**Regional Information Report No. 4K16-03**

# Chirikof Island Salmon Assessment, 2015

**by**

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**and**

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**Alaska Department of Fish and Game** **Divisions of Sport Fish and Commercial Fisheries**

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**Weights and measures (metric)**

| | |
|---|---|
| centimeter | cm |
| deciliter | dL |
| gram | g |
| hectare | ha |
| kilogram | kg |
| kilometer | km |
| liter | L |
| meter | m |
| milliliter | mL |
| millimeter | mm |

**Weights and measures (English)**

| | |
|---|---|
| cubic feet per second | $ft^3/s$ |
| foot | ft |
| gallon | gal |
| inch | in |
| mile | mi |
| nautical mile | nmi |
| ounce | oz |
| pound | lb |
| quart | qt |
| yard | yd |

**Time and temperature**

| | |
|---|---|
| day | d |
| degrees Celsius | °C |
| degrees Fahrenheit | °F |
| degrees kelvin | K |
| hour | h |
| minute | min |
| second | s |

**Physics and chemistry**

| | |
|---|---|
| all atomic symbols | |
| alternating current | AC |
| ampere | A |
| calorie | cal |
| direct current | DC |
| hertz | Hz |
| horsepower | hp |
| hydrogen ion activity (negative log of) | pH |
| parts per million | ppm |
| parts per thousand | ppt, ‰ |
| volts | V |
| watts | W |

**General**

| | |
|---|---|
| Alaska Administrative Code | AAC |
| all commonly accepted abbreviations | e.g., Mr., Mrs., AM, PM, etc. |
| all commonly accepted professional titles | e.g., Dr., Ph.D., R.N., etc. |
| at | @ |
| compass directions: | |
| east | E |
| north | N |
| south | S |
| west | W |
| copyright | © |
| corporate suffixes: | |
| Company | Co. |
| Corporation | Corp. |
| Incorporated | Inc. |
| Limited | Ltd. |
| District of Columbia | D.C. |
| et alii (and others) | et al. |
| et cetera (and so forth) | etc. |
| exempli gratia (for example) | e.g. |
| Federal Information Code | FIC |
| id est (that is) | i.e. |
| latitude or longitude | lat. or long. |
| monetary symbols (U.S.) | $, ¢ |
| months (tables and figures): first three letters | Jan,...,Dec |
| registered trademark | ® |
| trademark | ™ |
| United States (adjective) | U.S. |
| United States of America (noun) | USA |
| U.S.C. | United States Code |
| U.S. state | use two-letter abbreviations (e.g., AK, WA) |

**Mathematics, statistics**

| | |
|---|---|
| *all standard mathematical signs, symbols and abbreviations* | |
| alternate hypothesis | $H_A$ |
| base of natural logarithm | *e* |
| catch per unit effort | CPUE |
| coefficient of variation | CV |
| common test statistics | (F, t, $\chi^2$, etc.) |
| confidence interval | CI |
| correlation coefficient (multiple) | R |
| correlation coefficient (simple) | r |
| covariance | cov |
| degree (angular ) | ° |
| degrees of freedom | df |
| expected value | *E* |
| greater than | > |
| greater than or equal to | ≥ |
| harvest per unit effort | HPUE |
| less than | < |
| less than or equal to | ≤ |
| logarithm (natural) | ln |
| logarithm (base 10) | log |
| logarithm (specify base) | $\log_2$, etc. |
| minute (angular) | ' |
| not significant | NS |
| null hypothesis | $H_O$ |
| percent | % |
| probability | P |
| probability of a type I error (rejection of the null hypothesis when true) | α |
| probability of a type II error (acceptance of the null hypothesis when false) | β |
| second (angular) | " |
| standard deviation | SD |
| standard error | SE |
| variance | |
| population | Var |
| sample | var |

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# ABSTRACT

During 2015, the Alaska Maritime National Wildlife Refuge (AMNWR) and the Alaska Department of Fish and Game (ADF&G) collaborated on a project to assess salmon on Chirikof Island, Alaska. AMNWR staff were on Chirikof from May to September working on a separate project and collected juvenile fish samples from various freshwater systems throughout the island. ADF&G sent 2 staff members to Chirikof for 3 days during late August to collect genetic samples of salmonids and document fish distribution and habitat. Pink *Oncorhynchus gorbuscha*, and coho salmon *O. kisutch* were documented along with rainbow trout and steelhead *O. mykiss*. Other fishes observed included *Cottus spp.* (sculpin), *Gasterosteus spp.* (stickleback), and Dolly Varden *Salvelinus malma.* Genetic samples were taken from 2 populations of adult pink salmon and 3 populations of juvenile coho salmon.

Key words: Pink salmon, Oncorhynchus gorbuscha, coho salmon, Onocorhynches kisutch, rainbow trout, steelhead trout, Onocorhynchus mykiss, sculpin, Cottus spp., stickleback, Gasterosteus spp., Dolly Varden, Salvelinus malma, genetic sampling, Chirikoff Island.

# INTRODUCTION

Chirikof Island is situated remotely in the Gulf of Alaska approximately 129 km southwest of Kodiak Island and 134 km southeast of the Alaska Peninsula but within 63 km of the Semidi Islands and 74 km of Tugidak Island (Figure 1). Chirikof Island is part of the Alaska Maritime National Wildlife Refuge (AMNWR). The state waters surrounding the island are part of the Alaska Department of Fish and Game's (ADF&G) Kodiak Management Area. While the Chirikof waters (statistical area 258-83) open annually as part of commercial salmon management of the Kodiak eastside, due to its remoteness, there is no record of commercial salmon harvest dating back to 1970. Prehistoric studies suggest salmon being utilized as food for the indigenous peoples for at least 1,000 years (P. Saltonstall, curator of archeology Alutiiq Museum, May 12, 2015, personal communication). The anadromous waters catalog listing for streams on Chirikof Island only designate pink salmon *Oncorhynchus gorbuscha* (Johnson and Coleman 2014). However Withrow (2015) also documented coho salmon *O. kisutch* and Dolly Varden *Salvelinus malma* on the island while studying the avifauna.

Cattle were introduced to the island in the late 1800s as a food source for local residents and a larger number were transplanted throughout the 1900s as part of more industrial ranching prospects (Fields 2000). Commercial ranching ended in the 1990s and the longstanding federal grazing lease ended in 2000. Modern genetics studies have shown the existing cattle to be unique and highly differentiated likely due to natural selection in a harsh climate but genetically similar to the commercial breeds of Highland, Hereford, and Angus, but also Siberian Yakut cattle (McGinnis 2008).

In 1980, the AMNWR was established to conserve marine mammals, seabirds, other migratory birds on many of Alaska's remote islands. With the end of the cattle grazing lease in 2000 on the refuge's Chirikof Island, a solution was sought for the problem of cattle on the island. At that time, it was estimated that roughly 800 cattle existed on Chirikof. Federal officials believe the cattle population trample and consume vegetation imperative to nesting birds. Furthermore, archeologists studying the island recently have noted extensive erosion in areas trampled by cattle often destroying creeks that could be important salmon habitat. In 2003, attempts by a private company to remove cattle from the island were largely unsuccessful due to weather, logistics, and funding. The state of Alaska administration, at that time led by Governor Frank Murkowski, publicly opposed removal of the cattle from the island. Current state of Alaska administration has not commented publicly.

The most recent population surveys suggest over 2,000 cattle on the island, more than double the estimate in 2000. This has become a modern problem, where remnant animal populations historically used by pioneering people, have succeeded such that they now conflict with the contemporary mission statements and goals of protecting agencies. A renewed scoping process from 2013 to 2015 led by AMNWR invited public comment seeking alternatives (to extermination) to address the Chirikof Island cattle problem.

In 2015, a collaborative project between ADF&G and AMNWR assessed the salmon population existing on Chirikof Island. Juvenile and adult salmon observations were made throughout the season on various systems and fin clip tissue samples were collected and preserved for baseline genetic analysis.

# METHODS

## OVERVIEW

A 4-tiered approach to assessing salmon populations was utilized on Chirikof Island. The first component, juvenile salmon trapping was conducted by AMNWR staff during the summer. The second, third, and fourth components, a habitat survey and collection of genetic samples from juvenile and adults were performed by ADF&G staff with help from AMNWR in late August. The reconnaissance and data recorded by the AMNWR staff on salmon presence and absence was integral in determining genetics sampling and area targets by ADF&G in the late August field trip.

## JUVENILE TRAPPING

Juvenile trapping was planned on the major river systems and Southwest, Southeast, and East lakes (Figure 2). Sampling consisting of deploying minnow traps on each system once during the timeframe.

Traps were baited with cured (borax) and disinfected (betadine) salmon eggs and set at various locations throughout the system. Approximately 12 traps per system were deployed along channel banks and in any backwater areas. To avoid losing the traps, they were tethered with red twine and a metal stake or anchored with a rock. All locations or stakes were marked with brightly colored (blue) flagging. Areas that offered cover with slower moving, deeper water or cut banks were considered preferable relative to, the main flow of the river. Soak times varied, but a goal of approximately 4 hours of soak time during daytime, and overnight if set in the evenings was established. To ensure all traps were accounted for, trap number and location were noted in a rite in the rain notebook with landmarks or comments.

When checking traps, the trap was opened and the contents were poured into a white plastic dish pan half-filled with water. All fish were identified, enumerated and released, and all information was recorded. A small minnow net was used to count fish out of the dish pan. Juvenile fish identification standards were used to identify species. Photos were taken to document fish that were difficult to identify.

## JUVENILE COHO GENETICS

Juvenile salmon trapping was conducted in the Southwest, Chirikof, and South Cove rivers during late August (Table 2). Traps were baited with cured and fresh salmon eggs and set at various locations, similar to those described above. Traps were soaked for various amounts of

time, but were found to be effective for very short intervals, as short as 5 minutes. Coho salmon captured were sampled for genetic material by clipping the upper lobe of the caudal fin and placing it in a 250 ml bottle of ethanol for preservation.

### ADULT SALMON GENETICS

Tissue samples (fin clips) were collected from adult salmon encountered in Chirikof Island freshwater systems where available. Collections were made by department personnel in late August. A small beach seine was used to round haul schools of adult pink salmon. The tissue sample (axillary process) from the left side of fish (to avoid resampling) was collected. Genetic samples of juvenile coho salmon and adult pink salmon were taken and sent to the ADF&G's Gene Conservation Laboratory. The samples will be added to the pink and coho salmon baselines and integrated into future studies. The coho and pink salmon baselines are not currently well represented in southwest Alaska; however, it was valuable to opportunistically collect samples from these difficult-to-access locations.

### HABITAT SURVEY

Salmon habitat was surveyed to assess relative quality of spawning habitat, ease of access to river mouth from the ocean, and the general distribution of salmonids. The Southwest, South Cove, and Chirikof river watersheds were surveyed on foot and observations were made from the mouth of the rivers to the point in the watershed that adult salmonids were no longer observed.

## RESULTS

### JUVENILE TRAPPING

Juvenile trapping was conducted during July 17 through July 28 in 6 areas by AMNWR staff (Table 1). A total of 123 coho salmon, 697 Dolly Varden, 95 *Cottus spp.*(Sculpin), 124 *Gasterosteus spp.* (stickleback), and 1 rainbow trout *Oncorhynchus mykiss* were encountered in the trapping.

### JUVENILE COHO GENETICS

Coho were found to be plentiful in the Southwest, Chirikof, and South Cove rivers. The cured eggs were less effective in catching coho than the fresh pink salmon eggs. A total of 60 coho salmon were sampled in the Southwest River, 100 in the Chirikof River, and 53 in the South Cove River. Dolly Varden and stickleback were also caught in all areas

### ADULT SALMON GENETICS

Adult coho salmon were observed in small numbers (a total of approximately 20 fish) in the rivers, likely due to the early timing of the surveys. Pink salmon were abundant at the mouths of the Southwest and Chirikof rivers. Beach seine sets were made in the Southwest River where 110 pink salmon were sampled for genetics and in the Chirikof River where 197 pink salmon were sampled (Table 3). The mouth of South Cove River was packed with driftwood which likely precluded fish passage except under ideal tide and wave conditions (Figure 3). No adults were observed upstream of the log jam.

## HABITAT SURVEY

Only a small section of the South Cover River was surveyed, from the mouth to a log jam slightly upstream (Figure 3). A portion of the log jam appeared to have been in place for a long period of time, with a second portion, further inland, that was likely more transient in nature. Presence of juvenile salmonids above the log jam provides evidence that fish passage has occurred in recent years. Therefore, under the right conditions, fish likely escape into the South Cove River.

The River Styx was surveyed via ATV and no fish were observed. Unlike most streams on Chirikof, the River Styx was a higher gradient lower in the watershed, but was very shallow and spread out upon a sandy substrate (Figure 4). While upper reaches of the system appear to be vegetated, the lower reaches appear to be unsuitable for salmonid migration, spawning, and rearing.

The mouth to the short stream that drains East Lake was clogged with logs and water flow was subterranean, clearly precluding adult salmonid passage (Figure 5). AMNWR staff observed dramatic, frequent changes in beach grade and conditions during their residence time on Chirikof Island. A change in wind direction and wave dynamics could likely open the river mouth in a short amount of time.

The mouth to 3-Pond River did not appear passable to salmon migration due to logs and under gravel flow. Unlike other rivers on Chirikof, it did not appear that a change in wind conditions or tides would allow for fish migration due to the steep nature of the river. While 3-Pond River was in the Anadromous Waters Catalog for pink salmon, it did not appear that salmon had accessed the river in recent times and juvenile trapping did not encounter any anadromous fish but Dolly Varden were present (Table 1).

The Southwest and Chirikof rivers were surveyed from the mouth to points upstream that adult salmon were no longer observed. The habitat encountered was typical for low elevation salmon streams: deep, slow moving water and muddy substrate lower in the watershed and faster flowing, high gradient, and gravel substrates higher in the watershed.

In the Southwest River, pink salmon were observed in the river mouth and spread throughout the low gradient, slow moving water, with relatively few fish noted higher in the watershed. The water levels appeared to be high with pink salmon swimming through the marshy areas in the swollen lower portion of the river (Figure 6). Pink salmon were observed to approximately 3.2 river miles from the mouth. While no rainbow trout were observed by ADF&G staff during surveys, AMNWR staff were able to catch two fish with rod and reel in the Southwest River while sport fishing and genetic samples were taken by ADF&G staff.

Conversely, while the Chirikof River had a significant quantity of pink salmon near the river mouth similar to the Southwest River, few fish were observed in the slower moving water, and a larger quantity was observed higher in the watershed on the likely spawning grounds. Pink salmon were observed from the river mouth to approximately 1.6 miles upstream. In addition, a single female steelhead was observed in the upper portion of the Chirikof River. Attempts were made to capture the steelhead; however, they were unsuccessful.

# DISCUSSION

Most salmon streams on Chirikof Island appeared typical when compared to small streams located on exposed shoreline and low gradient watersheds. Many other salmon streams with mouths on high energy beaches in exposed areas are periodically blocked by log jams that restrict adult salmon passage. Changing wind direction can remove log jams and large waves and high tide cycles can allow salmon passage. It is possible however, that, in some years, salmon passage is blocked throughout the season.

The low gradient areas of Chirikof salmon streams are clearly frequented by cattle and likely result in increased erosion and muddy sections of the rivers (Figure 7). Salmon appear to transit those areas successfully to faster flowing, gravel substrate areas more suitable for spawning. It is unknown if juvenile rearing area is impacted by cattle presence through physical disturbance or alteration of water chemistry or visibility. The spawning areas appear suitable for salmon with reasonable flow, clarity, and gravel size. Pink salmon were observed spawning and the ubiquitous distribution of coho salmon juveniles suggests that coho salmon are successful spawners. While only a few adult coho salmon were observed in the rivers, the late August survey was still fairly early in coho salmon run timing typical in southwest Alaska and the bulk of fish would be expected later in the season.

The presence of rainbow trout and steelhead was unexpected on Chirikof Island. Only one juvenile rainbow (or steelhead) was encountered; however, the AMNWR staff observed larger rainbows, on the order of 300 mm, in the headwaters of the Southwest River. The timing for observing steelhead in the freshwater was early, therefore the single observation in Chirikof River was fortuitous. A higher frequency of observations may occur later in the season, however the small nature of all of the Chirikof Island streams preclude any large populations. A note in gray literature noting that in 1949 "…a lot of large fish (sorta like rainbow), that we could catch all winter long…" suggests that rainbow-steelhead have been on Chirikof Island for many years (Ardinger 1982). Genetic samples from the two rainbow trout were sent to the US Fish and Wildlife Conservation Genetics Laboratory. Dolly Varden, stickleback, and sculpin distribution on Chirikof Island is typical of southwest freshwater systems (Figure 8). There were several other lakes on Chirikof Island that were not investigated and could have contained fish.

The assessment of salmon on Chirikof Island documented pink and coho salmon in several streams. Because salmon population size scales with available habitat, the size of Chirikof Island streams support salmon populations that are small. Given the remoteness and cost of accessing Chirikof Island, much like the cattle, the populations of salmon probably have low commercial value.

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# TABLES AND FIGURES

Table 1.– Juvenile fish catch on Chirikof Island.

| | | Juvenile Fish Catch | | | | |
|---|---|---|---|---|---|---|
| Location | Sample Date | Coho | Dolly Varden | Sculpin | Stickleback | Rainbow |
| East Lake | 26-Jul | 1 | 7 | 0 | 3 | 0 |
| East River | 27-Jul | 3 | 25 | 45 | 0 | 0 |
| 3-Pond River | 20-Jul | 0 | 118 | 0 | 15 | 0 |
| River Styx | 28-Jul | 0 | 35 | 0 | 0 | 0 |
| Chirikof River | 21-Jul | 35 | 222 | 0 | 2 | 1 |
| Southeast Lake | 22-Jul | 0 | 39 | 50 | 7 | 0 |
| Southeast River | 18-Jul | 34 | 224 | 0 | 0 | 0 |
| Southwest Lake | 17-Jul | 38 | 2 | 0 | 96 | 0 |
| Southwest River | 18-Jul | 12 | 25 | 0 | 1 | 0 |
| Total | | 123 | 697 | 95 | 124 | 1 |

Table 2.– Juvenile coho salmon genetic sampling on Chirikof Island.

| Location | Date | Juvenile Coho salmon Genetic Samples |
|---|---|---|
| Southwest River | 8/26/2015 | 60 |
| Chirikof River | 8/27/2015 | 100 |
| South Cove River | 8/28/2015 | 53 |
| Total | | 213 |

Table 3.– Adult pink salmon genetic sampling on Chirikof Island.

| Location | Date | Adult Pink salmon Genetic Samples |
|---|---|---|
| Southwest River | 8/26/2016 | 110 |
| Chirikof River | 8/27/2015 | 197 |
| Total | | 307 |

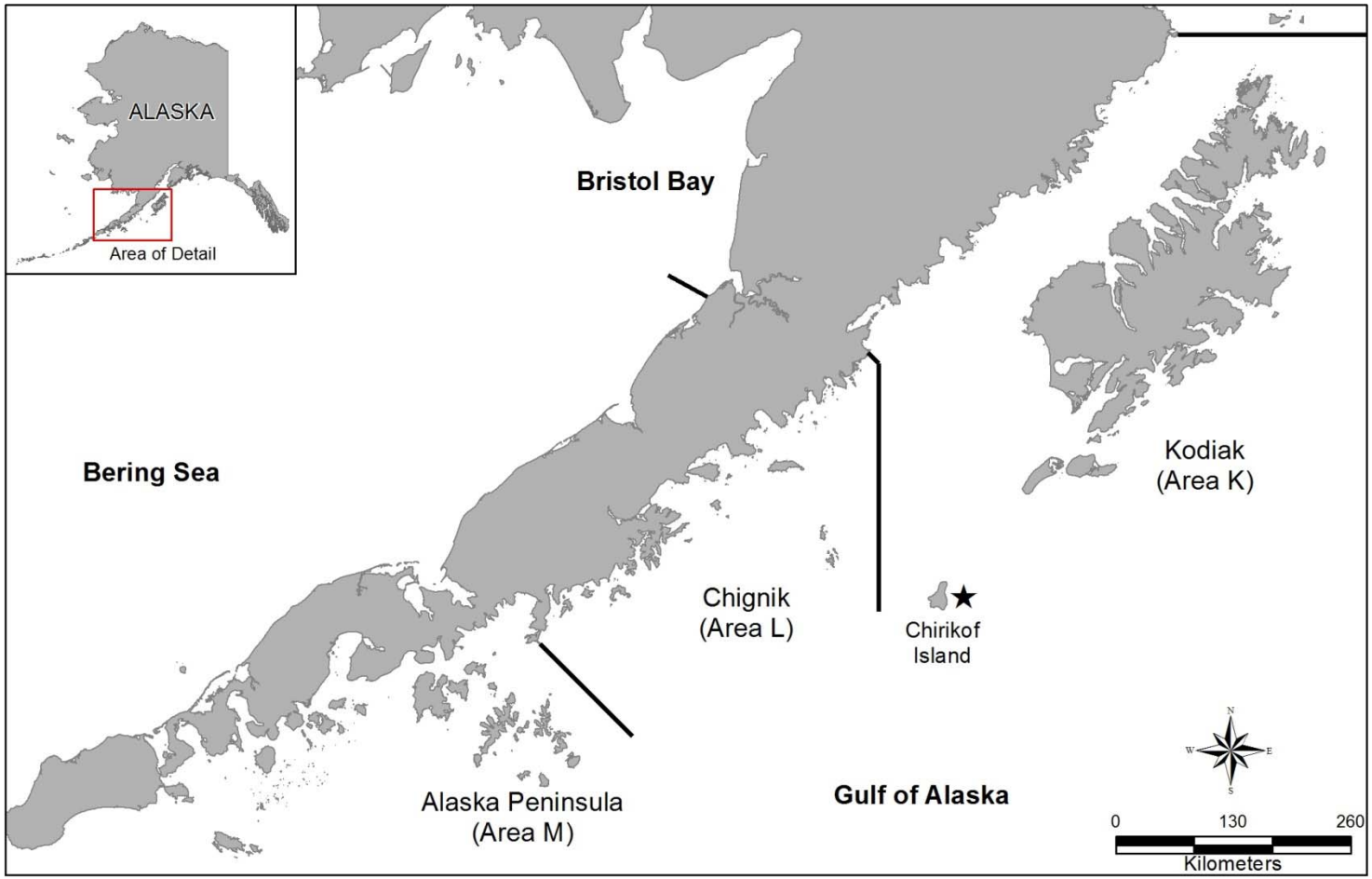


Figure 1.–Map depicting Chirikof Island in relation to the salmon management areas of the Westward Region.

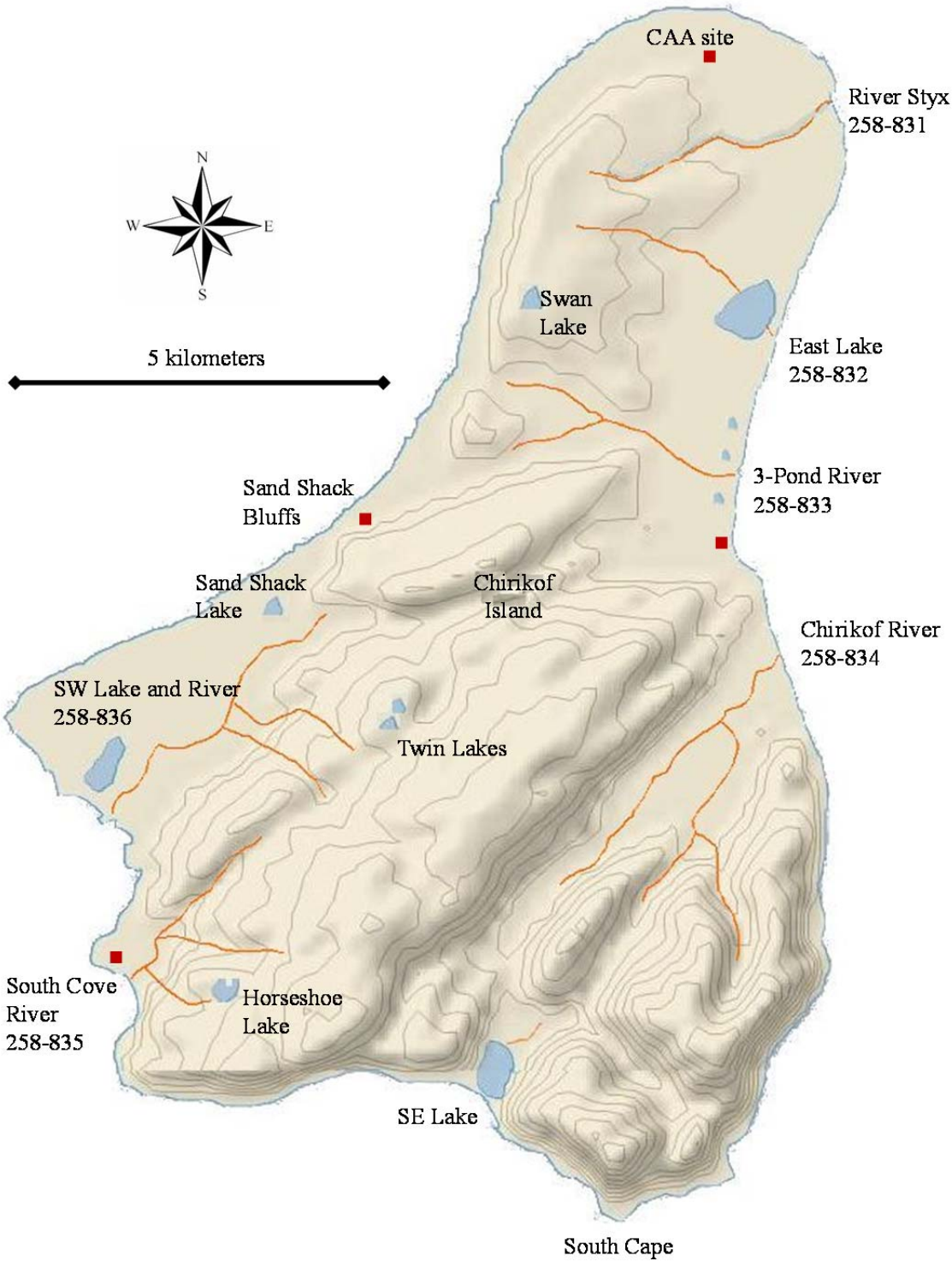


Figure 2.– Map depicting Chirikof Island, stream systems, and major landmarks.

Figure 3.– The log jam in the mouth of the South Cove River.

Figure 4.– Shallow, flowing water in the River Styx.

Figure 5.–Water seeping through rocks at the blocked mouth of East Lake.

Figure 6.–Pink salmom swimming through the grass in apparent high-water conditions in the Southwest River.

Figure 7.– An area low in the Chirikof River drainage apparently frequented by cattle.

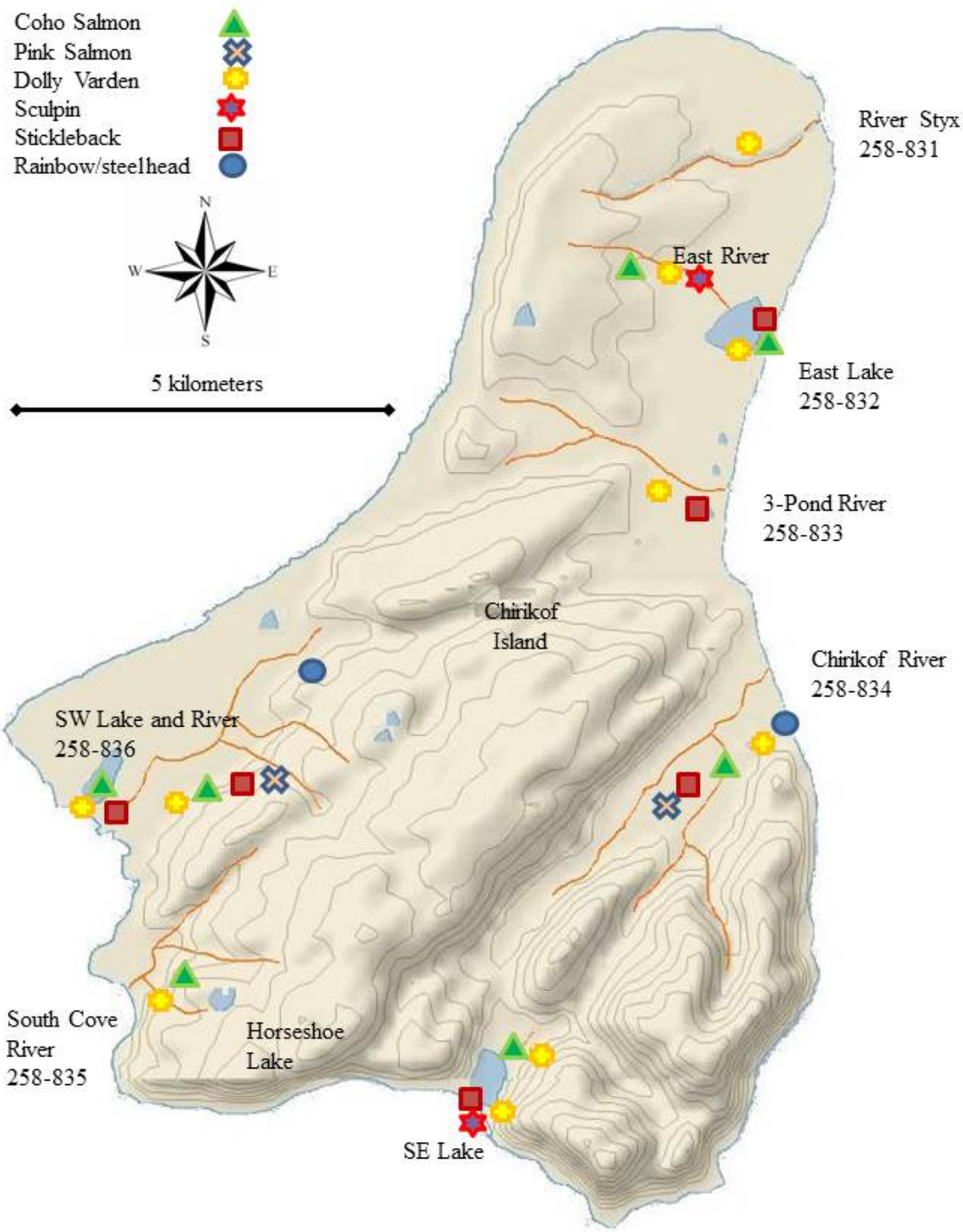


Figure 8.– Species distribution of fish observed on Chirikof Island.