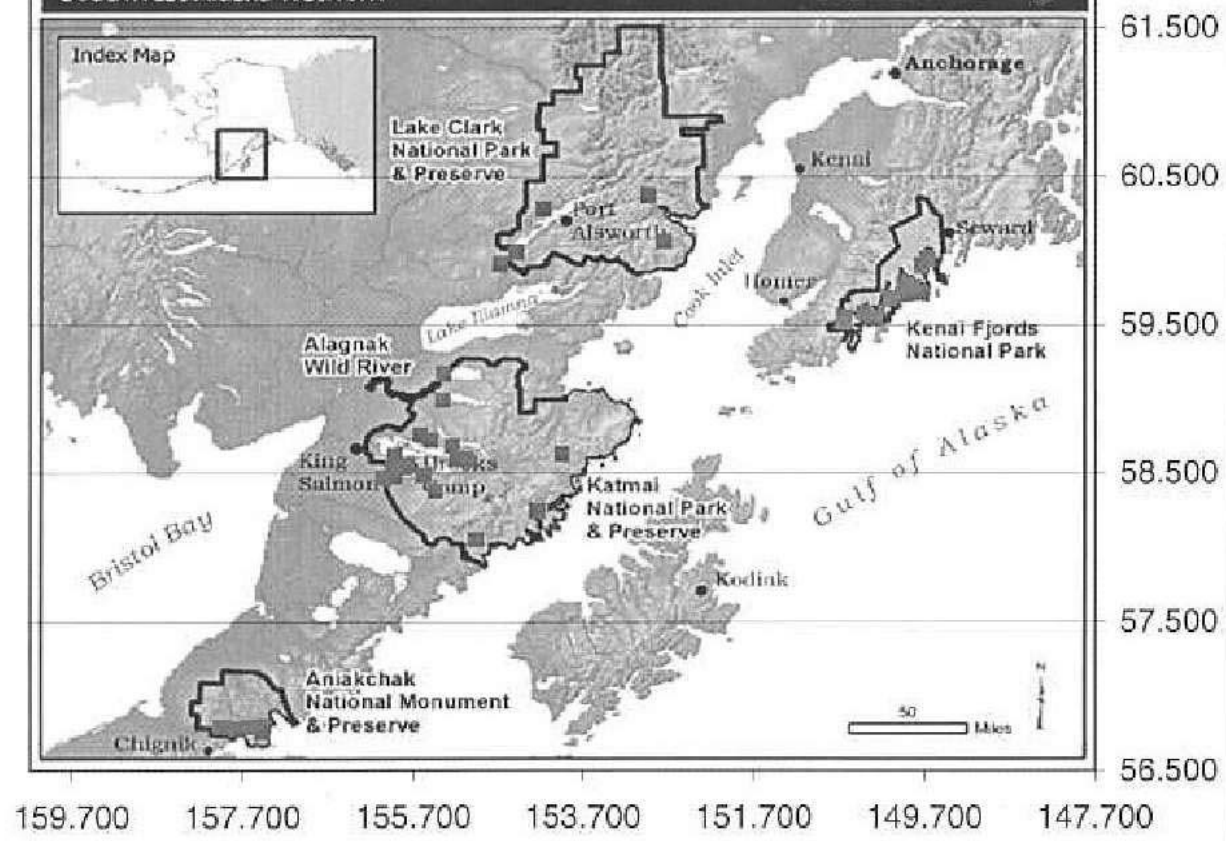
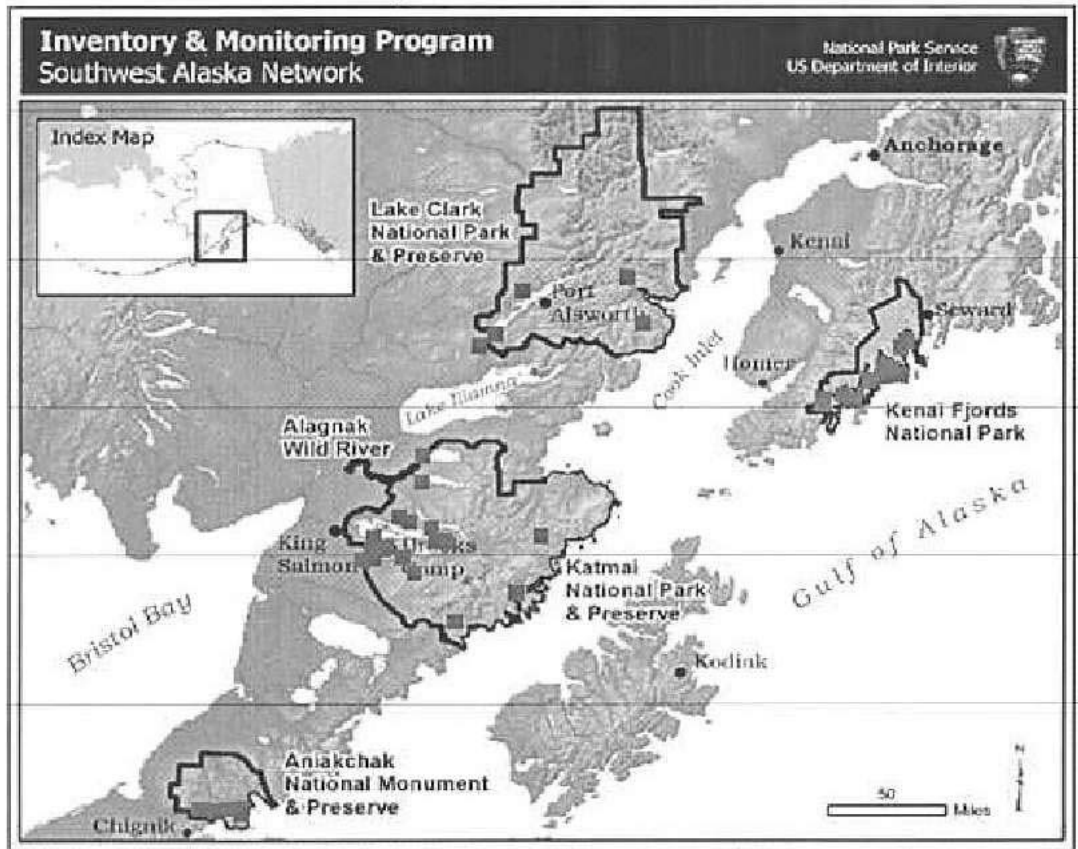
# Sockeye salmon Sites



# Starry flounder Sites



# Threespine stickleback Sites



Appendix 7. Geographical information regarding water bodies sampled in the SWAN fish inventory. ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve. Latitude and Longitude are in WGS-84 datum, decimal degrees. All elevations based on USGS topographic map data. River elevations are at outflow points. Area based on USGS topographic maps, Weeks (1999), and Wagner & Lanigan (1988). Flow rates are estimates based on Bennet (2004), Brabets and Whitman (2004), LaPerriere (1996), Curran (2003), Mahoney and Sonnevil (1991), National Park Service (1997), USGS guage stations (current), and Weeks (2001).

Water Body	Park Unit	Latitude	Longitude	Elevation (m)	Elevation (ft)	Area (sq. mi)	Flow Rate (cfs)	Flow Rate (cms)	Species Count
Addison Lake	KEFJ	59.904	149.737	4.0	13.0	0.1	N/A	N/A	3
Alagnak River	ALAG	59.017	155.874	14.3	47.0	N/A	4450	126.00	7
Albert Johnson Creek	ANIA	56.779	157.769	0.0	0.0	N/A	75	2.13	4
Alagogshak Creek	KATM	58.018	155.053	21.9	72.0	N/A	Unknown	Unknown	1
American Creek	KATM	58.813	155.662	0.0	0.0	N/A	530	15.00	9
Amalik River	KATM	58.130	154.604	32.6	107.0	N/A	Unknown	Unknown	1
Aniakchak River	ANIA	56.792	157.638	0.0	0.0	N/A	1223	34.63	9
Beards Hollow Lagoon	KEFJ	59.707	149.929	1.5	5.0	0.0	N/A	N/A	2
Big River	KATM	58.626	153.949	0.0	0.0	N/A	Unknown	Unknown	6
Boulder Creek Lakes	KEFJ	59.774	149.936	26.2	86.0	0.0	N/A	N/A	3
Brooks Lake	KATM	58.537	155.810	18.9	62.0	29.1	N/A	N/A	19
Brooks River	KATM	58.553	155.775	10.4	34.0	N/A	386	10.93	19
Caribou Lake	LACL	60.389	154.541	618.7	2030.0	0.0	N/A	N/A	3
Chakachamna Lake	LACL	61.212	152.552	352.0	1155.0	26.0	N/A	N/A	5
Chilikadrotna River	LACL	60.591	154.885	434.9	1427.0	N/A	Unknown	Unknown	11
Chokotok River	LACL	60.457	153.566	77.1	253.0	N/A	1200	33.98	1
Chulitna River	LACL	60.186	154.647	0.0	0.0	N/A	3160	89.48	10
Coville Lake	KATM	58.759	155.620	32.6	107.0	13.3	N/A	N/A	20
Coville River	KATM	58.721	155.499	31.1	102.0	N/A	Unknown	Unknown	12
Cozy Lake	KATM	58.214	155.967	180.4	592.0	0.7	N/A	N/A	6
Crescent Beach Creek	KEFJ	59.750	149.843	0.0	0.0	N/A	Unknown	Unknown	4
Crescent Lake	LACL	60.369	152.936	181.1	594.0	6.1	N/A	N/A	7
Dakavak Lake	KATM	58.109	154.692	78.0	256.0	1.9	N/A	N/A	3
Dakavak River	KATM	58.069	154.677	0.0	0.0	N/A	Unknown	Unknown	1

Appendix 7 (continued). Geographical information regarding water bodies sampled in the SWAN fish inventory. ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve. Latitude and Longitude are in WGS-84 datum, decimal degrees. All elevations based on USGS topographic map data. River elevations are at outflow points. Area based on USGS topographic maps, Weeks (1999), and Wagner & Lanigan (1988). Flow rates are estimates based on Bennet (2004), Brabets and Whitman (2004), LaPerriere (1996), Curran (2003), Mahoney and Sonnevil (1991), National Park Service (1997), USGS guage stations (current), and Weeks (2001).

Water Body	Park Unit	Latitude	Longitude	Elevation (m)	Elevation (ft)	Area (sq. mi)	Flow Rate (cfs)	Flow Rate (cms)	Species Count
Delight Lake	KEFJ	59.550	150.286	9.1	30.0	1.1	N/A	N/A	6
Delight River	KEFJ	59.543	150.331	0.0	0.0	N/A	Unknown	Unknown	6
Delusion Creek	KEFJ	59.640	150.265	0.0	0.0	N/A	Unknown	Unknown	1
Desire Creek	KEFJ	59.582	150.272	0.0	0.0	N/A	Unknown	Unknown	2
Devils Cove Lake	KATM	58.348	154.253	11.9	39.0	0.1	N/A	N/A	4
Devils Cove River	KATM	58.348	154.213	0.0	0.0	N/A	Unknown	Unknown	1
Drop Off Beach River	KEFJ	59.759	149.893	0.0	0.0	N/A	Unknown	Unknown	1
Exit Creek	KEFJ	60.189	149.616	90.5	297.0	N/A	Unknown	Unknown	1
Ferrum Creek	KEFJ	59.549	150.668	0.0	0.0	N/A	Unknown	Unknown	3
Fishtrap Lake	LACL	60.488	154.343	520.0	1706.0	1.0	N/A	N/A	8
Grosvenor Lake	KATM	58.684	155.242	31.1	102.0	28.5	N/A	N/A	17
Grosvenor River	KATM	58.594	155.075	29.6	97.0	N/A	Unknown	Unknown	12
Hammersly Lake	KATM	58.847	155.135	355.1	1165.0	3.4	N/A	N/A	6
Half Cabin Lake	LACL	60.818	154.880	487.4	1599.0	0.5	N/A	N/A	4
Hardscrabble Creek	KATM	58.945	154.998	31.1	102.0	N/A	Unknown	Unknown	3
Headwater Creek	KATM	58.468	156.053	18.9	62.0	N/A	265	7.50	11
Hickerson Lake	LACL	59.933	152.923	189.9	623.0	1.4	N/A	N/A	1
Hidden Creek	KATM	58.480	155.921	18.9	62.0	N/A	13	0.37	12
Hoknede Lake	LACL	60.100	154.934	130.5	428.0	1.0	N/A	N/A	4
Hudson Lake	LACL	59.935	154.803	104.5	343.0	0.1	N/A	N/A	4
Idavain Creek	KATM	58.662	155.685	10.4	34.0	N/A	60	1.70	1
Idavain Lake	KATM	58.761	155.929	223.1	732.0	4.2	N/A	N/A	2
Iris Creek	ANIA	56.762	157.465	0.0	0.0	N/A	Unknown	Unknown	6
James Lagoon River	KEFJ	59.584	150.412	0.0	0.0	N/A	Unknown	Unknown	4

Appendix 7 (continued). Geographical information regarding water bodies sampled in the SWAN fish inventory. ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve. Latitude and Longitude are in WGS-84 datum, decimal degrees. All elevations based on USGS topographic map data. River elevations are at outflow points. Area based on USGS topographic maps, Weeks (1999), and Wagner & Lanigan (1988). Flow rates are estimates based on Bennet (2004), Brabets and Whitman (2004), LaPerriere (1996), Curran (2003), Mahoney and Sonnevil (1991), National Park Service (1997), USGS guage stations (current), and Weeks (2001).

Water Body	Park Unit	Latitude	Longitude	Elevation (m)	Elevation (ft)	Area (sq. mi)	Flow Rate (cfs)	Flow Rate (cms)	Species Count
Johnson River	LACL	60.062	152.755	0.0	0.0	N/A	655	18.55	8
Jojo Lake	KATM	58.600	155.192	11.0	36.0	2.6	N/A	N/A	7
Kafliia Bay Lake	KATM	58.246	154.241	6.1	20.0	0.4	N/A	N/A	5
Kaguyak Crater	KATM	58.612	154.057	353.9	1161.0	1.4	N/A	N/A	1
Katmai River	KATM	58.052	154.970	0.0	0.0	N/A	Unknown	Unknown	5
Kijik Lake	LACL	60.302	154.325	110.0	361.0	1.7	N/A	N/A	8
Kijik River	LACL	60.345	154.284	77.1	253.0	N/A	1130	32.00	4
King Salmon River	KATM	58.162	156.012	3.0	9.0	N/A	Unknown	Unknown	1
Kontrashnibuna Lake	LACL	60.162	153.956	138.1	453.0	8.4	N/A	N/A	4
Kukaklek Lake	KATM	59.171	155.340	249.9	820.0	67.5	N/A	N/A	5
Kuliak Bay Creek	KATM	58.196	154.303	0.0	0.0	N/A	Unknown	Unknown	3
Lachbuna Lake	LACL	60.490	154.007	405.1	1329.0	1.3	N/A	N/A	3
Lake Clark	LACL	60.282	154.168	77.1	253.0	143.0	N/A	N/A	19
Little Kijik River	LACL	60.308	154.285	79.6	261.0	N/A	Unknown	Unknown	7
Long Lake	LACL	60.141	155.052	96.0	315.0	3.8	N/A	N/A	4
Loon Lake	LACL	60.868	154.793	365.2	1198.0	0.2	N/A	N/A	4
Margot Creek	KATM	58.486	155.580	10.4	34.0	N/A	210	5.95	8
Martin Creek	KATM	58.122	155.099	28.0	92.0	N/A	Unknown	Unknown	1
Meshik Lake	ANIA	56.790	157.928	36.0	118.0	0.1	N/A	N/A	5
Meshik River	ANIA	56.787	157.951	42.7	150.0	N/A	24	0.68	6
Miller Creek	LACL	60.316	154.332	77.1	253.0	N/A	Unknown	Unknown	4
Mulchatna River	LACL	60.893	154.698	210.0	689.0	N/A	Unknown	Unknown	20
Muriel Lake	KATM	58.518	155.155	25.3	83.0	0.9	N/A	N/A	1
Murray Lake	KATM	58.780	155.061	498.0	1634.0	1.0	N/A	N/A	1

Appendix 7 (continued). Geographical information regarding water bodies sampled in the SWAN fish inventory. ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve. Latitude and Longitude are in WGS-84 datum, decimal degrees. All elevations based on USGS topographic map data. River elevations are at outflow points. Area based on USGS topographic maps, Weeks (1999), and Wagner & Lanigan (1988). Flow rates are estimates based on Bennet (2004), Brabets and Whitman (2004), LaPerriere (1996), Curran (2003), Mahoney and Sonnevil (1991), National Park Service (1997), USGS guage stations (current), and Weeks (2001).

Water Body	Park Unit	Latitude	Longitude	Elevation (m)	Elevation (ft)	Area (sq. mi)	Flow Rate (cfs)	Flow Rate (cms)	Species Count
Naknek Lake	KATM	58.619	155.922	10.4	34.0	228.0	N/A	N/A	24
Naknek River	KATM	58.663	156.456	10.4	34.0	N/A	Unknown	Unknown	8
Naknek River Lakes	KATM	58.670	156.431	26.2	86.0	0.0	N/A	N/A	1
Necons River	LACL	61.063	153.954	283.2	929.0	N/A	Unknown	Unknown	1
Nonvianuk Lake	KATM	58.995	155.357	193.9	636.0	51.5	N/A	N/A	5
North Aialik Lagoon	KEFJ	59.946	149.676	3.0	10.0	0.0	N/A	N/A	3
Northwester Fjord River	KEFJ	59.773	149.926	0.0	0.0	N/A	Unknown	Unknown	2
Nuka River	KEFJ	59.558	150.643	0.0	0.0	N/A	21	0.59	9
One-Shot Creek	KATM	58.493	155.865	18.9	62.0	N/A	19	0.54	6
Otter Lake	LACL	60.478	153.779	113.1	371.0	0.2	N/A	N/A	2
Paguna Creek	KEFJ	59.681	150.102	0.0	0.0	N/A	Unknown	Unknown	1
Pederson Creek	KEFJ	59.898	149.736	0.0	0.0	N/A	Unknown	Unknown	3
Pickeral Lakes	LACL	59.991	154.700	84.1	276.0	1.3	N/A	N/A	7
Pike Lake	KATM	58.556	155.982	51.8	170.0	0.9	N/A	N/A	1
Portage Creek	LACL	60.363	154.037	77.1	253.0	N/A	Unknown	Unknown	2
Portage Lake	LACL	60.505	153.865	444.1	1457.0	0.6	N/A	N/A	3
Quicksand Beach Lagoon	KEFJ	59.786	149.791	4.0	13.0	0.0	N/A	N/A	4
Resurrection River	KEFJ	60.154	149.443	0.0	0.0	N/A	3160	89.48	3
Savonoski River	KATM	58.530	155.245	10.4	34.0	N/A	359	10.17	1
Shelter Cove Lake	KEFJ	59.519	150.646	2.4	8.0	0.1	N/A	N/A	2
Snipe Lake	LACL	60.250	154.299	559.9	1837.0	1.3	N/A	N/A	9
Split Glacier Creek	KEFJ	59.611	150.498	0.0	0.0	N/A	Unknown	Unknown	1
Surprise Lake	ANIA	56.925	158.102	321.0	1053.0	1.1	N/A	N/A	2



Appendix 7 (continued). Geographical information regarding water bodies sampled in the SWAN fish inventory. ALAG - Alagnak Wild River, ANIA - Aniakchak National Monument and Preserve, KATM - Katmai National Park and Preserve, KEFJ - Kenai Fjords National Park, LACL - Lake Clark National Park and Preserve. Latitude and Longitude are in WGS-84 datum, decimal degrees. All elevations based on USGS topographic map data. River elevations are at outflow points. Area based on USGS topographic maps, Weeks (1999), and Wagner & Lanigan (1988). Flow rates are estimates based on Bennet (2004), Brabets and Whitman (2004), LaPerriere (1996), Curran (2003), Mahoney and Sonnevil (1991), National Park Service (1997), USGS guage stations (current), and Weeks (2001).

<b>Water Body</b>	<b>Park Unit</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Elevation (m)</b>	<b>Elevation (ft)</b>	<b>Area (sq. mi)</b>	<b>Flow Rate (cfs)</b>	<b>Flow Rate (cms)</b>	<b>Species Count</b>
Swikshak River	KATM	58.624	153.741	0.0	0.0	N/A	Unknown	Unknown	2
Takayafo Creek	KATM	58.132	155.747	147.2	483.0	N/A	Unknown	Unknown	3
Tanalain River	LACL	60.189	154.314	77.1	253.0	N/A	1620	45.87	5
Tazimina Lake	LACL	59.993	154.487	192.3	631.0	5.0	N/A	N/A	5
Tazimina River	LACL	59.912	154.680	77.1	253.0	N/A	1061	30.04	8
Telaquana Lake	LACL	60.950	153.881	374.0	1227.0	16.0	N/A	N/A	12
Telaquana River	LACL	60.955	154.141	283.2	929.0	N/A	Unknown	Unknown	3
Tlikakila River	LACL	60.542	153.532	77.1	253.0	N/A	2410	68.24	1
Turquoise Lake	LACL	60.789	153.942	761.1	2497.0	5.2	N/A	N/A	8
Twin Lakes	LACL	60.645	153.848	603.5	1980.0	3.4	N/A	N/A	10
Two Lakes	LACL	61.043	153.595	342.9	1125.0	5.3	N/A	N/A	10
Ukak River	KATM	58.476	155.301	10.4	34.0	N/A	31	0.88	3
Up-a-Tree Creek	KATM	58.511	155.803	18.9	62.0	N/A	25	0.71	3
Upper Margot Valley Lakes	KATM	58.379	155.442	182.3	598.0	0.1	N/A	N/A	3
Verdant Lagoon	KEFJ	59.715	149.742	4.0	13.0	0.0	N/A	N/A	1
West Creek	KATM	58.532	155.940	18.9	62.0	N/A	12	0.34	12
Willow Creek	ANIA	56.799	157.453	0.0	0.0	N/A	Unknown	Unknown	3