FALL 2013 SUBSISTENCE FISHERY MONITORING ON THE COLVILLE RIVER

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FINAL REPORT

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We depend every year on the outstanding and welcoming support of the residents of Nuiqsut. They made our seventh year working out of the village as fun and eventful as ever! We thank members of the Qaaktaq Panel who continue to provide valuable support to our sampling crew throughout the year. Thanks also to the Kuukpik Subsistence Oversight Panel, Inc. (KSOPI). We thank the Kuukpik Hotel staff for the comfortable accommodations and good food and the Nanuq Corporation and its employees for entertainment and insights as they prepared for the ice road season. We thank Larry Moulton for his continued support over the years. As always, we are indebted to all the fishermen and women who graciously offered their harvest data, advice and insights during the 2013 fall fishery.

INTRODUCTION

In 2013, ABR worked with key fishery stakeholders in Nuiqsut, Alaska, to continue long-term monitoring of the Colville River subsistence fishery, which is conducted each fall after freeze-up in the Niġliq Channel of the Colville River. The 2013 subsistence fishery monitoring program is a continuation of long-term studies that have taken place annually since 1985 (no data were collected in 1999). Monitoring has been conducted by several contractors over that time period (MJM Research [1985–2005], LGL Alaska Research Associates [2006]), and ABR [2007–present]) on behalf of ConocoPhillips Alaska, Inc. (CPAI), and its predecessors (see Daigneault and Reiser 2007 and Moulton et al. 2006). The monitoring program has historically focused primarily on the fall harvest of Arctic Cisco (*Coregonus autumnalis*; Qaaktaq, in Iñupiaq), which are a staple in the diet of Nuiqsut residents and traded widely with other northern Alaska communities. However, the program also attempts to quantify harvest of other subsistence species captured in the *Qaaktaq* fishery. The primary impetus for the monitoring program is concern that oil and gas exploration and development in the nearshore marine environment and, more recently, on the Colville River delta (henceforth the Colville delta) could adversely affect these anadromous or amphidromous fish. Furthermore, in recent years this monitoring program has continued as mandated under stipulations defined by the CD-4 development permit issued by the North Slope Borough (NSB04-117, 2004). The 2013 harvest monitoring of the fall fishery marks the ninth year of a ten year study commitment by CPAI. The main goals of the monitoring program have been to obtain estimates of the total fishing effort and catch and more recently to monitor other environmental components of the fishery.

ABR continues to implement the Arctic Cisco fall fishery monitoring program as conceived during a series of community meetings with fishery stakeholders in 2007 (Seigle et al. 2008a). The result of those stakeholder meetings was that 1) ABR worked with the community of Nuiqsut to formulate a plan for continuing long-term fishery monitoring each fall and, 2) ABR made a commitment to continue working with the community via interactions with a Qaaktaq Panel of expert fishers to ensure that community concerns are continually incorporated into the monitoring plan. This process has been successful to date, and subsequently the monitoring program has been working closely with fishers and other stakeholders to keep all parties abreast of developments in the fishery. As an integral part of the monitoring program, ABR has conducted numerous meetings with community members and a *Qaaktaq* Panel (composed of expert participants in the fishery) before, during, and after the fishing season, and has offered assistance to fishers on the ice whenever seeking interviews. The objectives of the monitoring program in 2013 were to:

- Continue working with key stakeholders as per agreements made in 2007 (Seigle et al. 2008a, Appendix 1).
- Monitor the harvest of Arctic Cisco throughout the fishing effort, using interviews of fishery participants.
- Record the number of nets fishing at any given time and net dimensions and locations during the season.
- Document the subsistence fishery harvest.
- Collect age, length, and weight information for a subsample of Arctic Cisco harvested.
- Measure water salinity and water and sediment chemistry (i.e., testing for metals and petroleum-based organic compounds) in primary fishing areas.
- Compare the 2013 results with those of previous years for this program and other historical data.
- Continue to raise awareness for, and maintain a high level of participation in, the Qaaktaq Panel meetings.

BACKGROUND

Very little was known of the basic life history characteristics of Arctic Cisco until fish monitoring studies were initiated by the oil industry in the nearshore environments of the Prudhoe Bay region in the early 1980s (Gallaway et al. 1983). Those

studies discovered that all Arctic Cisco in Alaska originate in the Mackenzie River system in Canada. Young-of-the-year drift downriver into the Beaufort Sea in early summer, and prevailing easterly winds and ocean currents transport these young fish passively along the Beaufort Sea coast to the west. The number of young-of-the-year Arctic Cisco (i.e., recruitment strength) in Alaska and the Colville River region is correlated with the consistency and strength of easterly winds in the Beaufort Sea region during summer (Fechhelm and Fissell 1988). This wind- and ocean current-driven recruitment process largely determines the age structure of Arctic Cisco in Alaska (Gallaway and Fechhelm 2000), and the number of young-of-the-year Arctic Cisco at Prudhoe Bay (the site with the longest records on abundance of young-of-the-year Arctic Cisco) is highly correlated with harvest rates for the Colville fishery 5–7 years later (ABR et al. 2007). It was predicted that starting in 2011, above-average harvest of Arctic Cisco would occur for the foreseeable future (Larry Moulton 2008, personal communication). Indeed, catch per unit of effort in the Colville River during 2011 and 2012 were among the highest ever recorded (Table 3 *in* Seigle and Gottschalk 2011 and 2012).

Young Arctic Cisco in Alaskan Beaufort Sea waters spend their summers feeding in deltas and nearshore brackish waters before returning to deep pools of the Colville River for over-wintering (Craig 1984, Moulton et al. 1986). After achieving maturity (females at age 7–8, males at age 6–7), Arctic Cisco migrate during summer to their source rivers within the Mackenzie River system for fall spawning (Figures 1 and 2). These adult fish do not return to rearing streams in Alaska but rather stay in the Mackenzie system where they continue to spawn well into their teen-aged years (Craig and Halderson 1981, Gallaway et al. 1983, Bond and Erickson 1985, Bickham et al. 1989, Moulton 1989, Bond and Erickson 1997).

The Arctic Cisco fishery on the Colville delta is an under-ice fishery that yielded an average of 8,743 kg (19,200 lbs) of Arctic Cisco annually between 1985 and 2003 (Moulton and Seavey 2004). The subsistence fishery is conducted almost exclusively on the Niġliq Channel of the Colville River (Figure 2). A commercial Arctic Cisco fishery was operated by the Helmericks family on the Main Channel of the Colville River for ~50 years starting in the early 1950s. In 1993, the year with the highest combined harvest from these two fisheries, ~78,254 fish (31,340 kg) were taken on the Colville delta (Moulton and Seavey 2004). In contrast, only 5,859 fish (2,799 kg) were harvested in 2001, which was the lowest harvest on record. This substantial annual variability in harvest rates, coupled with increased development by the oil and gas industry within the range of Arctic Cisco, have raised concerns among subsistence users and other stakeholders about the population status of Arctic Cisco in Alaska. In 2003, the Minerals Management Service (MMS) convened a workshop in Nuiqsut to review the issue of variability in annual harvest of Arctic Cisco, from perspectives of both the subsistence community and scientists researching this species (MBC Applied Environmental Sciences 2004). Following the workshop, MMS commissioned a study to review and synthesize all available information from scientific studies and from subsistence users to assess the status of the Arctic Cisco population in Alaska and to evaluate the effects of anthropogenic disturbances on the fish (ABR et al. 2007). This study relied heavily on data collected since 1985 on the subsistence fishery in Nuiqsut (i.e., this long-term monitoring program).

METHODS

STAKEHOLDER MEETING

ABR has not held a stakeholder meeting with the *Qaaktaq* Panel of expert fishers to discuss the 2013 fishery as of this reporting. Typically, these Panel meetings occur in the fall of each year and the their purpose is to (1) summarize the previous year's fishery results (in this case 2012) in the context of historical records and to discuss the current year's ongoing fishery (in this case 2013), (2) continue to work with active fishers to get their perspective on the 2013 fall fishery as it unfolds, and (3) collect comments from the panel highlighting their concerns about the fishery to relay to CPAI. The Panel meeting was pushed back until the spring or summer of 2014 due to scheduling conflicts and will be reported in a subsequent draft of this report or in the following year's report.

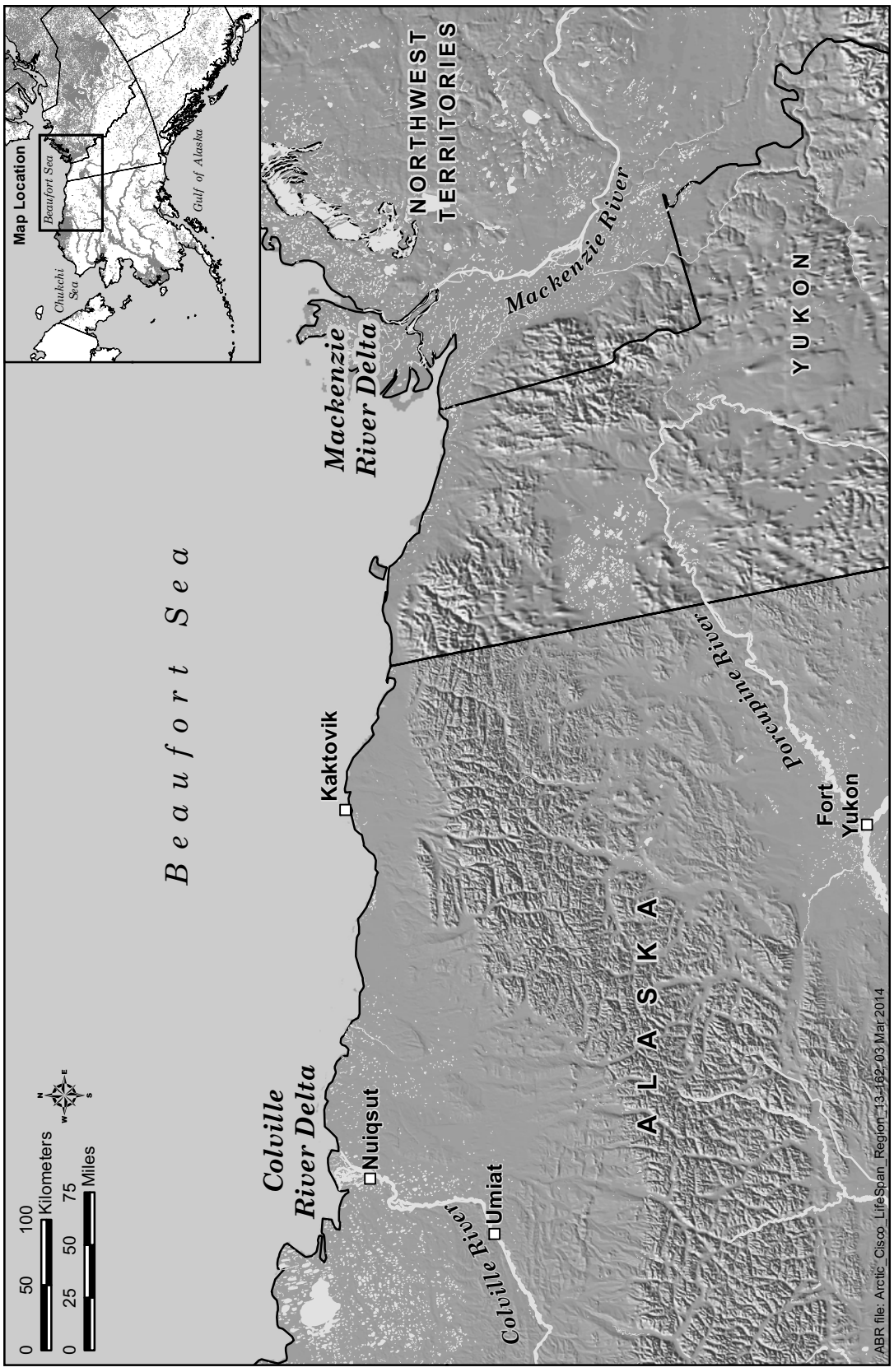


Figure 1. Waters important to the life history of Arctic Cisco in Canada (Mackenzie River drainages) and Alaska (Colville River delta) and the nearshore Beaufort Sea.

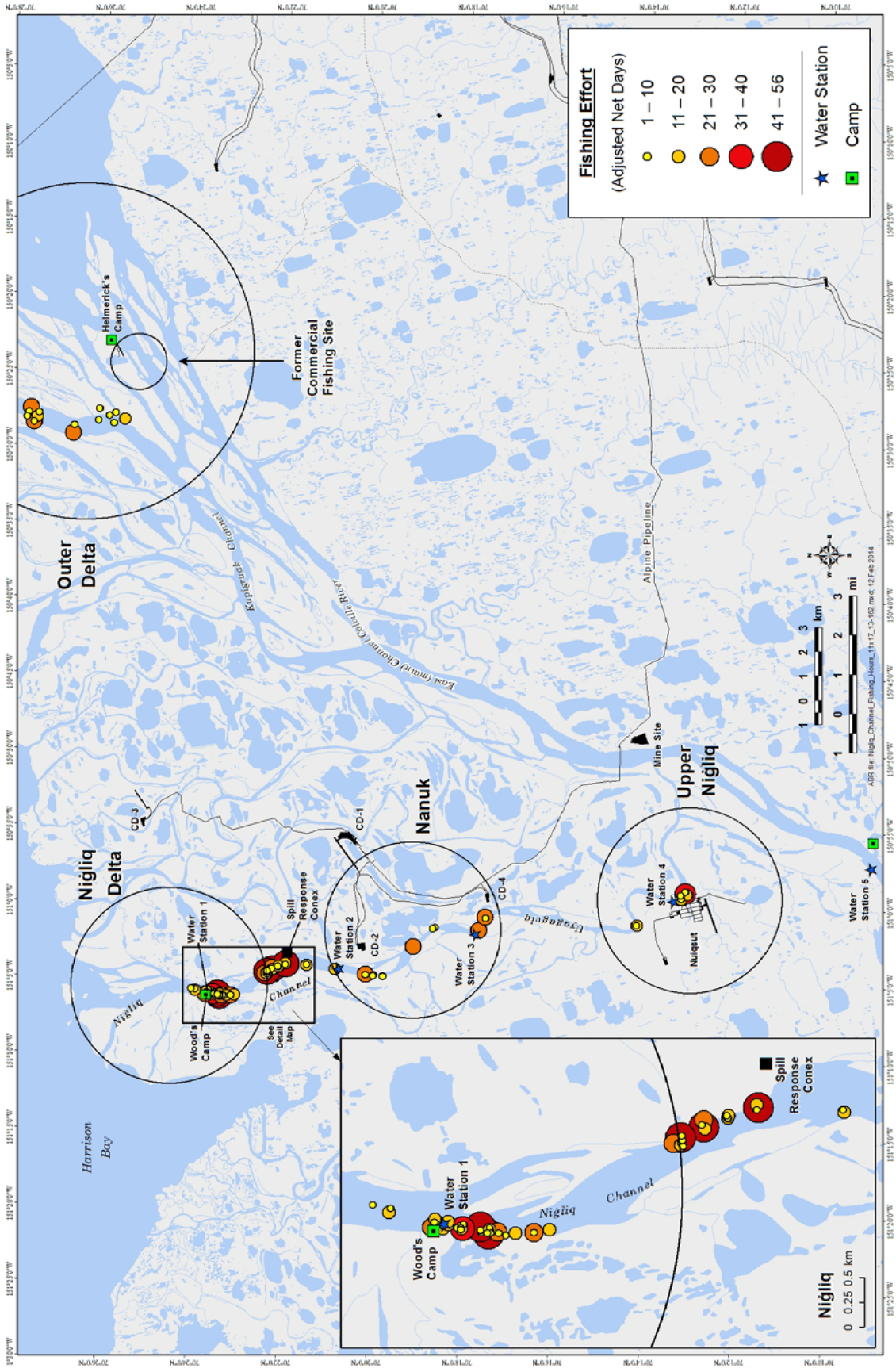


Figure 2. Salinity stations and net sites in each of the 3 main subsistence fishing areas in the Niġliq Channel of the Colville River, Alaska, 2013. The amount of effort for each net set (adjusted net-days) is depicted by both color and the size of the net symbol.

However, due to concerns over a water-born mold that affected the Broad Whitefish *(Coregonus nasus)* fishery in 2013 (summarized in Appendix A), the ABR fish survey team (John Seigle and Sabrina Garcia) was invited to a meeting on 17 October convened by the Kuukpik Subsistence Oversight Panel (KSOP) board to discuss the status of the water mold, its possible source, and whether it was safe to eat fish caught in the Colville River. Some members of the *Qaaktaq* Panel were present for this meeting. During the KSOP board meeting, members of the board, along with representatives from CPAI, the North Slope Borough (NSB), and ABR discussed concerns related to the water mold and its effects on subsistence fish as well as a plan for monitoring the mold over the course of the 2013 fall fishery and into 2014.

FISHERY EFFORT AND HARVEST

Three traditional fishing areas hosted the majority of concentrated fishing efforts within the Niġliq channel in 2013 (Figure 2). From upstream to downstream, these are the Upper Niġliq area (adjacent to the town of Nuiqsut), the Nanuk area, and the Niġliq Delta area (includes nets between the Nanuk and Niġliq Delta areas). A fourth traditionally used area, the Uyagagviq area (Figure 2), was not fished by Nuiqsut residents in 2013. For the fourth consecutive year, fishing effort was observed in the Main Channel (Kupigruak Channel) of the Colville River following a multi-year hiatus where no fall harvest occurred.

The fishery monitoring team always included two scientists from ABR. The remaining team members were local residents of Nuiqsut: Richard Tukle and Archie Nukapigak. Special assistance was frequently provided by past team member, Jerry Pausanna of Nuiqsut. ABR fishery monitors traveled each day by snow machine to the more intensively fished areas of the Colville River to conduct interviews for harvest assessment. When a member of the monitoring team observed a fisher on their way to or from a harvest, permission was asked to either assist in the harvest or to conduct an interview and assess the recently completed harvest event. During interviews, ABR scientists recorded net length, net mesh size, and start and end times for that particular harvest event. If a fisher expressed desire to work alone or to not participate in an interview, the monitoring team respected those wishes and moved on to another net.

As in years past, fishers used a variety of net lengths and mesh sizes depending on individual preferences. For this reason, in calculating fishing effort (i.e., net-days), net length and effort were adjusted to a standardized 18 m (60 ft) net length and full-day (24 hour) set duration. For example, if an 80 ft net was used during a 24 hour period, fishing effort was calculated as 80 ft/60 ft × 1 day = 1.3 days of adjusted effort. Catch per unit effort (CPUE), expressed as catch per net-day, was calculated using these adjusted estimates of effort. Because nets of different mesh sizes capture different sizes of fish at different rates, we specify when data presentations are broken down by mesh size, when they include all mesh sizes, or when they are limited to the most frequently used mesh of 7.6 cm (3 in). CPUE was calculated for all mesh sizes, but is most commonly reported for nets with 7.6 cm mesh as this has historically been the most fished mesh size in the Arctic Cisco fall fishery.

In the event that the fishery monitoring team did not actually witness a harvest, interviews with fishers were conducted the next time the team crossed their path (usually within 24–48 hours). Variations of the following questions were asked:

- How many nets are you fishing?
- How long have your nets been actively fishing (helps define total season effort)?
- What are your net dimensions?
- How many *Qaaktaq* did you harvest in each net?
- How many fish of other species did you harvest?
- How often are you checking your nets (helps monitors determine when to meet fishers)?
- Do other people check your nets (helps monitors recognize when friends or relatives are assisting the net owner)?
- Where is your net and has it been moved recently (helps monitors determine location and end times for calculating effort in specific river sections)?

Catch data from these post-harvest interviews was included in the overall "observed" harvest assessment even if it was unclear which nets fish had been captured in (i.e., the fisher knew how many fish he/she caught in a day but could not say how many fish were caught in individual nets of varying mesh sizes and net lengths). Reported harvest numbers from these interviews were used in CPUE analysis only if the fisher also knew the number of days each net fished and the number of fish caught in nets of each mesh size. In 2013, as in previous years, ABR distributed a "North Slope Fisheries Logbook" to interested fishers (Appendix B). These books were distributed to fishers to assist them in tracking their personal harvests year-round. Several fishers chose to share their daily harvest information throughout the fall fishing season, bolstering ABR's observational efforts.

LENGTH, WEIGHT, AND AGE OF CATCH

After fish were removed from each net, they were enumerated and a sub-sample was measured for fork length (to the nearest mm). The harvest from each specific net was enumerated separately. The standard routine for sub-sampling from each net's catch was to lay out all fish of each species side-by-side on the ice in no particular order. Depending on the number of fish in the harvest and the amount of time available for the interview, monitors measured every second, third, or fourth fish from a specific net. The monitoring team endeavored to enumerate and measure Arctic Cisco first and other species, including Least Cisco (*Coregonus sardinella*), as time permitted, mainly because Arctic Cisco were the target species of fall fishing and monitoring efforts.

The total number of fish measured on a given day varied depending on several factors including a fisher's availability, the total number of fish caught in the net, and the number of fishers in the area. When several fishers were harvesting simultaneously in the same area, monitors attempted to obtain a sub-sample of measurements from every fisher. When possible, ABR paid a participation honorarium to fishers who were willing to donate a sub-sample of fish from their harvest for age and length–weight analysis (~10/day at $10/fish) or who otherwise provided detailed information about their fishing efforts and harvests outside of normal daily encounters with the monitoring team. The monitoring team was primarily interested in fish caught with 7.6 cm mesh nets, although fish from other known mesh sizes were accepted. The fish were kept frozen and transported to Anchorage where they were measured for fork length (mm) and weight (g) using a top-loading electronic scale.

Otoliths (sagittae) were extracted for aging at a later date. Otoliths were cleaned with tap water and stored in 96 well pipette trays. Otoliths were embedded in resin molds and then thin-sectioned in the transverse plane following the methods of Secor et al. (1992). The thin-sectioning process exposes the annuli of each otolith for the ageing process. The otolith preparations were examined under a dissecting microscope at 25× magnification using reflected light. Alternating bands of dark and light on the otolith correspond to winter and summer growth, respectively, and together represent one year's growth. Following methodologies used in previous years, the central core region of the otolith, composed of a dark and light region, was recognized as the first summer and winter growth of an age zero fish. All annuli outside this region were then counted to determine the age of the fish. Each fish was aged by two individuals and read at least three times with additional readings as necessary to arrive at an agreement on the age of each fish.

SALINITY MEASUREMENTS AND WATER CHEMISTRY

As in previous years, water salinity was measured every other day (weather permitting) at the same four water sampling stations used in previous years that correspond to areas of intense fishing (Figure 2). Warm weather prevented the monitoring team from travelling over the ice during 18–20 October and a shift in focus towards monitoring the water mold (Appendix A) delayed salinity measurements until 21 October. At these stations, surface ice was removed and the sampling probe from a YSI Professional Plus meter was lowered into the water. Salinity was measured in parts per thousand (ppt) and was recorded at the surface and at 0.5 m increments of depth until the probe reached the river bottom. The monitoring team also measured ambient water chemistry,

temperature (° C), pH, dissolved oxygen (% and mg/L), specific conductance (µS/cm), and conductivity (µS/cm) at a depth of 3 m. At the end of each sampling event, a small piece of insulation was used to cover the hole in the ice to prevent it from freezing completely shut.

On three dates, 17 October, 21 October, and 24 October, ABR collected water samples for detailed chemical analyses by Arctic Fox Environmental, Inc. (Arctic Fox), in Prudhoe Bay, Alaska. Samples were collected at the water stations in the Niġliq Delta fishing area near Woods' Camp, in the Nanuk fishing area, and in the Upper Niġliq fishing area closest to Nuiqsut. ABR collected an additional water sample from a fifth water station located upstream of Nuiqsut where infected Broad Whitefish were caught during several sampling events in 2013 (see Appendix A). Water samples were collected at a depth of 3 meters using a van Dorn 4.2 l, β acrylic horizontal water column sampler. Water sample aliquots were poured directly from the sampler into pre-rinsed glass and polypropylene bottles provided by Arctic Fox and were kept cool until shipment to Prudhoe Bay (see Appendix E for laboratory results). Analyses included total metals (arsenic, barium, cadmium, chromium, lead, selenium and silver; EPA 6020), mercury (method 7470A), total nitrogen (NO3 + NO2; EPA 353.2), diesel range organics (DRO), and residual range organics (RRO) (AK102 and 103).

SEDIMENT ANALYSIS

As in previous years, benthic sediment samples were collected on 24 October at each of five water stations (Figure 2) for laboratory analysis of metals and diesel and residual range organics. Sediment samples were collected with an Ekmann dredge from the river bed and immediately transferred to non-reactive plastic bottles, and kept cool until shipping. Samples were transferred to coolers and shipped to TestAmerica Laboratories, Inc., Portland, Oregon, for analysis.

RESULTS

FISHERY EFFORT AND HARVEST

ABR fishery biologists arrived in Nuiqsut on 14 October 2013, following the start of the Arctic Cisco fishery. In 2013, the Arctic Cisco subsistence harvest began on 9 October, almost two weeks earlier than its start in 2012 (Table 1). One fisher commenced fall fishing under ice for Broad Whitefish with 14 cm mesh gill net on 7 October upstream on the Main Channel of the Colville River, south of Nuiqsut. This mesh size is too large for Arctic Cisco and was excluded from harvest estimates. The 9 October start date is later than the median (7 October) and average (8 October) start

Table 1. Estimated onset of the fall subsistence fishery for Arctic Cisco in the Niġliq Channel of the Colville River, Alaska, 1985–2013.

Year	Start Date
1985	2 October
1986	3 October
1987	8 October
1988	14 October
1989	22 October
1990	6 October
1991	12 October
1992	26 September
1993	3 October
1994	3 October
1995	16 October
1996	28 September
1997	13 October
1998	28 September
1999	–
2000	3 October
2001	6 October
2002	14 October
2003	16 October
2004	9 October
2005	7 October
2006	14 October
2007	4 October
2008	4 October
2009	6 October
2010	5 October
2011	13 October
2012	21 October
2013	9 October
Average	8 October

date during the last 27 years of harvest monitoring. Arctic Cisco fall fishery start dates over the last 10 years range from 4 to 21 October.

ABR harvest monitors recorded 376 harvest events in 2013 compared to 267 harvest events in 2012. Twenty-eight households deployed 66 unique nets during the fall fishery in 2013 (Table 2, Figure 3), 17 more nets than were deployed in 2012 and more than the average (56) and median (55.5) nets deployed since 1985. The total number of nets deployed in 2013 was the third highest number deployed since 2004. Fifty-eight of 66 nets were deployed in the Niġliq Channel in 2013. The remaining 8 net sets were located in the Main Channel. Fishing began 9 October and ended on 17 December in the Nigliq Channel. Fishing began on 15 October and ceased on 3 November in the Main Channel.

A total of 10 nets were deployed in the Niġliq Channel on 9 October. The number of nets deployed rose steadily until reaching its peak early in the season on 16 October (Figure 4). Although early season temperatures were cold enough that 2013 fall fishing began earlier than in 2012, fishing effort was reduced from 18–22 October due to above freezing temperatures that resulted in unstable ice conditions. Others fishers simply left their nets in place until ice conditions improved but did not harvest. Starting 22 October, the number of nets fishing the Niġliq and Main Channel increased until 2 November and then slowly decreased until the end of the fishing season. Two nets continued to fish in the Upper Niġliq from 29 November until the end of the season on 17 December.

The peak of 2013 net activity on the Niġliq Channel occurred from 15–18 October compared to 31 October–4 November in 2012. At the time of ABR's departure from Nuiqsut on 21 November 2013, five nets were actively fishing the Niġliq Channel as compared to 16 active nets when ABR departed Nuiqsut on 20 November 2012. It was determined through daily contact with fishers via email and phone that all but two nets had been pulled from the river by 28 November. Two nets remained active adjacent to town until 17 December.

After standardizing for net length, a total of 1,429 adjusted net-days of fishing effort were calculated for 2013, with 1,311 in the Niġliq Channel and 118 in the Main Channel (Table 2). This represents a 69% increase in fishing effort compared to 2012 (1,429 versus 847 adjusted net-days). In the Niġliq Channel, fishing effort was highest in the Niġliq Delta area at 60% of the total, followed by the Nanuk area at 25%, and the Upper Niġliq at 15% (Figure 5). Fishing effort in the Niġliq Delta increased 8% from 2012 to 2013.

The most frequently deployed mesh size of nets in the Nuiqsut fall fishery has traditionally been 7.6 cm, and this continued in 2013. Thirty-eight of 58 nets deployed in 2013 in the Niġliq Channel were 7.6 cm mesh nets (Table 2). In the Niġliq Channel, 5,460 Arctic Cisco were documented during harvest monitoring in 7.6 cm mesh nets which was 1,352 fish lower than were harvested from 7.6 cm mesh in 2012. The number of Arctic Cisco captured in 7.6 cm mesh in 2013 was similar to the number of Arctic Cisco captured in 7.6 cm mesh nets on average over the previous 27 years (n = 5,236) (Table 3, Figure 6). The total documented catch in 7.6 cm mesh nets decreased by 55.1% in the Nanuk section of the Niġliq Channel while documented harvest numbers increased 290% in the Upper Niġliq compared to 2012 (Table 3, Figure 6). An additional harvest of 438 Arctic Cisco was documented for 7.6 cm nets in the Main Channel, down from 1,184 Arctic Cisco in 2012.

For the purposes of this report, CPUE (expressed as catch per adjusted net-day) in the Niġliq Channel was calculated for nets of 7.6 cm mesh (standardized to 18 m length) because this is the dominant net used in the fishery. The 2013 CPUE in 7.6 cm mesh nets for Arctic Cisco in the Niġliq Channel was highest in the Nanuk area (15.0 fish per adjusted net-day) followed by the Niġliq Delta area (13.9 fish/adjusted net-day) and the Upper Niġliq area (7.0 fish/adjusted net-day) (Table 3). In 2012, the Niġliq Delta area had the largest CPUE (31.2 fish/adjusted net-day) followed by the Nanuk area (27.2 fish/adjusted net-day). In 2013, the total CPUE in 7.6 cm mesh nets for Arctic Cisco in the Niġliq Channel (13.2 fish/adjusted net-day) was the eleventh lowest in the history of the monitoring program and the third lowest over the last 10 years (Table 3, Figure 7). CPUE in 7.6 cm nets in the Main Channel was 14.3 fish per adjusted net-day compared to 52.2 in 2012 (Table 4). In 2013, the daily average CPUE in 7.6 cm mesh nets in the Niġliq Channel peaked on 24

Table 2. Total fishing effort (adjusted net-days) recorded for the fall subsistence fishery for Arctic Cisco, Niġliq and Main Channel, Colvillle River, Alaska, 2013.

Fisher Code	Fishing Location	Net	Net Code	Length (m)	Start Date	End Date	Stretched Mesh (cm)	Net Days	Adjusted Net Days
16	Nanuk	A	1316A1	24.4	10/12/13	11/18/13	6.4	37	49.3
16	Nanuk	B	1316B1	24.4	10/12/13	11/15/13	8.9	34	45.3
16	Nanuk	C	1316C1	18.3	10/26/13	11/18/13	8.9	23	23.0
16	Nanuk	D	1316D1	18.3	10/26/13	11/15/13	8.9	20	20.0
24	Nanuk	A	1324A1	30.5	11/6/13	11/12/13	7.6	6	10.0
25	Nanuk	A	1325A1	18.3	10/15/13	10/28/13	7.6	13	13.0
25	Nanuk	B	1325B1	18.3	10/15/13	11/28/13	8.9	44	44.0
25	Nanuk	C	1325C1	24.4	10/15/13	10/23/13	8.9	8	10.7
25	Nanuk	D	1325D1	30.5	10/23/13	11/2/13	7.6	10	16.7
25	Niġliq	D	1325D2	30.5	11/4/13	11/17/13	7.6	13	21.7
27	Upper Niġliq	A	1327A1	18.3	11/3/13	11/7/13	7.6	4	4.0
28	Upper Niġliq	A	1328A1	18.3	10/11/13	10/13/13	7.6	2	2.0
28	Nanuk	A	1328A2	18.3	10/13/13	10/17/13	7.6	4	4.0
28	Niġliq	A	1328A3	18.3	10/26/13	10/30/13	7.6	4	4.0
28	Niġliq	B	1328B1	24.4	10/27/13	10/30/13	8.9	3	4.0
30	Main	A	1330A1	24.4	10/16/13	10/19/13	7.6	3	4.0
30	Main	B	1330B1	24.4	10/16/13	10/19/13	7.6	3	4.0
30	Nanuk	A	1330A2	24.4	11/1/13	11/8/13	7.6	7	9.3
30	Nanuk	B	1330B2	24.4	11/1/13	11/8/13	7.6	7	9.3
31	Nanuk	A	1331A1	18.3	11/10/13	11/16/13	7.6	6	6.0
32	Nanuk	A	1332A1	24.4	10/18/13	11/10/13	7.6	23	30.7
32	Nanuk	B	1332B1	24.4	10/18/13	11/10/13	7.6	23	30.7
33	Niġliq	A	1333A1	24.4	10/15/13	10/18/13	7.6	3	4.0
33	Niġliq	A	1333A2	24.4	10/22/13	11/5/13	7.6	14	18.7
33	Niġliq	A	1333A3	24.4	11/5/13	11/9/13	7.6	4	5.3
33	Niġliq	B	1333B1	15.2	10/15/13	10/18/13	8.9	3	2.5
33	Niġliq	B	1333B2	15.2	10/23/13	11/2/13	8.9	10	8.3
33	Niġliq	B	1333B3	15.2	11/2/13	11/5/13	8.9	3	2.5
33	Niġliq	B	1333B4	15.2	11/5/13	11/9/13	8.9	4	3.3
33	Niġliq	C	1333C1	30.5	10/27/13	11/9/13	7.6	13	21.7
48	Niġliq	A	1348A1	18.3	10/10/13	10/18/13	7.6	8	8.0
48	Niġliq	B	1348B1	18.3	10/10/13	10/18/13	7.6	8	8.0
49	Niġliq	A	1349A1	30.5	11/5/13	11/11/13	6.4	6	10.0
49	Niġliq	B	1349B1	24.4	11/6/13	11/18/13	7.6	12	16.0
51	Niġliq	A	1351A1	18.3	10/10/13	10/18/13	8.9	8	8.0
51	Niġliq	B	1351B1	24.4	10/10/13	10/18/13	7.6	8	10.7
51	Niġliq	C	1351C1	18.3	10/28/13	11/9/13	8.9	12	12.0
51	Niġliq	D	1351D1	24.4	10/29/13	11/19/13	7.6	21	28.0
51	Upper Niġliq	C	1351C2	18.3	11/12/13	11/25/13	8.9	13	13.0
55	Niġliq	A	1355A1	30.5	10/30/13	11/4/13	7.0	5	8.3
55	Niġliq	A	1355A2	30.5	11/4/13	11/17/13	7.0	13	21.7
56	Upper Niġliq	A	1356A1	24.4	10/10/13	10/16/13	7.6	6	8.0
56	Upper Niġliq	B	1356B1	24.4	10/10/13	10/20/13	7.6	10	13.3

Table 2. Continued.

Fisher Code	Fishing Location	Net	Net Code	Length (m)	Start Date	End Date	Stretched Mesh (cm)	Net Days	Adjusted Net Days
56	Upper Niġliq	C	1356C1	18.3	10/16/13	10/20/13	7.6	4	4.0
63	Nanuk	A	1363A1	30.5	10/15/13	10/18/13	7.6	3	5.0
65	Niġliq	A	1365A1	18.3	10/15/13	11/9/13	7.6	25	25.0
65	Niġliq	B	1365B1	18.3	10/15/13	11/9/13	8.3	25	25.0
69	Niġliq	A	1369A1	18.3	10/9/13	10/18/13	7.6	9	9.0
69	Niġliq	B	1369B1	18.3	10/9/13	10/18/13	7.6	9	9.0
69	Niġliq	A	1369A2	18.3	11/5/13	11/12/13	7.6	7	7.0
70	Main	A	1370A1	30.5	10/16/13	10/19/13	7.0	3	5.0
70	Niġliq	A	1370A2	30.5	10/24/13	10/26/13	7.0	2	3.3
70	Niġliq	A	1370A3	30.5	10/26/13	11/5/13	7.0	10	16.7
70	Niġliq	B	1370B1	30.5	10/27/13	11/5/13	7.6	9	15.0
72	Niġliq	A	1372A1	18.3	10/9/13	10/19/13	7.6	10	10.0
72	Niġliq	B	1372B1	24.4	10/9/13	10/19/13	8.9	10	13.3
72	Niġliq	C	1372C1	30.5	10/9/13	10/19/13	8.9	10	16.7
72	Niġliq	D	1372D1	18.3	10/9/13	10/19/13	7.6	10	10.0
72	Niġliq	E	1372E1	18.3	10/9/13	10/19/13	7.6	10	10.0
72	Niġliq	A	1372A2	18.3	10/28/13	11/2/13	7.6	5	5.0
72	Niġliq	A	1372A3	18.3	11/2/13	11/18/13	7.6	16	16.0
72	Niġliq	B	1372B2	24.4	11/3/13	11/10/13	8.9	7	9.3
72	Niġliq	B	1372B3	24.4	11/10/13	11/16/13	8.9	6	8.0
72	Niġliq	C	1372C2	30.5	11/10/13	11/16/13	8.9	6	10.0
74	Main	A	1374A1	30.5	10/15/13	10/19/13	6.4	4	6.7
74	Main	B	1374B1	24.4	10/15/13	10/19/13	7.6	4	5.3
75	Main	A	1375A1	24.4	10/16/13	10/19/13	7.6	3	4.0
77	Upper Niġliq	A	1377A1	24.4	10/9/13	12/17/13	7.6	69	92.0
77	Upper Niġliq	B	1377B1	18.3	11/3/13	12/17/13	6.4	44	44.0
79	Niġliq	A	1379A1	24.4	10/15/13	10/18/13	7.0	3	4.0
79	Niġliq	B	1379B1	18.3	10/15/13	10/18/13	7.6	3	3.0
79	Niġliq	A	1379A2	24.4	10/27/13	11/12/13	7.0	16	21.3
79	Niġliq	B	1379B2	18.3	10/28/13	11/12/13	7.6	15	15.0
82	Niġliq	A	1382A1	18.3	10/12/13	10/16/13	8.9	4	4.0
82	Niġliq	B	1382B1	24.4	10/12/13	10/16/13	7.6	4	5.3
82	Main	A	1382A2	18.3	10/16/13	10/17/13	8.9	1	1.0
82	Main	B	1382B2	24.4	10/16/13	10/17/13	7.6	1	1.3
82	Main	A	1382A3	18.3	10/21/13	10/25/13	8.9	4	4.0
82	Main	B	1382B3	24.4	10/21/13	10/25/13	7.6	4	5.3
82	Main	C	1382C1	30.5	10/22/13	10/25/13	7.6	3	5.0
82	Niġliq	B	1382B4	24.4	10/26/13	11/20/13	7.6	25	33.3
82	Niġliq	C	1382C2	30.5	10/26/13	11/20/13	7.6	25	41.7
82	Niġliq	D	1382D1	24.4	10/26/13	11/20/13	7.6	25	33.3
87	Niġliq	A	1387A1	18.3	10/10/13	10/18/13	7.6	8	8.0
87	Niġliq	B	1387B1	18.3	10/10/13	10/18/13	7.6	8	8.0
87	Niġliq	C	1387C1	24.4	10/10/13	10/18/13	7.6	8	10.7
87	Niġliq	D	1387D1	30.5	10/10/13	10/18/13	7.6	8	13.3

Table 2. Continued.

Fisher Code	Fishing Location	Net	Net Code	Length (m)	Start Date	End Date	Stretched Mesh (cm)	Net Days	Adjusted Net Days
87	Main	A	1387A2	18.3	10/22/13	11/3/13	7.6	12	12.0
87	Main	B	1387B2	18.3	10/22/13	11/3/13	7.6	12	12.0
87	Main	C	1387C2	24.4	10/22/13	11/3/13	7.6	12	16.0
87	Main	D	1387D2	30.5	10/22/13	11/3/13	7.6	12	20.0
87	Main	E	1387E1	18.3	10/22/13	11/3/13	8.9	12	12.0
88	Niġliq	A	1388A1	24.4	10/28/13	11/4/13	7.6	7	9.3
88	Niġliq	B	1388B1	18.3	10/29/13	11/19/13	7.6	21	21.0
88	Niġliq	A	1388A2	24.4	11/4/13	11/9/13	7.6	5	6.7
88	Upper Niġliq	A	1388A3	24.4	11/9/13	11/25/13	7.6	16	21.3
89	Niġliq	A	1389A1	24.4	10/10/13	10/18/13	7.6	8	10.7
89	Niġliq	B	1389B1	24.4	10/10/13	10/18/13	7.6	8	10.7
89	Niġliq	A	1389A2	24.4	10/28/13	11/10/13	7.6	13	17.3
89	Niġliq	B	1389B2	24.4	10/30/13	11/10/13	7.6	11	14.7
93	Niġliq	A	1393A2	30.5	10/28/13	10/29/13	8.9	1	1.7
93	Niġliq	A	1393A3	30.5	10/30/13	11/2/13	8.9	3	5.0
93	Niġliq	A	1393A4	30.5	11/2/13	11/8/13	8.9	6	10.0
93	Niġliq	A	1393A1	30.5	10/9/13	10/18/13	8.9	9	15.0
93	Niġliq	B	1393B1	30.5	10/9/13	10/18/13	6.4	9	15.0
Total									1,429.3

October with 86 fish/adjusted net-day (Figure 8). However, this peak is due to a single harvest event where an 18 m net caught 86 Arctic Cisco in a 24 hour period.

A total of 10,155 Arctic Cisco were documented by the fishery monitoring team in all mesh sizes and combinations of mesh sizes for the Niġliq Channel in 2013, compared to 10,804 Arctic Cisco in 2012. An additional 1,295 fish were documented in the Main Channel, slightly more than half the fish documented in the Main Channel in 2012 (n = 2,558). The net-length adjusted CPUE for each individual mesh size from observed harvests in the Niġliq Channel reveals that harvest results ranged from 4.4 fish per adjusted net-day in 8.9 cm mesh nets to 13.2 fish per adjusted net-day in 7.6 cm mesh nets (Table 4). Observed CPUE (adjusted for net length) multiplied by observed adjusted fishing effort (net-days) for each mesh size class yields a total harvest estimate of ~20,670 Arctic Cisco from the Niġliq Channel and ~1,570 from the Main Channel of the Colville River for an estimated total harvest of ~22,240 Arctic Cisco in 2013 (Table 4). Estimated Arctic Cisco harvest from the Niġliq Channel increased compared to 2012, but harvest from the Main Channel was less than half that estimated for 2012.

In addition to Arctic Cisco, seven other species of fish were documented in the Colville River fall fishery harvest in 2013, including Fourhorn Sculpin *(Myoxocephalus quadricornis)* which are observed but not enumerated for this monitoring project (Table 5). A total of 13,872 fish (all species, mesh sizes, and combinations of mesh size) were directly counted during interviews. Arctic Cisco (82.5%) and Least Cisco (7.7%) comprised the bulk of the recorded harvest (Table 5). Rainbow Smelt made up 5.5% of the total harvest, the largest proportion since fishery monitoring began in 1985. The proportion of Least Cisco in the observed harvest was one-third of the long-term average of 20.6% and the proportion of Arctic Cisco was above the historical average of 70.0%. Saffron Cod *(Eleginus gracilis)*, Broad Whitefish, and Humpback Whitefish *(C. pidschian)* were observed but comprised a

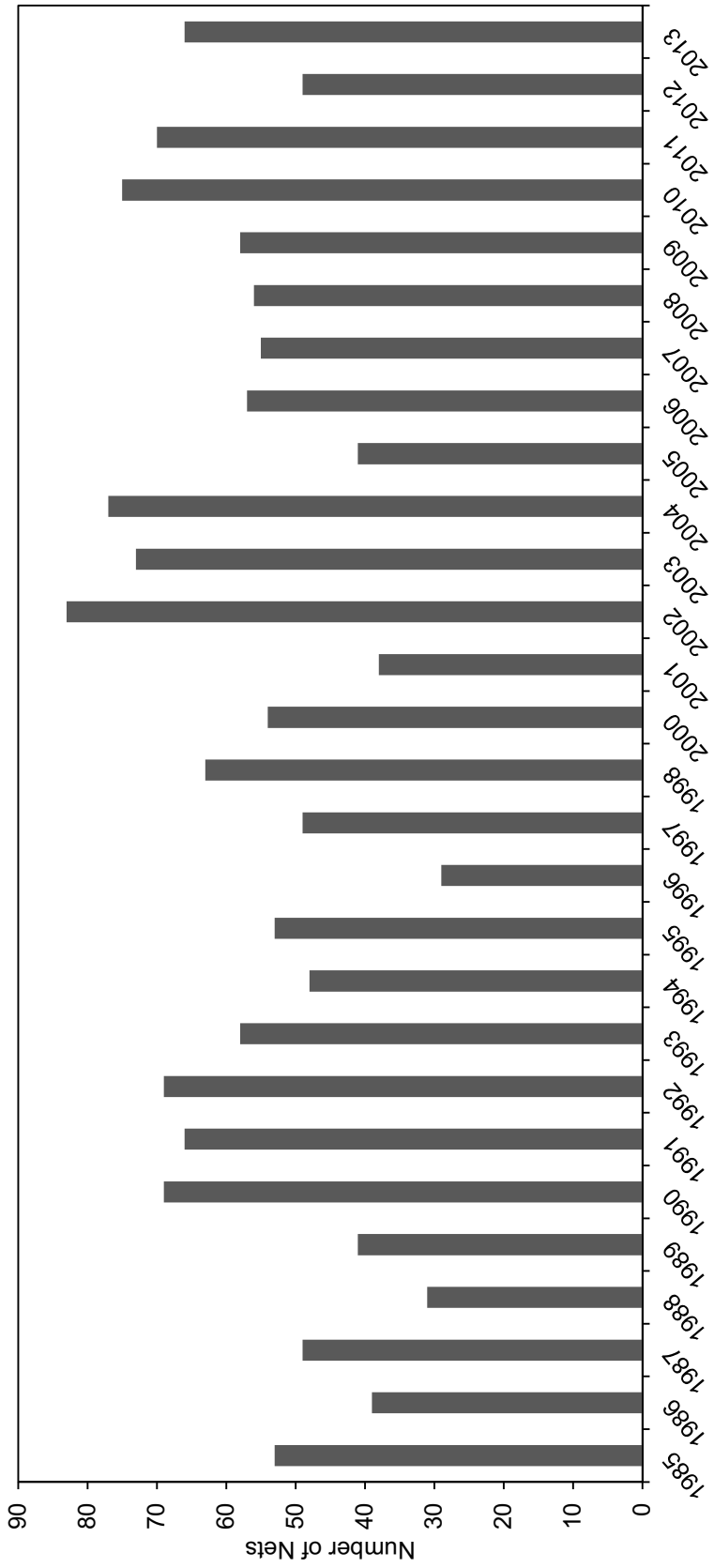


Figure 3. The number of gill nets deployed annually in the fall subsistence fishery for Arctic Cisco, Colville River, Alaska, 1985–2013.

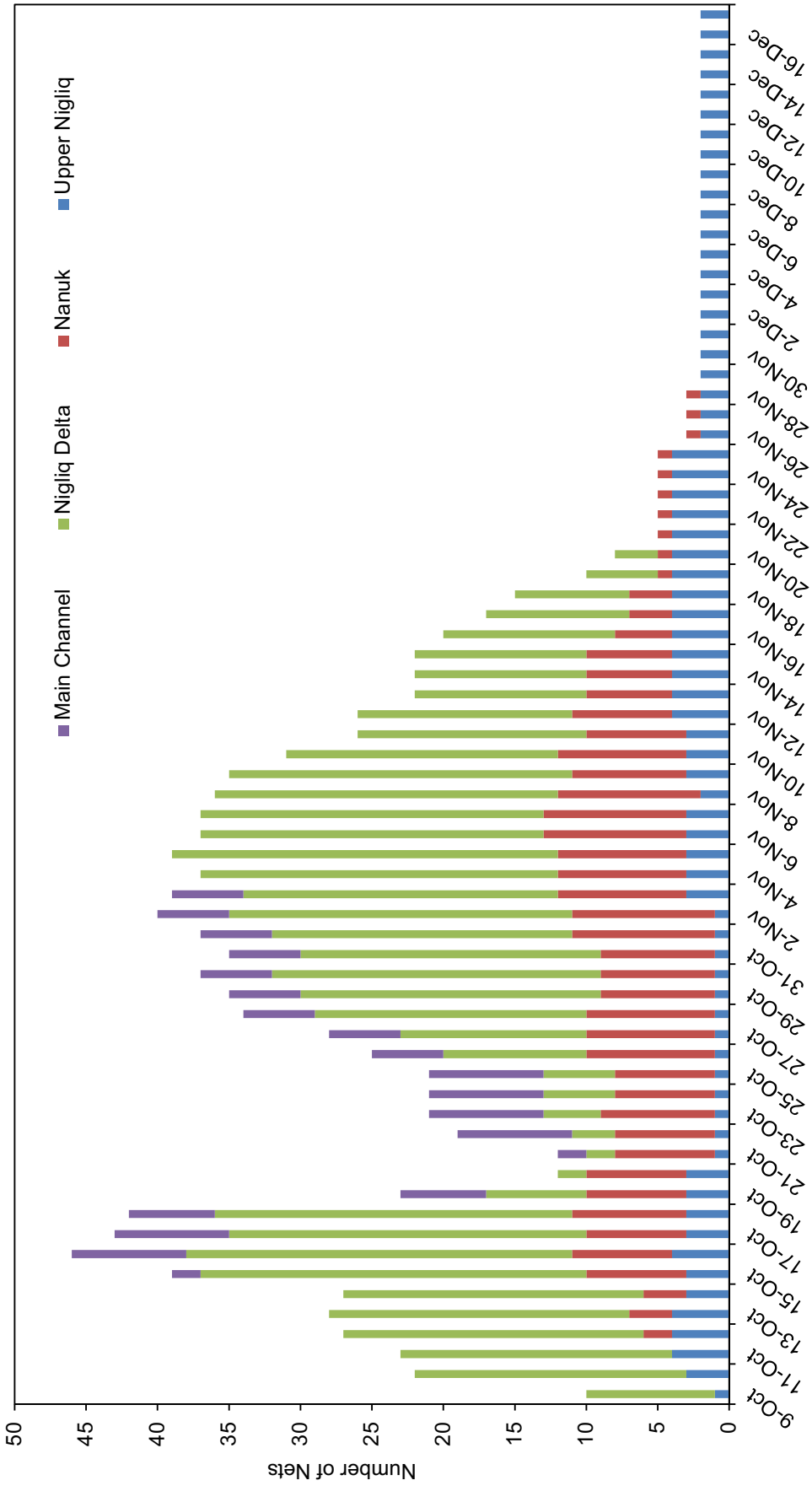


Figure 4. Number of nets fishing each day in each of the 3 Nigliq Channel fishing areas and in the Main Channel, Colville River, Alaska, 9 October–17 December 2013.

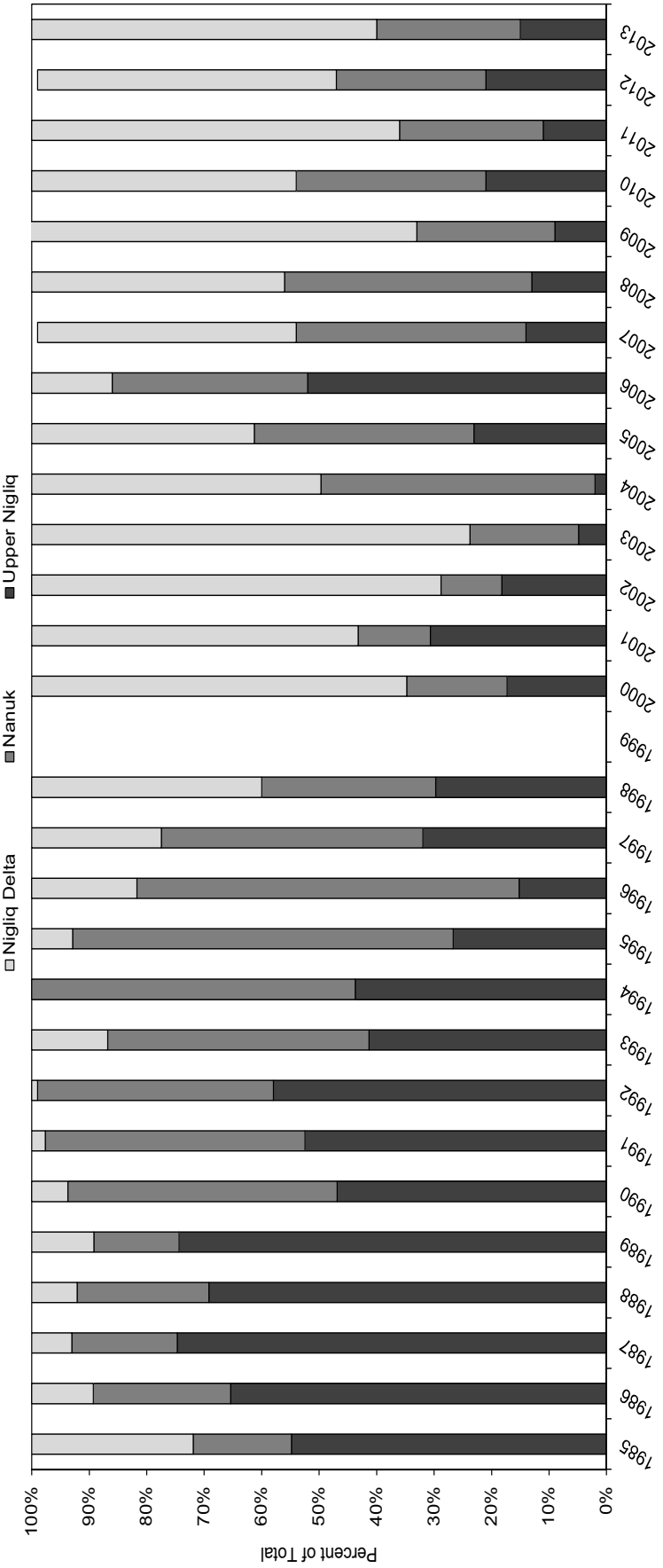


Figure 5. The percent of annual fishing effort in each of the 3 Niġliq Channel fishing areas, Colville River, Alaska, 1985–2013. All nets are included regardless of length and mesh size.

Table 3. Observed catch of Arctic Cisco (number of fish), effort (adjusted net-days), and catch per unit effort (CPUE; fish/net-day) for each fishing area in the Niġliq Channel, Colville River, Alaska, 1986–2013. Catch and effort data are for 7.6 cm mesh gillnets standardized to 18 m length.

	Upper Niġliq			Nanuk			Niġliq Delta			Total Niġliq Channel		
Year	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1986	2,218	115.7	19.2	752	25.1	29.9	3,379	51.3	65.8	6,349	192.2	33.0
1987	1,451	131.7	11.0	948	32.6	29.1	661	31.3	21.1	3,060	195.7	15.6
1988	366	56.9	6.4	146	18.0	8.1	2,078	37.3	55.7	2,590	112.3	23.1
1989	993	90.8	10.9	258	14.3	18.0	535	21.7	24.7	1,786	126.8	14.1
1990	650	147.1	4.4	1,114	148.5	7.5	202	27.6	7.3	1,966	323.1	6.1
1991	522	143.0	3.7	1,327	326.9	4.1	16	8.0	2.0	1,865	477.9	3.9
1992[a]	4,825	316.2	15.3	2,322	130.4	17.8	4,956	96.2	51.5	12,103	542.8	22.3
1993[a]	1,709	106.2	16.1	5,783	158.3	36.5	1,568	57.7	27.2	9,060	322.2	28.1
1994	366	99.0	3.7	642	190.2	3.4	0	0.0	--	1,008	289.2	3.5
1995[a]	56	50.3	1.1	568	178.3	3.2	267	12.0	22.3	891	240.7	3.7
1996	413	36.0	11.5	3,591	193.3	18.6	0	0.0	--	4,004	229.3	17.5
1997	2,539	119.0	21.3	3,586	128.8	27.8	2,207	53.3	41.4	8,332	301.2	27.7
1998	189	92.3	2.0	218	83.7	2.6	1,214	155.3	7.8	1,621	331.3	4.9
1999						No Data						
2000	8	8.0	1.0	217	62.0	3.5	1,826	190.4	9.6	2,051	260.4	7.9
2001	92	62.0	1.5	36	22.7	1.6	611	208.8	2.9	739	293.4	2.5
2002	103	115.7	0.9	137	36.7	3.7	2,925	460.9	6.3	3,165	613.2	5.2
2003	62	11.7	5.3	1,495	104.0	14.4	6,187	455.7	13.6	7,744	571.3	13.6
2004	338	22.0	15.4	8,102	270.9	29.9	5,021	199.7	25.1	13,461	492.6	27.3
2005	1,387	90.0	15.4	3,222	169.5	19.0	4,512	177.0	25.5	9,121	436.5	20.9
2006[a]	1,281	105.0	12.0	2,930	83.3	35.0	6,913	81.3	85.0	11,124	269.7	41.0
2007[a]	498	63.0	7.9	935	109.2	8.6	4,422	200.2	22.1	5,855	372.5	15.7
2008[a]	156	44.0	3.5	1,665	203.3	8.2	2,662	198.3	13.4	4,483	445.6	10.1
2009[a]	0	0.0	0.0	1,027	88.3	11.6	4,258	196.3	21.7	5,285	284.6	18.6
2010[a]	91	34.7	2.6	270	98.0	2.8	1,866	193.0	9.7	2,227	326.0	6.8
2011[a]	212	27.3	7.8	1,064	56.3	18.9	13,395	320.7	41.8	14,671	404.3	36.3
2012[a]	86	24	3.6	1,313	48.3	27.2	5,413	173.7	31.2	6,812	246.0	27.7
2013[a]	335	48.0	7.0	589	39.3	15.0	4,536	327.0	13.9	5,460	414.3	13.2
Total[b]	20,946	2,159.6	9.7	44,257	3,020.4	14.7	81,630	3,934.6	20.7	146,833	9,115.1	16.1

[a]Upper Niġliq catch and effort values include fish and net data from the Uyagagviq area (Area 630).
[b]Denotes average CPUE from 1986–2013.

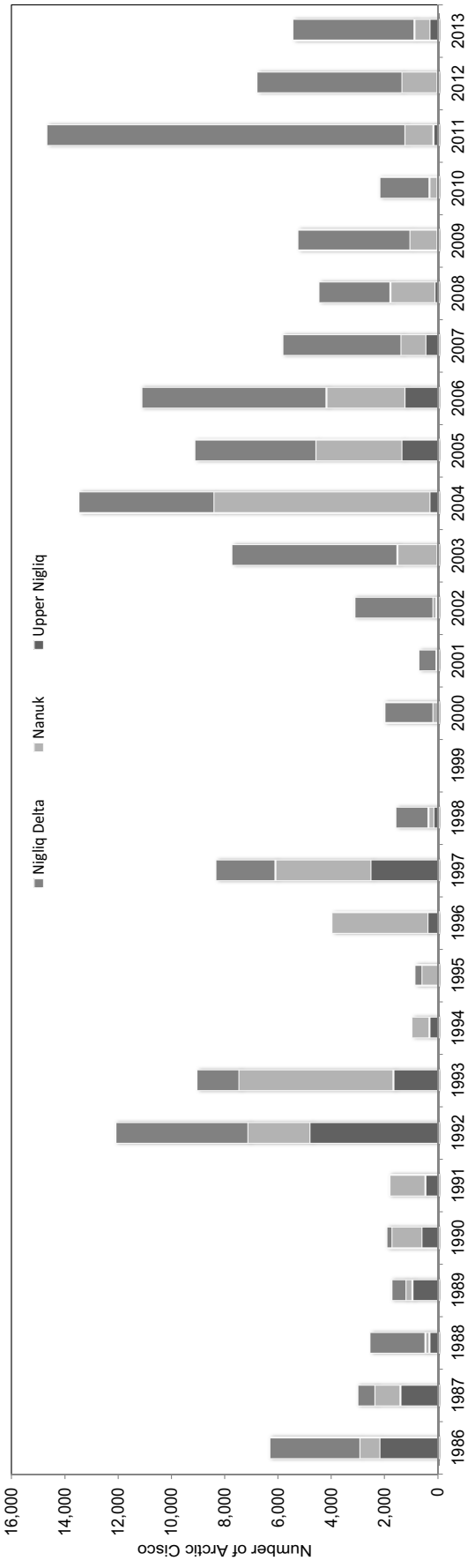


Figure 6. The observed number of Arctic Cisco harvested in 7.6 cm mesh gills nets in each of 3 Nigliq Channel fishing areas, 1986–2013.

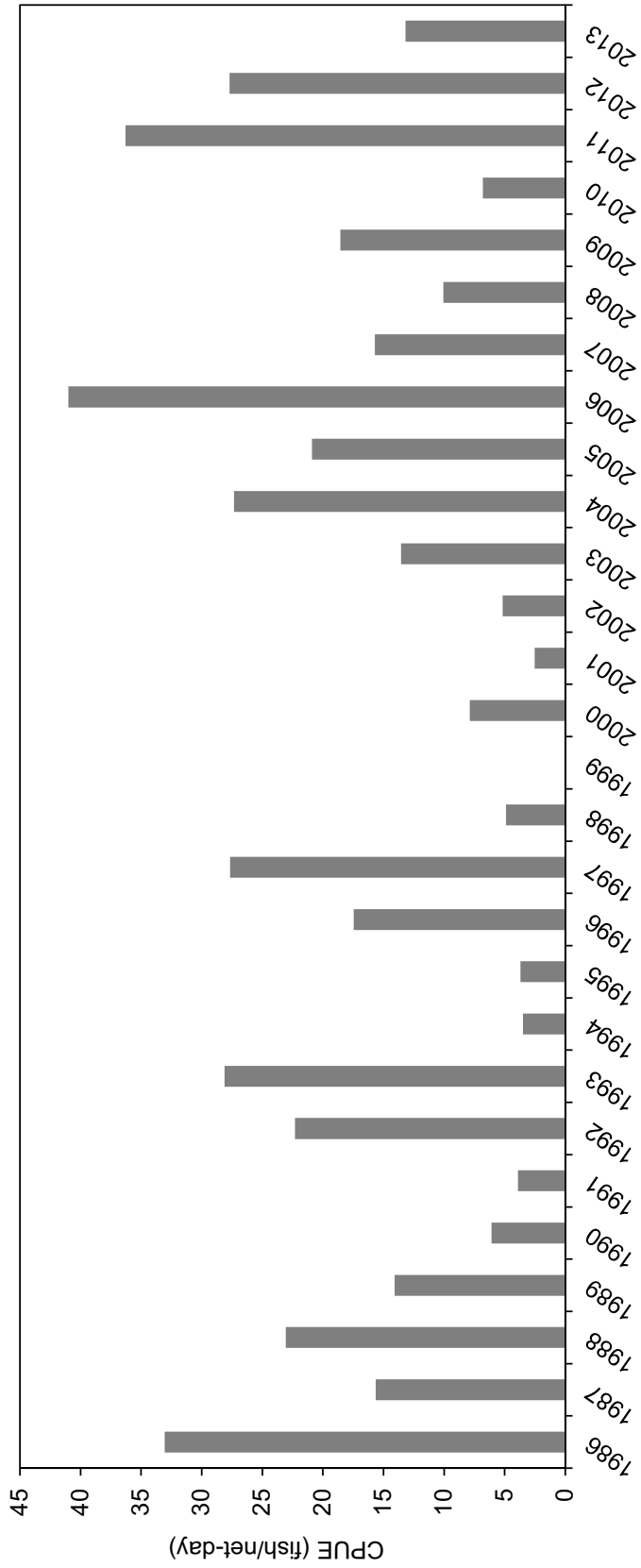


Figure 7. Catch per unit effort (CPUE; fish/net-day) of Arctic Cisco in 7.6 cm gillnets, Nigliq Channel, Colville River, Alaska, 1986–2013. Effort is standardized to an 18 m net length.

Table 4. Observed catch of Arctic Cisco (number of fish), effort (adjusted net-days), and catch per unit effort (CPUE; fish/net-day) for each fishing area in the Niġliq Channel and Main Channel by mesh size, Colville River, Alaska, 1986–2013. Gill nets are standardized to 18 m length. Estimate of total harvest is calculated based on calculated effort and estimated CPUE for each river section.

	Mesh Size					
FISHING AREA	6.40 cm	7.00 cm	7.60 cm	8.30 cm	8.90 cm	Total
UPPER NIGLIQ						
Observed Catch (no. of fish)	99	--	335	--	-	434
Effort (net-days)	6.0	--	48.0	--	2.0	56.0
CPUE (fish per net-day)	16.5	--	7.0	--	-	23.5
NANUK						
Observed Catch (no. of fish)	9	--	589	--	163	761
Effort (net-days)	4.0	--	39.3	--	60.7	104.0
CPUE (fish per net-day)	2.3	--	15.0	--	2.7	20.0
NIGLIK DELTA						
Observed Catch (no. of fish)	1,008	801	4,536	223	463	7,031
Effort (net-days)	10.0	46.7	327.0	6.0	81.0	470.7
CPUE (fish per net-day)	100.8	17.2	13.9	37.2	5.7	174.8
TOTAL NIGLIK CHANNEL						
Observed Catch (no. of fish)	1,116	801	5,460	223	626	8,226
Effort (net-days)	20.0	46.7	414.3	6.0	143.7	630.7
CPUE (fish per net-day)	55.8	17.2	13.2	37.2	4.4	127.8
MAIN CHANNEL						
Observed Catch (no. of fish)	--	66	438	--	94	598
Effort (net-days)	--	3.3	30.7	--	8.0	42.0
CPUE (fish per net-day)	--	19.8	14.3	--	11.8	45.9
TOTAL						
Observed Catch (no. of fish)	1,116	801	5,898	223	720	8,758
Effort (net-days)	20.0	46.7	445.0	6.0	151.7	669.4
CPUE (fish per net-day)	55.8	17.2	13.3	37.2	4.7	128.2
SUMMARY						
Niġliq Channel Actual Adjusted Net Days	118.3	75.3	803.3	25.0	289.7	1,311.6
Estimated Niġliq Channel Harvest	6,601	1,292	10,586	929	1,262	20,670
Main Channel Actual Adjusted Net Days	6.7	5.0	89.0	--	17.0	117.7
Estimated Main Channel Harvest	--	99	1,271	--	200	1,570
Estimated Total Harvest						22,240

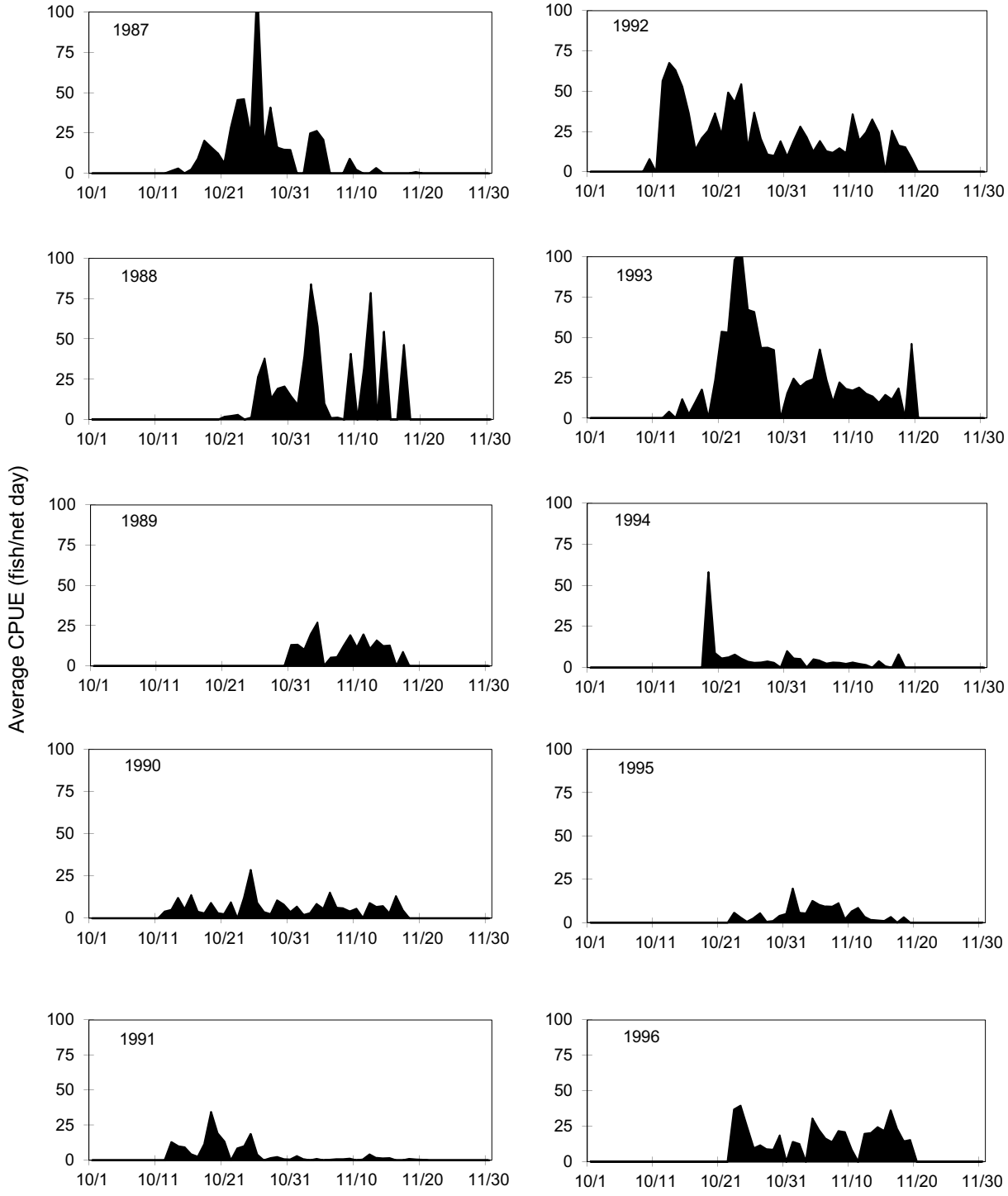


Figure 8. Average daily catch per unit effort (CPUE; fish/net-day) of Arctic Cisco in 7.6 cm gillnets, Niġliq Channel, 1987–2013. Effort is standardized to an 18 m net length.

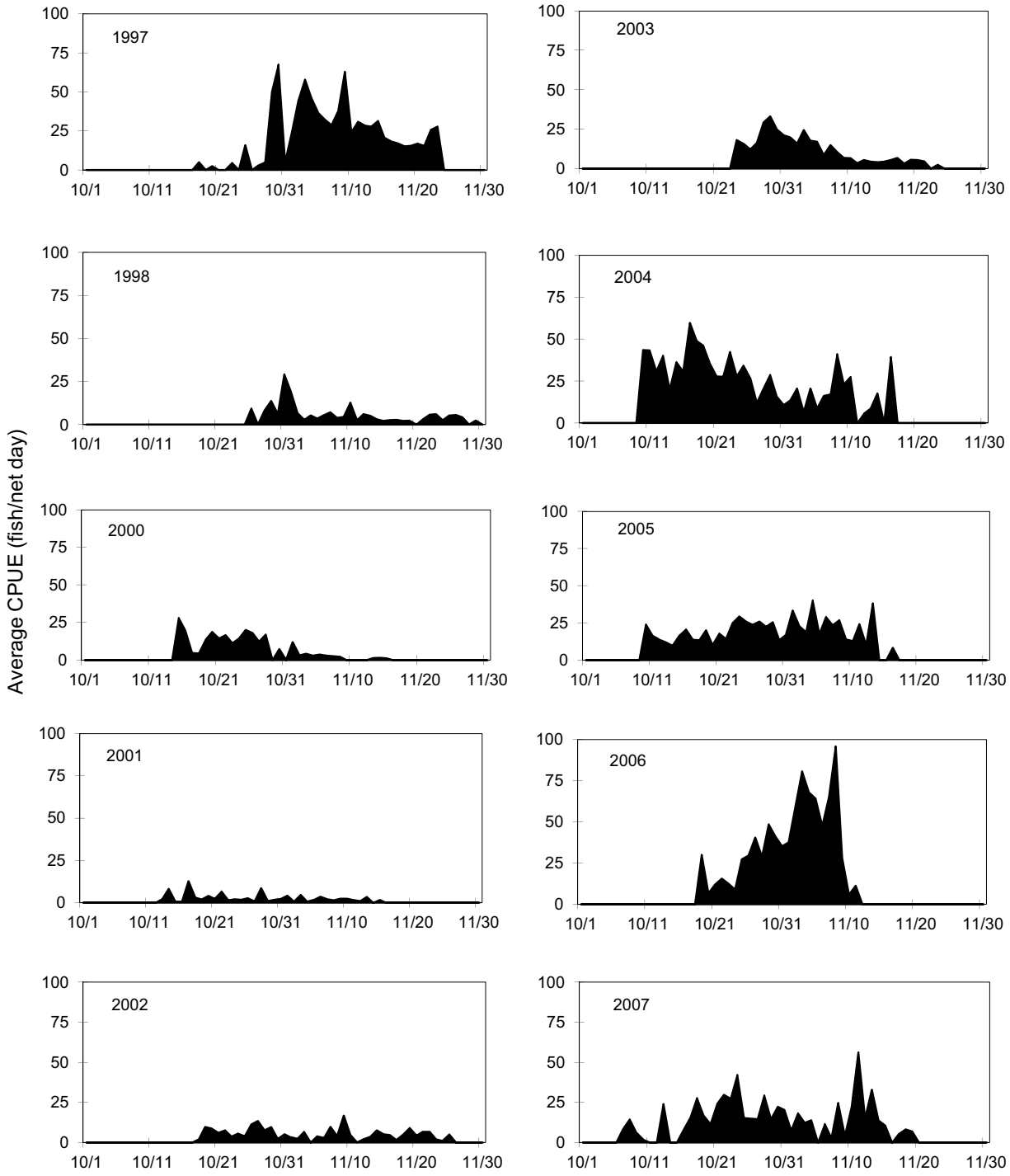


Figure 8. Continued.

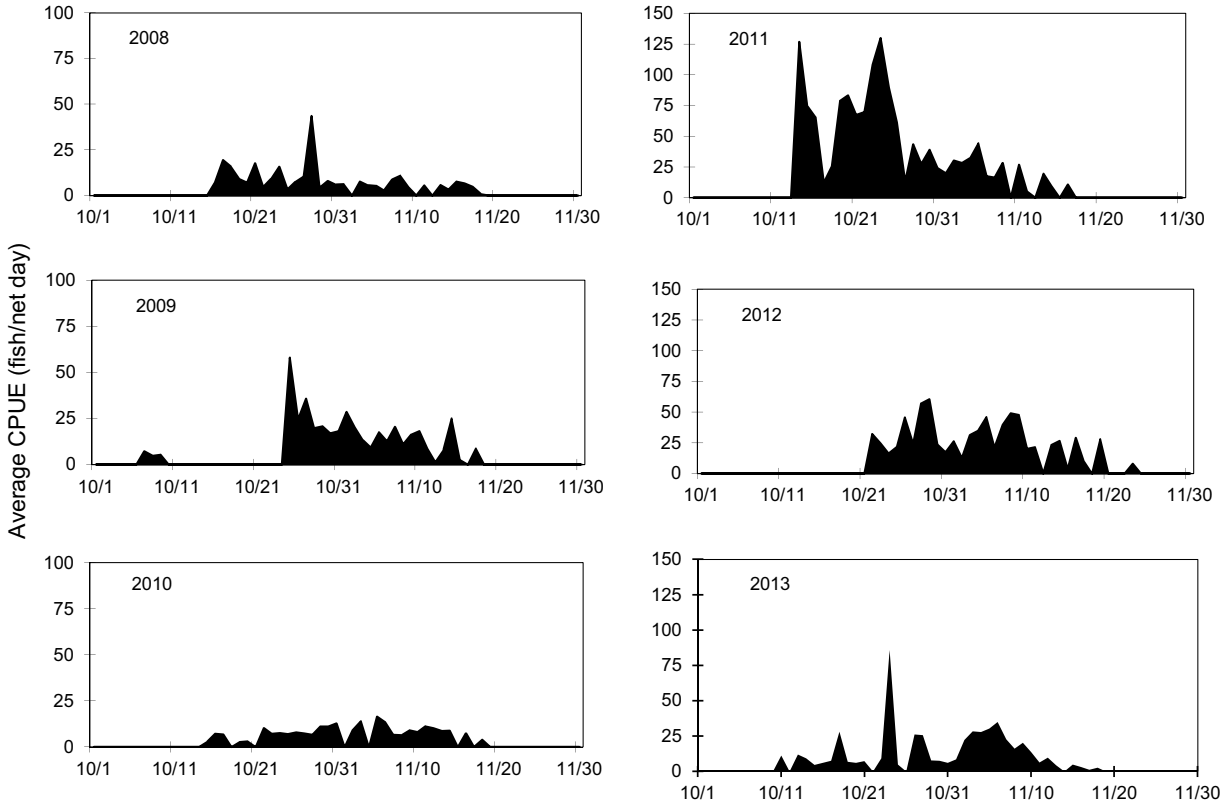


Figure 8. Continued.

negligible proportion of the harvest. Northern Pike *(Esox lucius)* was observed in 2012, but not in 2013.

The CPUE for Least Cisco in 7.6 cm mesh nets in the Niġliq Channel in 2013 was lower (0.5 fish per adjusted net-day) than both 2012 (4.0 fish per adjusted net-day) and 2011 (1.7 fish per adjusted net-day) (Table 6). The CPUE for Least Cisco in the Niġliq Channel in 2013 was the lowest observed since monitoring began in 1986. In 2013 the CPUE was highest in the Upper Niġliq (1.5 fish/net-day) and lowest in the Niġliq Delta (0.3 fish/net-day). The CPUE for Least Cisco in the Niġliq Channel in 2013 was lower than the long term average 1986–2013 (3.2 fish/net-day).

LENGTH, WEIGHT, AND AGE OF CATCH

A sub-sample of fish was measured daily at net sites to determine the length distribution present in the fishery. ABR measured fork lengths of 1,460 Arctic Cisco in 2013 compared to 2,027 in 2012 and 1,914 in 2011. Arctic Cisco ranged in length from 195 to 436 mm (Figure 9). The middle 50% of fish ranged between 312 and 332 mm as compared to a middle 50% of 308 to 329 mm in 2012, and 296 to 322 mm in 2011. The median fork length was 321 mm (compared to a median of 316 mm in 2012) with a mean fork length of 322.6 mm. The data appear normal due to similar median and mean values and a bell-shaped distribution. However, the smallest and largest data points do not fall within 4 standard deviations of the mean thereby precluding normality. Five different mesh sizes were deployed in the Colville delta in 2013 (6.4, 7.0, 7.6, 8.3, and 8.9), up from four mesh sizes used in 2012, but down from six mesh sizes used in years prior. The median length of Arctic Cisco caught in these five mesh sizes was higher

Table 5. Species composition of the observed harvest from the fall subsistence fishery for Arctic Cisco expressed as a percent of the sampled catch, Colville River, Alaska, 1985–2013. Table includes all fish caught in every net, regardless of mesh size and location.

Year	Arctic Cisco	Bering Cisco	Least Cisco	Broad Whitefish	Humpback Whitefish	Arctic Grayling	Rainbow Smelt	Round Whitefish	Dolly Varden Char	Northern Pike	Saffron Cod	Burbot	Arctic Flounder	Fourhorn Sculpin	Total Observed
1985	69.5	(a)	14.8	15.1	0.5	0	0.2	0	0	0	0	0	0	(b)	2,705
1986	95.9	(a)	3.8	0.3	0.0	0	0.03	0.01	0	0	0	0	0	(b)	8,952
1987	71.8	(a)	18.7	5.5	3.8	0	0.01	0	0.03	0	0.03	0.06	0	(b)	6,826
1988	90.6	(a)	8.3	0.6	0.5	0	0	0	0	0	0	0.1	0	(b)	2,948
1989	66.2	(a)	23.7	7.0	3.1	0	0.03	0	0	0	0.03	0.03	0	(b)	2,946
1990	39.6	21.8	30.2	5.3	2.9	0	0.2	0	0.1	0	0.03	0.01	0	(b)	7,911
1991	62.8	1.2	30.0	1.0	3.8	0	1	0.03	0	0	0.04	0.09	0	(b)	7,576
1992	89.2	0.1	6.0	0.2	0.1	0	0	0	0	0	0	0	0	4.4	24,305
1993	85.4	0.02	11.1	0.3	0.4	0	0.04	0	0	0	0.01	0	0	2.7	17,155
1994	39.6	0.1	44.6	2.2	13.2	0	0.3	0	0	0	0	0	0	(b)	3,792
1995	34.7	0.2	35.0	7.6	22.3	0	0.2	0	0	0	0	0.1	0	(b)	7,155
1996	81.9	0	4.8	0.1	0.4	0	0.1	0	0	0	0.02	0.02	0.02	12.5	5,730
1997	74.8	0	22.9	1.3	0.9	0	0	0	0	0	0	0	0	(b)	19,758
1998	39.6	0	50.8	0.4	8.9	0	0	0.2	0	0	0	0	0	(b)	6,481
2000	79.4	0.1	14.0	0.2	6.0	0	0.3	0	0	0	0.03	0	0	(b)	3,871
2001	35.6	0.1	29.6	5.5	27.8	0	0.1	0	0	0	0	1.3	0	(b)	3,515
2002	49.8	0.1	30.6	1.6	17.5	0	0.2	0	0	0	0.1	0.2	0	(b)	8,445
2003	66.3	0.2	22.3	0.2	9.4	0	0.9	0	0	0	0.6	0.1	0	(b)	16,654
2004	74.7	0.06	24.2	0.0	0.9	0	0.08	0	0	0	0.04	0.03	0	(b)	20,705
2005	81.3	0	14.8	0.2	3.5	0	0.15	0	0	0	0.01	0	0	(b)	13,957
2006	86.6	0	12.0	0.4	0.9	0	0	0	0	0.1	0	0	0	(b)	17,344
2007	71.7	0	22.3	0.4	5.5	0	0	0	0	0	0.1	0	0	(b)	14,686
2008	84.1	0.2	14.7	0.0	0.1	0	0.7	0	0	0	0.1	0.01	0	(b)	9,199
2009	85.4	0.2	9.2	0.2	0.5	0	4.3	0	0	0	0.1	0.03	0	(b)	11,700
2010	60.7	0	34.4	0.4	3.0	0	1.3	0	0	0	0.2	0	0	(b)	18,505
2011	94.8	0	4.0	0.1	0.6	0	0.4	0	0	0	0.09	0	0	(b)	28,211
2012	77.8	0	19.8	0.6	0.9	0	0.4	0	0	1	0.5	0	0	(b)	17,172
2013	82.5	0	7.7	0.1	2.3	0	5.5	0	0	0	1.8	0	0	(b)	13,872

(a) = included with Arctic Cisco prior to 1990
(b) = always present but not counted

Table 6. Observed catch of Least Cisco (number of fish), effort (net-days), and catch per unit effort (CPUE; fish/net-day) for each fishing area in the Niġliq Channel, Colville River, Alaska, 1986–2013. Catch and effort data are for 7.6-cm mesh gillnets standardized to 18 m length.

	Upper Niġliq			Nanuk			Niġliq Delta			Total Niġliq Channel		
Year	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1986	146	115.7	1.0	16	25.1	1.0	24	51.3	0.0	186	192.2	1.0
1987	730	131.7	6.0	63	32.6	2.0	12	31.3	0.0	805	195.7	4.0
1988	93	56.9	2.0	12	18	1.0	105	37.3	3.0	210	112.3	2.0
1989	332	90.8	4.0	16	14.3	1.0	10	21.7	0.0	358	126.8	3.0
1990	711	147.1	5.0	416	148.5	3.0	179	27.6	6.0	1,306	323.1	4.0
1991	50	143	0.0	272	326.9	1.0	0	8	0.0	322	477.9	1.0
1992	261	316.2	1.0	88	130.4	1.0	151	96.2	2.0	500	542.8	1.0
1993	181	106.2	2.0	498	158.3	3.0	96	57.7	2.0	775	322.2	2.0
1994	330	99	3.0	711	190.2	4.0	0	0	--	1,041	289.2	4.0
1995	238	50.3	5.0	494	178.3	3.0	94	12	8.0	826	240.7	3.0
1996	14	36	0.0	195	193.3	1.0	0	0	--	209	229.3	1.0
1997	1,370	119	12.0	1,575	128.8	12.0	203	53.3	4.0	3,148	301.2	10.0
1998	544	92.3	6.0	577	83.7	7.0	935	155.3	6.0	2,056	331.3	6.0
1999						No Data						
2000	11	8	1.0	97	62	2.0	330	190.4	2.0	438	260.4	2.0
2001	129	62	2.0	222	22.7	10.0	491	208.8	2.0	842	293.4	3.0
2002	176	115.7	2.0	165	36.7	5.0	1,033	460.9	2.0	1,374	613.2	2.0
2003	25	11.7	2.0	459	104	4.0	1,038	455.7	2.0	1,522	571.3	3.0
2004	167	22	8.0	2,493	270.9	9.0	1,483	199.7	7.0	4,143	492.6	8.0
2005	405	90	5.0	710	140.3	5.0	700	177	4.0	1,815	407.3	4.0
2006	274	92.7	3.0	261	67.3	4.0	414	65.0	6.0	949	225.0	4.0
2007	939	63.0	15.0	559	109.4	5.0	1085	188.7	6.0	2583	361.2	7.0
2008	78	44.0	1.8	529	188.0	2.8	460	233.2	2.0	1067	465.2	2.3
2009	6	1.7	3.6	321	88.3	3.6	265	181.3	1.5	592	271.3	2.2
2010	139	34.7	4.0	235	92	2.6	225	193.3	1.2	599	320	1.9
2011	8	27.3	0.3	90	56.3	1.6	550	292.0	1.9	648	375.7	1.7
2012	92	24.0	3.8	585	48.3	12.1	319	173.7	1.8	996	246.0	4.0
2013	74	48.0	1.5	21	23.3	0.9	93	322.0	0.3	188	393.3	0.5
Totals	7,523	2,149	3.5	11,680	2,938	4.0	10,295	3,893	2.6	29,498	8,981	3.3

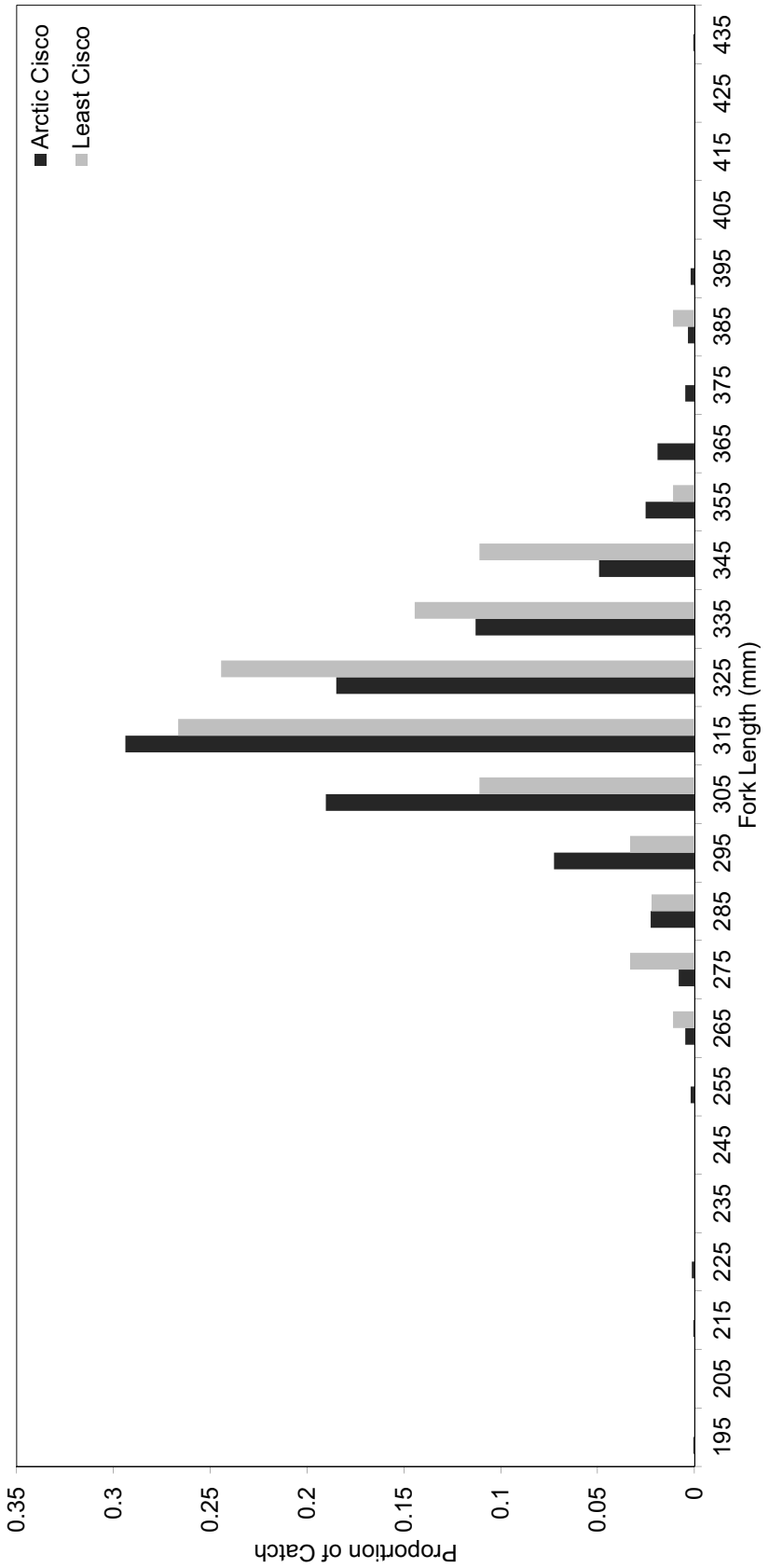


Figure 9. Length frequency (10 mm increments) of Arctic Cisco and Least Cisco captured in all mesh sizes in the fall subsistence fishery, Nigliq Channel, Colville River, Alaska, 2013.

for each mesh size compared to 2012, with the exception of 8.9 cm nets (Figure 10). The length distribution for Least Cisco was narrower than that of Arctic Cisco in 2013 and was normally distributed about its mean and both the minimum and maximum values of the sample fell within 4 standard deviations of the mean (Figure 9). Fork lengths ranged from 269 mm to 390 mm with a median of 326.5 mm, compared to 2012 where fork lengths ranged from 245 mm to 368 mm with a median fork length of 307 mm. The middle 50% of measured Least Cisco was between 318 and 338 mm in 2013, compared to 295 mm and 321 in 2012.

In 2013, ABR received donated fish samples (n = 200) from several fishers to be used for aging fish and for calculating length (mm) and weight (g) relationships. This relationship can be used as an indicator of fish health or condition of the fish. Length and weight were highly correlated (R^2 = 0.87) in Arctic Cisco in 2013 (Figure 11) and had a higher coefficient of determination than in 2012 (R^2 = 0.68) and 2011 (R^2 = 0.78) (Figure 12). The strength of the correlation decreases (R^2 = 0.71) when only Arctic Cisco harvested from 7.6 cm mesh are analyzed. A five year comparison of length–weight regressions for Arctic Cisco caught in 7.6 cm mesh show that the highest correlation occurred in 2011 (R^2 = 0.73) followed by 2013.

Analysis of otoliths revealed that Arctic Cisco in the 2013 harvest ranged in age from 4 to 6 years (all mesh sizes combined, n = 161) (Figure 13). This age range is the same as 2012 but differed from 2011 when the age range was between 5 and 8 years. Age composition was 63% age 5, 27% age 4, and 10% age 6. Because different mesh-size nets catch different age classes (i.e., sizes of fish) differentially, we also examined harvest separately for 7.6 cm mesh nets, the size most commonly used in the fishery. In 7.6 cm mesh nets (n = 134), age composition was approximately 67% age 5, 21% ages 4, and 12% age 6 (Figure 13, Appendix C). Age 5 fish also made up the majority of the harvest in 2012 (Figure 13 *in* Seigle and Gottschalk 2013). The age 5 fish that comprised 69% of the catch in 2012 only contributed to 12% of the catch as age 6 fish in 2013. The 2007 year class did not appear in the 2011 fishery (as age 4 fish), but were the dominant year class in 2012 (age 5), before nearly disappearing from the fishery in 2013 (as age 6 fish) (Seigle and Gottschalk 2012 and 2013). Arctic Cisco generally recruit to the fishery at age 4, when they first reach lengths sufficient for capture in a range of mesh sizes from 6.4 to 7.6 cm. The fish continue to grow in subsequent years and are caught in higher proportions in these and larger nets. In 2013, as in previous years, there was large variability in size within each age class. Furthermore, there was little difference in size at age between 4 and 5 year old fish (Figure 14).

Using the age composition of the catch (as percentage of catch) and the overall CPUE of 13.2 fish/net-day in the Niġliq Channel (Table 3), age-specific CPUE was estimated for the 2013 Arctic Cisco harvest. For 7.6 cm mesh nets, the CPUE increased nearly three times from age 4 (2.76 fish per adjusted net-day) to age 5 (8.87 fish per adjusted net-day). CPUE dropped off in age 6 (1.58 fish per adjusted net-day) Arctic Cisco (Figure 15, Appendix C). These fish represent the 2007–2009 year classes. Based on these estimates, there was minimal representation in the fishery by the 2005–2006 year classes. Summing CPUE by age at capture for each year class across all years that the year class was represented in the fishery provides an indicator of the relative contribution of each year class in the fishery (Figure 16). After a strong showing as age 5 fish in 2012, the 2007 year class was poorly represented in the 2013 fishery as age 6 fish. The 2008 year class was represented nearly equally in 2012 as age 4 fish and in 2013 as age 5 fish. It appears that the 2006 and earlier year classes, age 7 and older fish, have left the Colville River for spawning grounds in the McKenzie River. The cumulative total CPUE for the 2005 (age 8) year class appears to have reached a final value of ~27 fish/adjusted net-day by age class, above the average of 15 fish per adjusted net-day by year class from 1985 to 2003. The 2006 (age 7) year class also appears to have reached a final value CPUE of ~8 fish per adjusted net-day as of 2013. The 2007 year class (age 6) has so far contributed nearly 21 fish per adjusted net-day to the fishery while the 2008 year class (age 5) has contributed ~15 fish/net-day to the cumulative CPUE. The 2009 year class (age 4) has made its first appearance to the fishery and contributed ~3 fish/net-day to the cumulative CPUE (Figure 15).

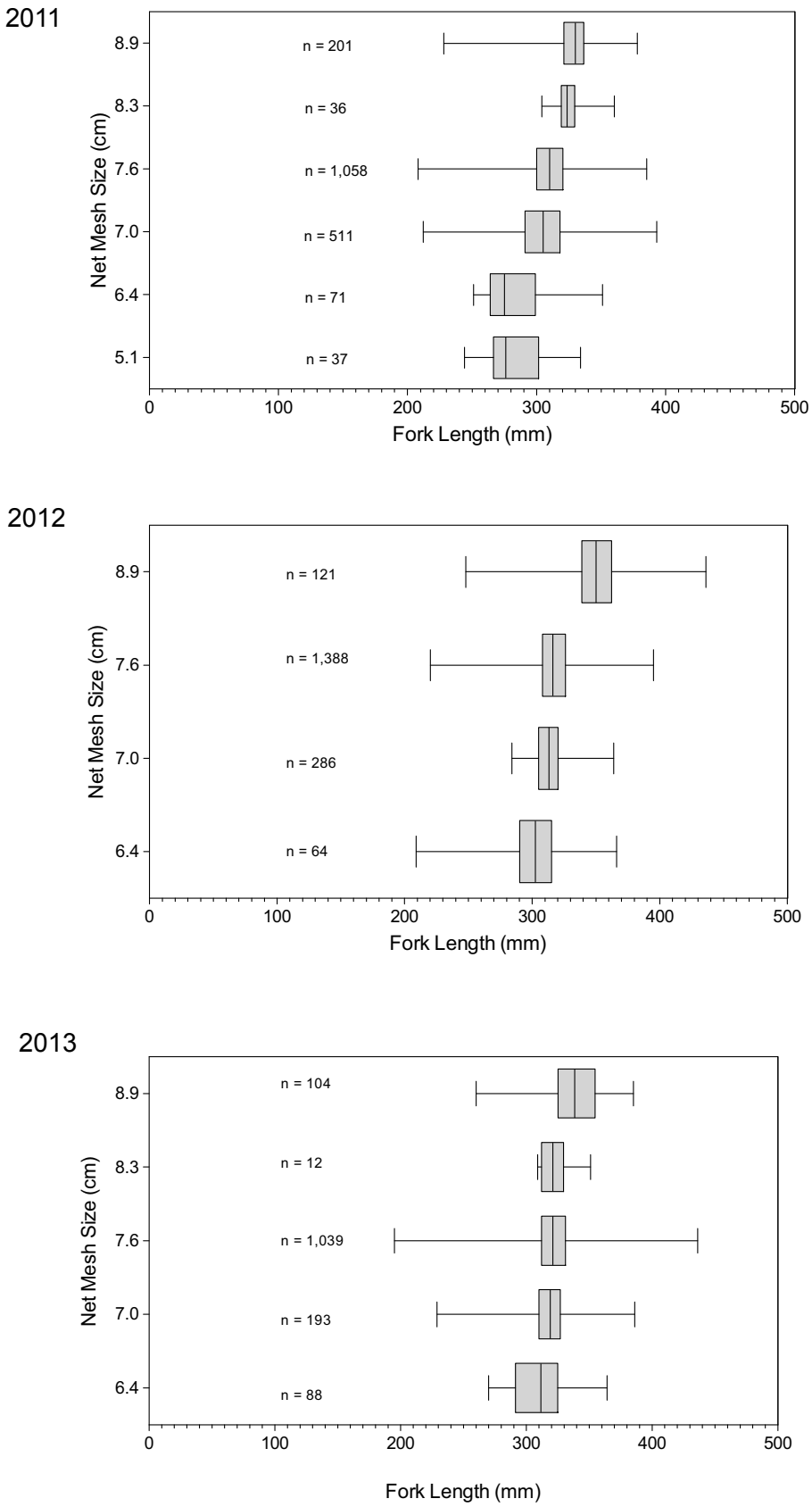


Figure 10. Length frequencies of Arctic Cisco in the fall subsistence fishery by gillnet mesh size, Niġliq and Main Channel, Colville River, 2011–2013.

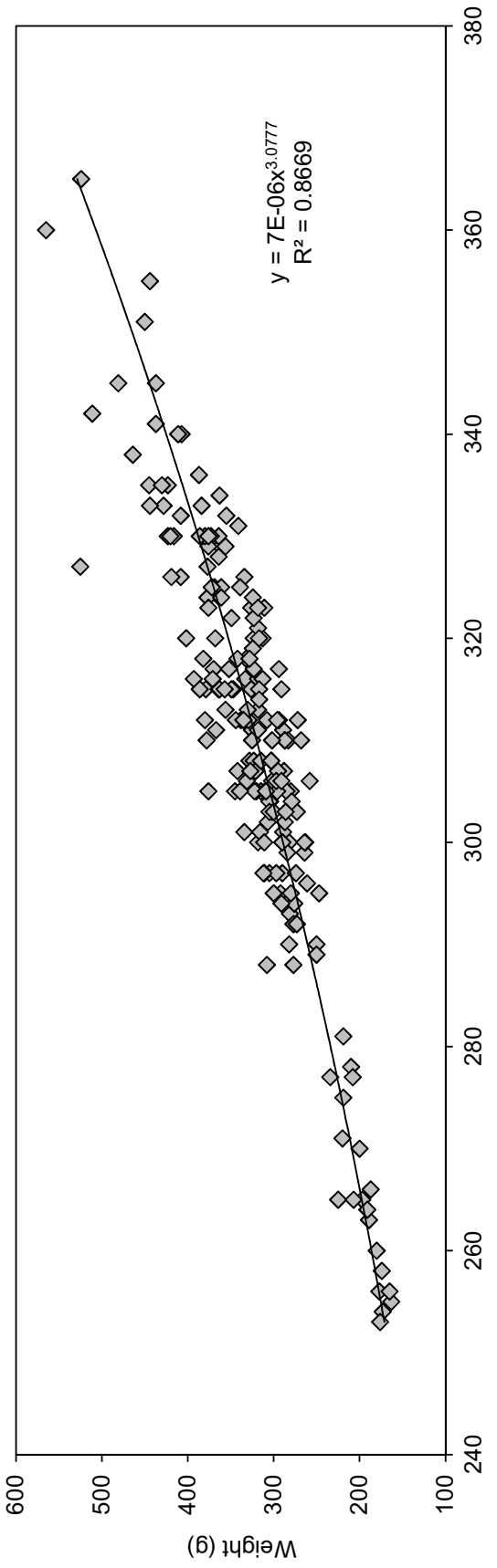


Figure 11. Length-weight relationship of Arctic Cisco captured in the fall subsistence fishery, Nigliq Channel, Colville River, 2013. Includes fish captured in all mesh sizes and all nets (n = 200).

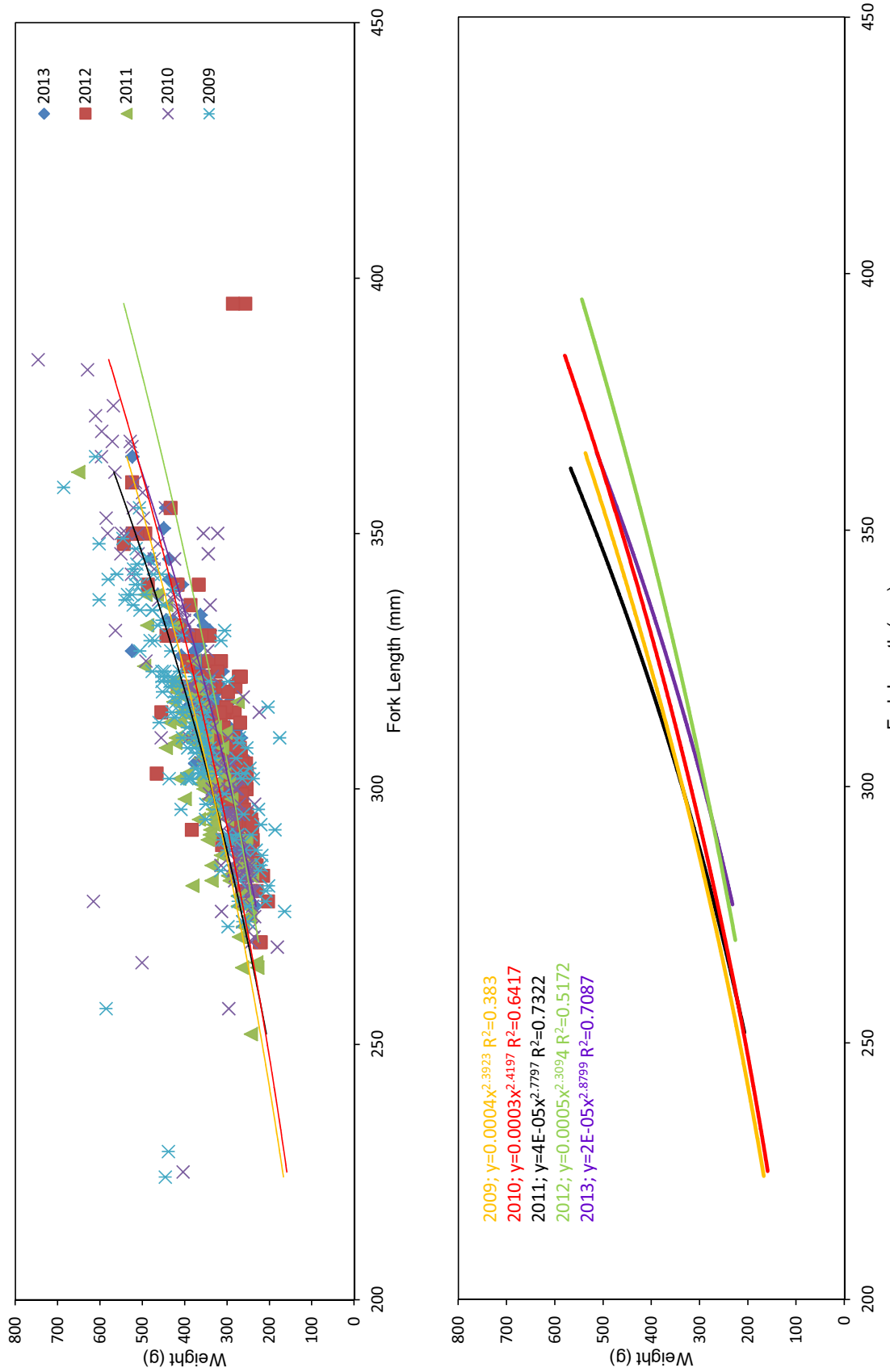


Figure 12. A 5-year (2009–2013) comparison of length-weight regression lines for Arctic Cisco captured in 7.6 cm mesh in the fall subsistence fishery, Nigliq Channel, Colville River, Alaska.

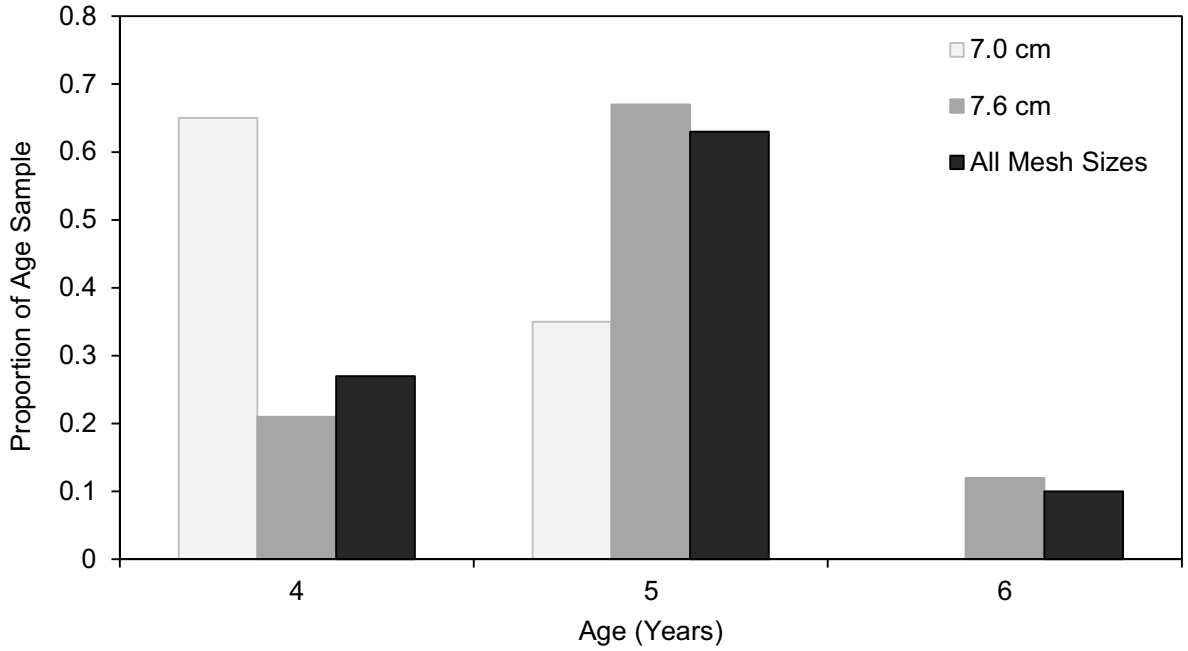


Figure 13. Age composition of Arctic Cisco harvested in 7.0 cm mesh nets (n = 20), 7.6 cm mesh nets (n = 134), and all mesh sizes combined (n = 158).

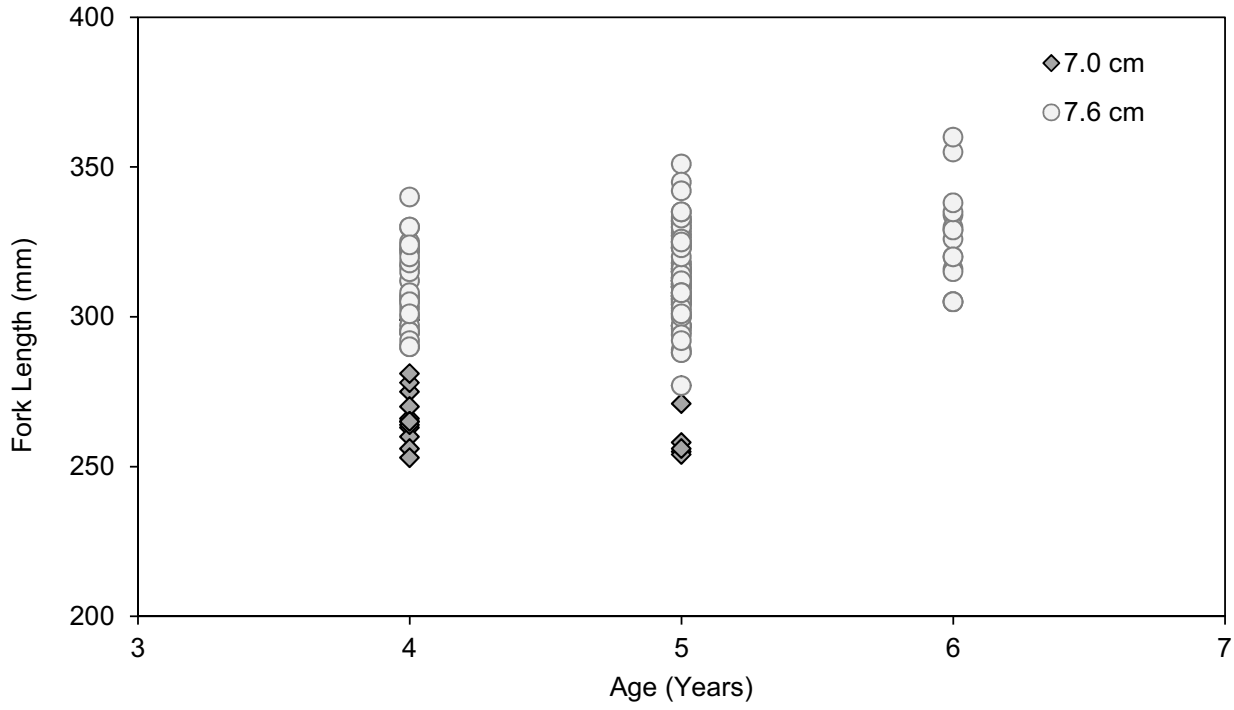


Figure 14. Age-specific length distribution of Arctic Cisco harvested in the fall subsistence fishery, Niġliq Channel, Colville River, Alaska, 2013.

SALINITY

Arctic Cisco are commonly associated with salinities in the range of 15 to 25 ppt. West winds in the Colville delta raise water levels on the Niġliq Channel and bring saline waters upstream, attracting greater numbers of Arctic Cisco and encouraging movement farther upstream in the channel (Moulton and Seavey 2004). ABR commenced salinity sampling at pre-established stations on 21 October 2013, which was three days earlier than 2012 salinity sampling but three days later than 2011 salinity sampling. Salinity over the sampling season was steadily above 15 ppt at Nanuk and the Niġliq Delta areas throughout the season (Figures 2 and 17). However, salinity at the Upper Niġliq sampling station did not reach 15 ppt until 12 November. The 3 m salinity levels at downstream stations (water stations 1 and 2) were within those preferred by Arctic Cisco (>15 ppt) during the peak harvest period. The salinity station at Uyagagviq (water station 3) did not reach 15 ppt until 29 October, increased to 18.94 ppt on 8 November, and unexpectedly dropped to 16.02 ppt on 12 November before returning to values above 18 ppt by 19 November. As expected, the highest salinities were found closest to the outer delta and lowest salinities were found upstream, indicative of the "salt wedge" that moves up and down the channel with changing flow conditions. It is interesting to note that salinity at water station 1 in the Nigliq Delta decreased steadily from 31 October to 8 November when a salinity of 18.64 ppt was registered, lower than the salinity at upstream at Nanuk on the same day (19.22 ppt). Salinity reached 15 ppt (3 m depth) at the farthest upstream station in the Upper Niġliq four days earlier than in 2012, well beyond the peak period of harvest in the Niġliq Channel (Figures 8, 17, and 18). This is not unusual as in many years this area does not reach this salinity threshold over the course of the entire fall fishery season (e.g., 2008, 2009, and 2010) (Figure 18). Though salinity measurements had not commenced by the period of the first peak fishing effort in 2013 (15–18 October), measurements at the three downstream water stations were above 15 ppt by the time of the second peak in fishing effort (31 October–4 November) (Figure 17).

WATER CHEMISTRY

ABR biologists collected water chemistry samples at water stations 1, 2, 4, and 5 on 17 October, 21 October, and 24 October for analysis of total metals, total nitrogen, diesel range organics, and residual range organics (Figure 2, Appendix D and E). Total nitrogen, diesel range organics, and residual range organics were not detected at any of the water stations. Trace amounts of barium were detected at all locations, with the highest value occurring at water station 4 located on the Upper Niġliq adjacent to Nuiqsut (Figure 2, Appendix D). Similar to 2011 results, the levels of barium detected during all sampling events were well below acceptable EPA standards for drinking water (2 mg/L) (USEPA 2013). Arsenic, cadmium, chromium, silver, and selenium were below reporting limit at all water stations and sampling dates. Lead levels at water station 1 (0.0032 mg/L) and water station 2 (0.0023 mg/L) were below USEPA drinking water standards (0.015 mg/L), but the lead concentration at water station 1 was above the USEPA aquatic life standard of 0.0025 mg/L (USEPA 2013). Lead was not detected at any water station or sampling event in 2011. In 2011, mercury was detected once at water stations 3 and twice at station 4 (Appendix F *in* Seigle and Gottschalk 2012). In 2013, mercury was only detected at station 4 on 24 October (0.00033 mg/L) and was below both the drinking water and aquatic life standards. Unlike 2011, nitrate/nitrite as total nitrogen was not detected at any water station during 2013 sampling.

SEDIMENT ANALYSIS

ABR biologists collected sediment samples at salinity stations 1–5 on 24 October for analysis of total metals, diesel range and heavy oil (residual) range organics, and percent solids (Figure 2, Appendices F and G). Except for arsenic, all metals were present at each site at concentrations below the Alaska Department of Environmental Conservation's (ADEC) Arctic Zone direct contact level. Arsenic was above the Arctic Zone direct contact level of 6.1 (mg/kg) at all stations except water station 2 (5.89 mg/kg). Arsenic levels in 2011 and 2012 were also higher than ADEC's Arctic Zone direct contact level. However,

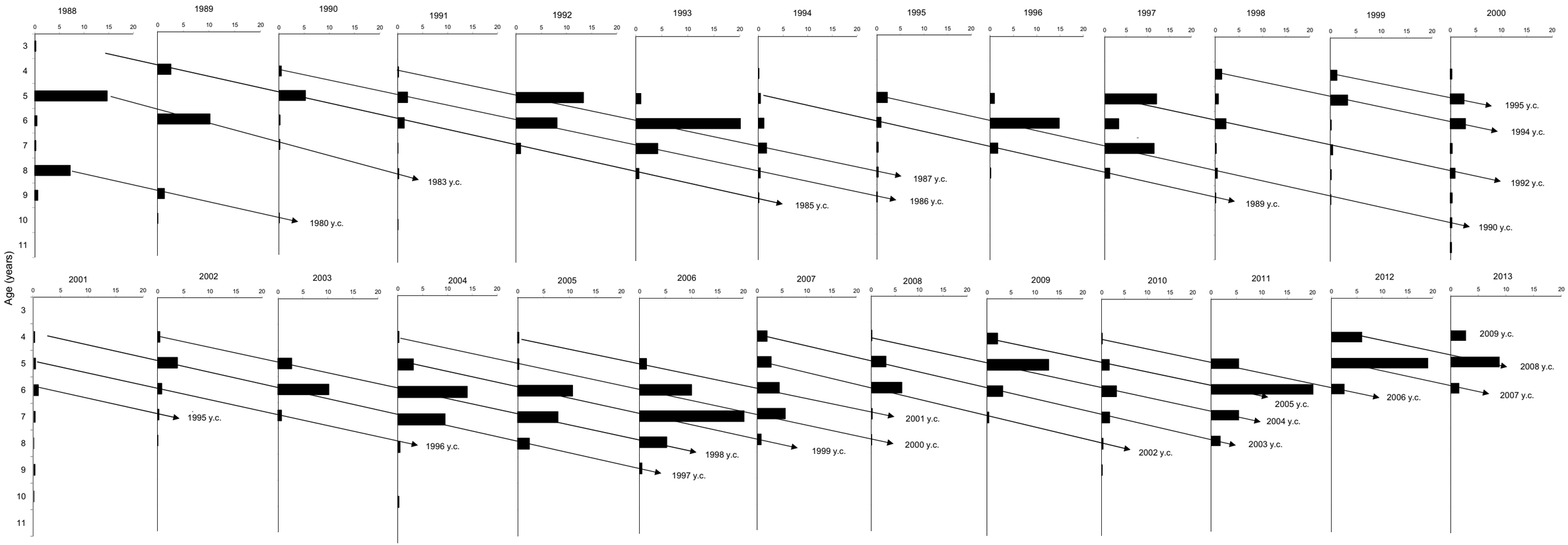


Figure 15. Catch per unit effort (CPUE) of Arctic Cisco by age class in the fall subsistence fishery, Niġliq channel, 1988–2013. Arrows demonstrate the progression of select year classes through the fishery. Only fish harvested in 7.6 cm mesh gillnets are included and counts are standardized to 18 m net length, as described in text.

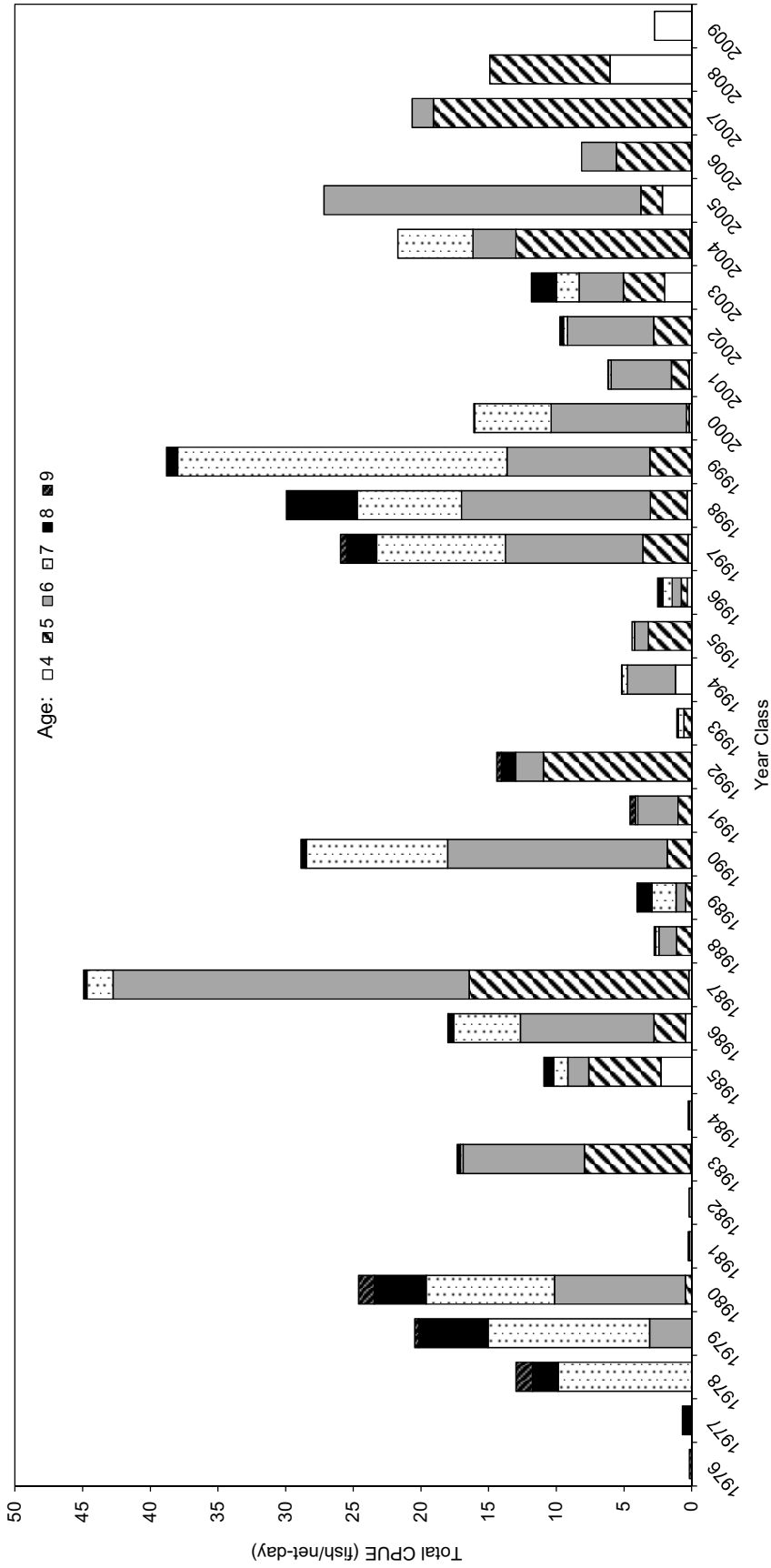


Figure 16. Cumulative catch per unit effort (catch per net-day) of Arctic Cisco by year class (year of hatch) in the fall subsistence fishery, Nigliq Channel, Colville River, 1976–2009 (capture dates 1985–2013). Catch per unit effort was estimated only for fish captured in 7.6 cm mesh nets.

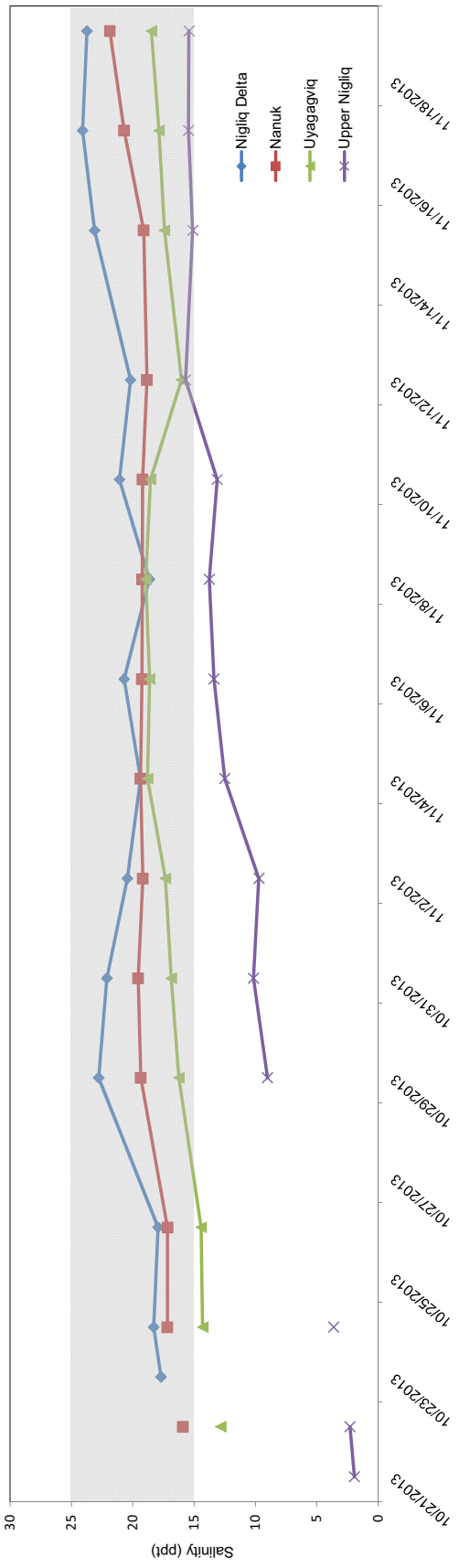


Figure 17. Water salinity (parts per thousand) measured at 3.0 m depth from 4 water stations on the Nigliq Channel, Colville River, Alaska, 21 October–19 November 2013. Shaded area represents the preferred salinity range of Arctic Cisco.

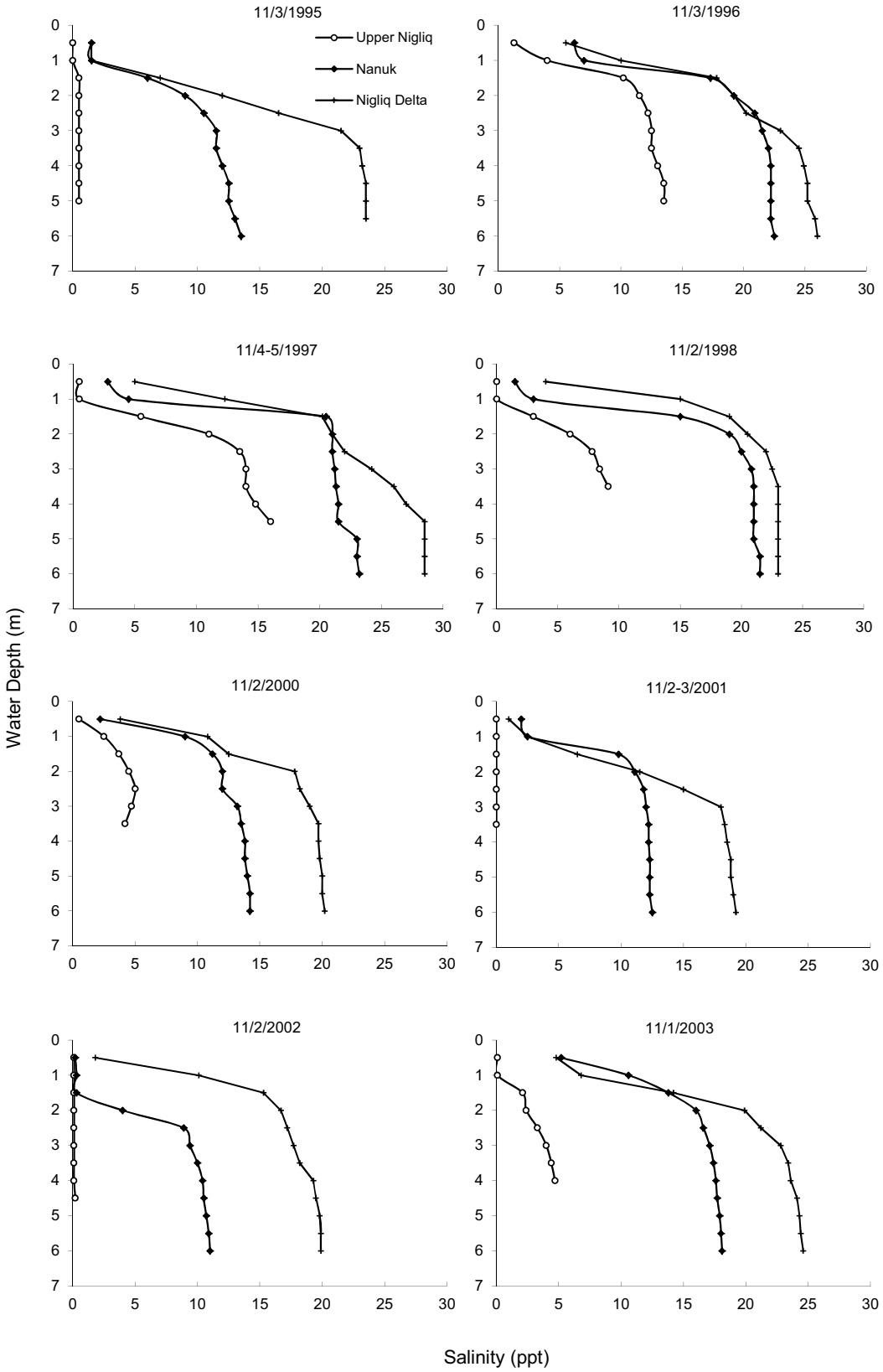


Figure 18. Water salinity depth profiles in Niġliq Channel fishing areas, Colville River, Alaska, early November 1987–2013.

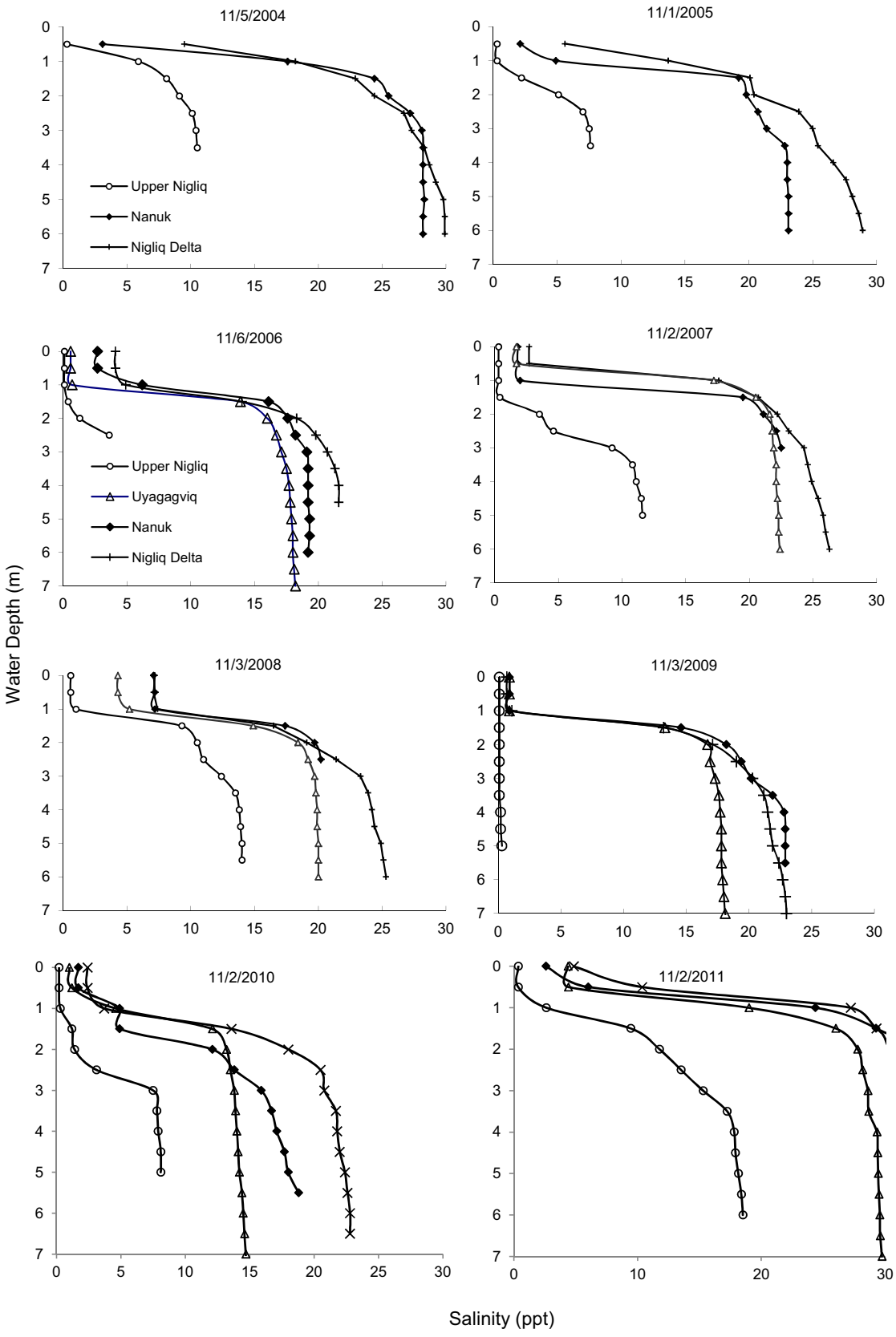


Figure 18. Continued.

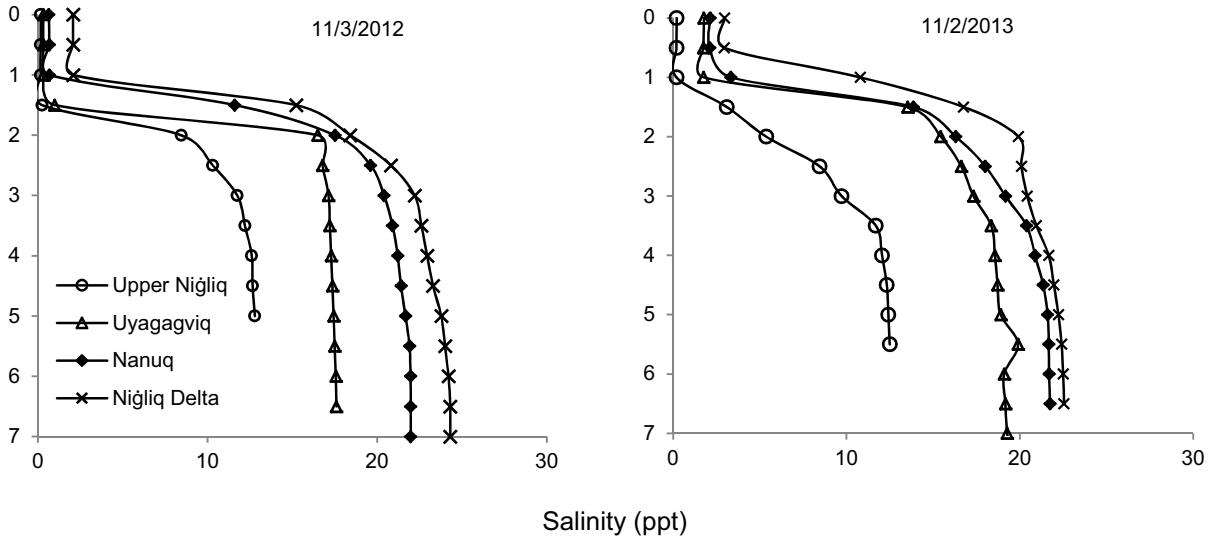


Figure 18. Continued.

localized areas of elevated arsenic are not uncommon in Alaska due both to atmospheric deposition and local geology (ADEC 2009). Diesel range organics ranged from 12–34.1 mg/kg and residual range organics ranged from 36.4 to 173 mg/kg. Similar to 2011 and 2012, all diesel and residual range organics were well below the ADEC direct contact and ingestion limit. Water station 5 was sampled because a fisher caught infected Broad Whitefish on numerous occasions at this site (see Appendix A). However, none of the analyte concentrations from water station 5 were markedly different than those from the other 4 water stations.

DISCUSSION

In 2013, the fall fishery for Arctic Cisco began on 9 October, almost two weeks earlier than in 2012 (Table 1). Over the course of harvest monitoring, ABR recorded 376 unique harvest events from the Niġliq and Main Channels, up from 262 in 2012 (Seigle and Gottschalk 2013). This increase in recorded harvest events was related to the increase in the number of safe ice travel days in 2013 versus 2012. Twenty-eight households deployed 66 unique nets with 106 sets over the course of the fishing season. This was well above the effort recorded in 2012 (49 nets and 62 distinct sets) and above the long-term average effort in terms of net sets (56 nets) (Figure 3). After ABR's departure on 20 November, fishing effort was indirectly monitored until 17 December via personal communication with several resident fishers. By 29 November, only one fisher remained with two nets actively fishing on the Upper Niġliq adjacent to town until 17 December. The observed fishing effort of 1, 429 adjusted net-days of fishing was a considerable increase over the 2011 (1,232) and 2012 (847) harvest seasons. However, between 19 and 22 October 2013, temperatures were well above freezing on the Niġliq Channel resulting in unstable ice conditions for the fishery monitoring team and fishers alike and resulting in a much reduced fishing effort during that time. Fishing effort picked up following the warm weather period as fishers attempted to make up for lower harvests.

In 2013, the early start to the fishery allowed for number of active nets fishing at any one time to reach a maximum of 42 by 16 October (Figure 4). This was well above the maximum of 27 nets fishing at in 2012 (Figure 4 *in* Seigle and Gottschalk 2013). Furthermore, peak net deployment did not occur until 4 November in 2012. Active net deployment displayed two peaks during the 2013 season due to the warming period

mentioned above. After dropping to 12 active nets on 16 October, fishing effort reached 39 nets on 2 November (Figure 4). Effort steadily decreased to nine nets on the last day of direct monitoring (20 November). This was a major decrease in late season effort compared to 2012. Decreased harvest rates by 10 November likely influenced the exodus of fishers from the river over the next 10 days (Figure 8).

Since 1998 and with few exceptions, the majority of fishing effort on the Niġliq Channel has occurred in the Niġliq Delta fishing area, followed by the Nanuk area, and then the farthest upstream Upper Niġliq area. This remained true in 2013 (Figures 2, 4, and 5). The increasing fishing effort in downstream fishing areas over the past 15 years results from the perception amongst fishers that fishing returns relative to effort are superior in the delta compared to locations farther upstream. Fishers that historically fished only in the Upper Niġliq or Nanuk areas have begun to place nets in the two downstream fishing areas (i.e., Niġliq Delta and Main Channel) in recent years. Despite these efforts, fishers who placed their nets in the Nanuk area were rewarded with higher CPUE than fishers in the Niġliq Delta (15 versus 13.9 fish per adjusted net-day in 7.6 cm nets). CPUE nearly doubled in the Upper Niġliq in 2013 versus 2012 (from 3.5 to 7.0 fish per adjusted net-day), allowing fishers who set nets closer to town to spend less on fuel for snow machines while approaching historical average CPUE values (9.7 fish per adjusted net-day) (Table 3).

In the Niġliq Delta area, the CPUE of 13.9 Arctic Cisco per adjusted net-day (7.6 cm mesh nets) continues the trend of decreasing harvests over the last two years (31.2 fish per adjusted net-day in 2012 and 41.8 fish per adjusted net-day in 2011. This catch rate for Arctic Cisco in the Niġliq Delta was only the sixteenth highest in the monitoring history (Table 3). Fishers made up for the relatively low CPUE in 7.6 cm mesh nets in 2013 by keeping their nets in the water longer than they did in 2012.

Fishing effort also occurred on the Main Channel of the Colville River for the third year in a row. ABR relies on local hires to provide all of the information about harvests on the Main Channel. Fishing effort and catch in the Main Channel showed similar patterns as in the Niġliq Channel with effort increased over 2012, but with CPUE decreasing from 52.2 Arctic Cisco per adjusted net-day in 2012 to 14.3 in 2013 for 7.6 cm mesh nets. (Figures 2 and 4, Table 4). Traditionally, the Main Channel has been fished by overnight campers because its distance from Nuiqsut precludes nets from being checked reliably on a daily or semi-daily basis. However, in 2013, eight nets were deployed in the Main Channel by fishers, most with the intention of commuting daily to their nets from Nuiqsut. Despite an increased number of nets and adjusted net-days in 2013, we had fewer reported harvests from the Main Channel than in 2012. Fishers reported mixed results in 2013 depending on the mesh size deployed, but in general saw a large decrease in CPUE over 2012.

CPUE estimates for Arctic Cisco in 7.6 cm mesh nets in 2011 and 2012 were well above long term averages and led to near record harvests. Recruitment of young Arctic Cisco into the fishery probably contributed to the high harvest rates. Since 2007, fyke net surveys of near-shore waters at Prudhoe Bay have reported large numbers of young-of-the-year Arctic Cisco (Craig Reiser, LGL, personal communications 2009 and 2010, and Figure 17 *in* Seigle et al. 2008b). These fish begin to appear in the Colville River fall fishery at age 4. Thus, 2013 was predicted to be an above average year for harvest rates. While fishers were generally pleased with the overall number of fish caught in the 2013 season, there was a sense of greatly increased effort necessary to achieve harvest numbers (Table 4). The sharp decline in CPUE from 2011 and 2012 to 2013 remains unexplained. Factors such as the success of young-of-the-year recruitment to the fishery, early maturing adults, seasonal environmental conditions (e.g., wind direction, water temperature, and salinity), and over-fishing may all contribute to a decrease in the number of fish available for harvest in any given year (Table 3).

Salinity levels in the Niġliq Delta and Nanuk fishing areas were optimal for overwintering Arctic Cisco from the onset of water sampling (15–25 ppt, Figure 17). Movement of the salt wedge upstream in the Niġliq Channel usually is associated with offshore west winds (Moulton and Field 1988, Moulton 1994) which were prevalent at various

intervals in 2013. However, daily CPUE averages in 7.6 cm mesh nets remained low through most of the season. After excluding the lone harvest record on 24 October of 86 Arctic Cisco caught in one net, the first week of November stands out as the period of highest daily CPUEs during the 2013 fall fishery (Figure 8). However daily salinity levels were not a good predictor of fish harvests as daily CPUE began to decrease in the second week of November (Figures 8 and 17). This in turn corresponded with a steady rate of decrease in total nets deployed on the river (Figure 4).

Just as the upstream extent of the salt wedge is often a good predictor for Arctic Cisco location and harvest numbers, so too does it tend to predict Least Cisco presence and abundance. Least Cisco prefer salinities slightly lower than Arctic Cisco in the Niġliq Channel. Indeed, Least Cisco generally reside in waters with salinity <15 ppt (Moulton and Field 1988). The presence of high salinities in the Niġliq Delta and Nanuk areas early in the monitoring season likely influenced the low numbers of Least Cisco observed during the 2013 season. In fact, CPUE of Least Cisco observed in 7.6 cm mesh nets was the lowest recorded in the history of the fishery (Table 6). Harvest effort was low in the fresher waters of the Niġliq Channel located adjacent to Nuiqsut and thus it is difficult to say with certainty if say Least Cisco were residing in the Niġliq Channel or much farther upstream on the Main Channel.

As was the case 2012, we continued to see a limited range of age classes in the fishery. 2013 was the second year in a row that only age 4, age 5, and age 6 fish were identified from donated samples, with age 5 fish dominating the harvests of 7.6 cm mesh nets (Figure 13). This leads to questions about the disappearance of age 7 and age 8 fish (2006 and 2005 year classes). Could it be that Arctic Cisco are maturing faster and therefore leaving the Colville River earlier for the spawning grounds on the Mackenzie River system? We continue to see a similar range of overlapping fish sizes being captured across all mesh sizes in recent years (Figure 10). As in recent years, we continue to see that there is wide variability in size at age (e.g., a 325 mm Arctic Cisco can be age 4, 5, or 6) (Figure 14). Size differences among age classes could be caused by differences among years in the nutrient availability in offshore waters during summer months, or differences in overwintering conditions between different parts of the river which might make different metabolic demands on overwintering fish.

ABR has suggested in previous reports that 2011 and the years to follow were predicted to be the first years of an upward trend in harvest of Arctic Cisco. This prediction was justified in 2011 and 2012 but did not come to pass in 2013 (Table 3, Figure 6). We remain optimistic that Colville River harvests will remain relatively high in the next few years assuming high recruitment into the fishery of 2009 and later year classes as well as continued high production of young-of-the-year from the Mackenzie River system. Still, it is surprising to see the fluctuating harvest levels of certain year classes. For example, the 2007 year class was barely represented in the 2011 fishery but then appeared in large numbers as 5-year-olds in 2012 fishery only to contribute to a rather small percentage of the harvests in 2013 as 6-year-olds.

ABR continues to improve communication with fishers in Nuiqsut. In 2013, a water-born mold infected a large number of Broad Whitefish in the Upper Niġliq and upstream into the Main Channel of the Colville River (see Plates). While no other fish species were observed with this infection, there are many concerns about the possible impact of this mold and changing water conditions on subsistence fish. ABR continues to work with members of the Qaaktaq Panel, along with KSOP, NSB, ADFG, BLM, and CPAI, as the community of Nuiqsut voices their concerns about the fall fishery. We will continue to work with various stakeholders to assist in facilitating the exchange of information related to the fishery so that resource managers and community leaders can make informed management decisions related to a healthy Arctic Cisco fishery.

PLATES

Plate 1. Close-up of infected Broad Whitefish caught on the Main Channel of the Colville River, south of Nuiqsut, Alaska, October 2013.

Plate 2. Close-up of infected Broad Whitefish caught on the Main Channel of the Colville River, south of Nuiqsut, Alaska, October 2013.

Plate 3. Two side-by-side infected Broad Whitefish caught on the Niġliq Channel of the Colville River, Alaska, November 2013.

Plate 4. Infected Broad Whitefish caught on the Niġliq Channel of the Colville River, Alaska, November 2013.

LITERATURE CITED

ABR, Inc.; Sigma Plus, Statistical Consulting Services; Stephen R. Braund & Associates; and Kuukpik Subsistence Oversight Panel, Inc. 2007. Variation in abundance of Arctic Cisco in the Colville River: Analysis of existing data and local knowledge. Volumes I and II. Report for the U.S. Department of the Interior, Minerals Management Service Alaska OCS Region, Anchorage, AK. Technical Report No. MMS 2007-042.

ADEC. 2009. Alaska Department of Environmental Conservation Division of Spill Prevention and Response Contaminated Sites Program. Technical Memorandum: Arsenic in Soil. March 2009. Accessed online: http://dec.alaska.gov/spar/csp/guidance/tm-arsenic.pdf (15 February 2013).

Bickham, J.W., S.M. Carr, B.G. Hanks, D.W. Burton, and B.J. Gallaway. 1989. Genetic analysis of population variation in the Arctic Cisco (*Coregonus autumnalis*) using electrophoretic, flow cytometric, and mitochondrial DNA restriction analysis. Biological Papers of the University of Alaska 24: 112–122.

Bond, W.A., and R.N. Erickson. 1985. Life history studies of anadromous coregonid fishes in two freshwater lake systems on the Tuktoyaktuk Peninsula, Northwest Territories. Canadian Technical Report of Fisheries and Aquatic Sciences 1336: 1–61.

Bond, W.A., and R.N. Erickson. 1997. Coastal migrations of Arctic Cisco in the eastern Beaufort Sea. Pages 155–164 *in* J. Reynolds, editor. Fish ecology in Arctic North America. American Fisheries Society Symposium 19, Bethesda, Maryland.

Chilton, D.E., and R.J. Beamish. 1982. Age determination methods for fishes studied by the Groundfish Program at the Pacific Biological Station. Canadian Special Publication of Fisheries and Aquatic Sciences 60. 102 pp.

Craig, P.C. 1984. Fish use of coastal waters of the Alaskan Beaufort Sea: A review. Transactions of the American Fisheries Society 113: 265–282.

Craig, P.C., and L. Halderson. 1981. Beaufort Sea barrier island-lagoon ecological process studies: Final report, Simpson Lagoon. Part 4. Fish. Pages 384–678 *in* Environmental Assessment of the Alaskan Continental Shelf. OCS Final Reports of Principal Investigators, MMS/NOAA, OCSEAP, Anchorage, AK. Volume 7.

Crecelius, E.A., J. H. Trefry, M. S. Steinhaur, and P. D. Boehm. 1991. Trace metals in sediments from the inner continental shelf of the western Beaufort Sea. Environmental Geology 18: 71–79.

Daigneault, M.J., and C. Reiser. 2007. Colville River fall fishery monitoring, 2006. Report by LGL Alaska Research Associates, Inc., Anchorage, AK, for ConocoPhilips Alaska, Inc., Anchorage, AK. 42 pp.

Douglas, T.A., and M. Sturm. 2004. Arctic haze, mercury, and the chemical composition of snow across the northwestern Arctic. Atmospheric Environment 38: 805–820.

Fechhelm, R.G., and D.B. Fissel. 1988. Wind-aided recruitment of Canadian Arctic Cisco (*Coregonus autumnalis*) into Alaskan waters. Canadian Journal of Fisheries and Aquatic Sciences 47: 2,164–2,171.

Gallaway, B.J., and R.G. Fechhelm. 2000. Anadromous and amphidromous fishes. Chapter 17 *in* The natural history of an Arctic oil field. Joe C. Truett and Stephen R. Johnson, editors. Academic Press, New York, NY. 422 pp.

Gallaway, B.J., W.B. Griffiths, P.C. Craig, W.J. Gazey, and J.W. Helmericks. 1983. An assessment of the Colville River delta stock of Arctic Cisco (*Coregonus autumnalis*)—Migrants from Canada? Biological Papers of the University of Alaska 21: 4–23.

Loseto, L.L., S.D. Sicilliano, and D.R.S. Lean. 2004. Methylmercury production in high arctic wetlands. Environmental Toxicology and Chemistry 23: 17–23.

Long, E.R, D.D. MacDonald, S.L, Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of concentrations in marine and estuarine sediments. Environmental Management. 19: 81–97.

MBC Applied Environmental Sciences. 2004. Proceedings of a workshop on the variability of Arctic Cisco (*Qaaktaq*) in the Colville River, November 18–20, Nuiqsut, AK. OCS Study, MMS 2004-033. USDOI, MMS, Alaska OCS Region, Anchorage, AK. 60 pp. + appendices.

Moulton, L.L. 1989. Recruitment of Arctic Cisco (*Coregonus autumnalis*) into the Colville delta, Alaska, in 1985. Biological Papers of the University of Alaska 24: 107–111.

Moulton, L.L. 1994. The 1993 Endicott Development Fish Monitoring Program. Vol. II: The 1993 Colville River fishery. Report by MJM Research, Bainbridge Island, WA, for BP Exploration (Alaska) Inc. and North Slope Borough. 60 pp. + appendices.

Moulton, L.L., and L.J. Field. 1988. Assessment of the Colville River fall fishery 1985–1987. Report by Environmental Sciences and Engineering, Inc., Anchorage, AK, for ARCO Alaska, Inc., North Slope Borough, and the City of Nuiqsut. 42 pp.

Moulton, L.L., L.J. Field, and S. Brotherton. 1986. Assessment of the Colville River fishery in 1985. Colville River Fish Study, Chapter 3. Report by Entrix, Inc., Anchorage, AK, for ARCO Alaska, Inc., the North Slope Borough, and the City of Nuiqsut. 86 pp.

Moulton, L.L., and B.T. Seavey. 2004. Harvest estimate and associated information for the 2003 Colville River fall fishery. Report by MJM Research, Bainbridge Island, WA, for ConocoPhillips Alaska, Inc., Anchorage, AK. 79 pp.

Moulton, L.L., B.T. Seavey, and J. Pausanna. 2006. Harvest rates for the 2005 Colville River fall fishery. Report by MJM Research, Bainbridge Island, WA, for ConocoPhillips Alaska, Inc., Anchorage, AK.

Moulton, L.L., B.T. Seavey, and J. Pausanna. 2010. History of an under-ice subsistence fishery for Arctic Cisco and Least Cisco in the Colville River, Alaska. Arctic 63: 381–390.

Rember, R.D, and J.H Trefry. 2004. Increased concentrations of dissolved trace metals and organic carbon during snowmelt in rivers of the Alaskan arctic. Geochimica et Cosmochimica Acta 68: 477–489.

Secor, D.H., J.M Dean, and E.H. Laban. 1992. Otolith removal and preparation for microstructural examination. Chapter 3 *in* Otolith microstructure examination and analysis. D. Stephenson and S. Campana, editors. Special Publication, Canadian Journal of Fisheries and Aquatic Science 117: 17−59.

Seigle, J.C., S.M. Murphy, and S.R. Braund. 2008a. Fall 2007 fishery monitoring on the Colville River. Report by ABR, Inc, Anchorage, AK, for ConocoPhillips Alaska, Inc., Anchorage, AK. 33 pp.

Seigle, J.C., and J.P. Parrett. 2008b. Fall 2008 subsistence fishery monitoring on the Colville River. Report by ABR, Inc.—Environmental Research & Services, Anchorage, AK, for ConocoPhillips Alaska, Inc., Anchorage, AK. 46 pp.

Seigle, J.C., J.M. Gottschalk, and J.R. Rose. 2011. Fall 2010 subsistence fishery monitoring on the Colville River. Report by ABR, Inc.—Environmental Research & Services, Anchorage, AK, for ConocoPhillips Alaska, Inc., Anchorage, AK. 78 pp.

Seigle, J.C., and J.M. Gottschalk. 2012. Fall 2011 subsistence fishery monitoring on the Colville River. Report by ABR, Inc.—Environmental Research & Services, Anchorage, AK, for ConocoPhillips Alaska, Inc., Anchorage, AK. 93 pp.

Seigle, J.C., and J.M. Gottschalk. 2013. Fall 2012 subsistence fishery monitoring on the Colville River. Report by ABR, Inc.—Environmental Research & Services, Anchorage, AK, for ConocoPhillips Alaska, Inc., Anchorage, AK. 93 pp.

Stenhaur, M.S., and P.B Boehm. 1992. The composition and distribution of saturated and aromatic hydrocarbons in the nearshore sediments, river sediments, and coastal peat of the Alaskan Beafort Sea: Implications for detecting anthropogenic hydrocarbon inputs. Marine Environmental Research 33: 223–253

USEPA. 2012. Current drinking water regulations. Accessed online: http://water.epa.gov/lawsregs/rulesregs/sdwa/currentregulations.cfm (15 February 2013).

Wetzel D., and P. Mercurio. 2007. Petroleum hydrocarbons in fish and sediments of NPR-A Teshekpuk Lake and Colville and Ikpikpuk rivers. Mote Marine Technical Report Number 1128.

Appendix A. Incident report for observations of water mold *(Saprolegnia)* in the Colville River and on Broad Whitefish

While en route to Nuiqsut for the fall fishery harvest monitoring season, ABR fish biologist John Seigle was contacted by Craig George (North Slope Borough (NSB) biologist) on 14 October 2013 to inform ABR biologists of the presence of sick Broad Whitefish on the Colville River near Nuiqsut. Later, ABR learned from biologist Todd Sformo (NSB) that these sick fish had been caught in gill-nets since 8 October. On 15 October, ABR biologists received more information about the sick fish from local fishers Edward Nukapigak, Jonah Nukapigak and Sam Kunaknana. On the afternoon of 15 October ABR biologists observed 2 sick Broad Whitefish caught in Sam Kunaknana's 14 cm mesh net on the main channel of the Colville River south of Nuiqsut. The fish appeared to have a fungal outbreak covering the entire head and parts of the body and fins. No sick fish were caught in this net on 16 October, but additional sick fish were captured from this same net on 17 October. Additional sick Broad Whitefish were captured in Jonah Nukapigak's 7.6 cm mesh net on the Niġliq Channel adjacent to Nuiqsut during several harvests in early October, prior to ABR's arrival in Nuiqsut.

News of these sick fish spread quickly through Nuiqsut and to NSB and CPAI personnel. On 16 October, ABR biologists were invited to meet with the Kukpik Susbisistence Oversight Panel (KSOP) board and NSB biologists as well as representatives from CPAI to begin the process of gathering information regarding sick Broad Whitefish caught at different locations on the river. The meeting took place on 17 October and a number of issues were discussed, including concerns over how many sick Broad Whitefish were being caught by fishers, where they were being caught, whether other species were being affected by the outbreak, the results of preliminary analysis of tissues by State of Alaska pathologists, and how future affected fish should be handled. It was decided that the NSB would work with fishers to collect sick fish and ship them to labs for analysis. The group decided that ABR biologists would work closely with fishers and other stakeholders to keep all entities up to date on the latest information regarding the presence of sick fish.

Starting 18 October, warm air temperature and overflow on the river caused most fishers to pull their nets from the Colville River. The warm weather continued for approximately 3 days. However, 1 sick Broad Whitefish was caught on 20 October from Jonah Nukapigak's 7.6 cm net in the Niġliq Channel. ABR biologists documented the catch with photos. On 21 October Sam Kunaknana caught 24 Broad Whitefish south of Nuiqsut on the main channel of the Colville River in his 14 cm net, though none appeared infected. A water and sediment sample was collected from that net site (Water Station 5) and sent to Arctic Fox Environmental Inc., in Prudhoe Bay and TestAmerica Laboratories in Portland, Oregon. Additionally, ABR biologists took ambient water chemistry readings which were in the normal range (near freezing, highly oxygenated, near neutral pH, absent salinity).

Craig George (NSB) informed ABR biologists on 21 October that they had a preliminary result from the State of Alaska pathologist of a water mold in the genus *Saprolegnia*, a common water mold/fungi in freshwater fish. It is important to note that this was simply a preliminary result and that attempts were ongoing at that time to culture the organism for confirmation of taxon. During this same period of time, a fisher reported seeing an oily sheen on the water at his net location on the Niġliq Channel. ABR biologists observed the sheen and determined that it was a bio-film left on the ice and in the water during fish harvests. It was theorized that warmer than usual temperatures allowed the daily accumulation of bio-film to separate from the melting ice and accumulate at the harvest location.

This same fisher reported that Arctic Cisco which had been harvested days earlier and left outside his home to freeze solid were showing signs of accumulations of orange ice crystals on the scales of some fish. Indeed, this phenomenon was observed by ABR biologists during one day though crystals began disappearing in subsequent days. Because these fish were left in the open air to freeze, it could not be determined from where these crystals emanated (i.e., from air born particulate matter perhaps related to dust stirred up by passing vehicles or from water in the river itself). No other fish observed by ABR biologists exhibited this phenomenon.

ABR biologists were notified by Gordon Brown on 21 October that he had caught 5 sick Broad Whitefish at the same location of Sam Kunaknana's net set on the Colville River main channel south of town. Infected Broad Whitefish were not seen again until 7 November and again on 10 November. ABR biologists recorded photo-documented of these fish. These are the final records of sick fish reported to ABR personnel. Additional sick fish may have been reported directly to NSB personnel. Subsequent reports from the NSB suggest confirmation of the successful culture of the water mold *Saprolegnia* from samples provided to the State of Alaska pathology laboratory.

Appendix B. North Slope Fisheries logbook distributed to Nuiqsut fishers, fall 2013.

North Slope Fisheries Logbook

ABR inc.

Background information for this project:

There are many changes taking place in the environment of the NPR-A. Oil and gas development is increasing and there is strong evidence for climate change.

We are attempting to monitor fish harvests in the region in order to assess the health of fish populations as these changes continue.

This project is designed to begin a long-term study of fishing effort and harvest levels for Aanaakłiq, Qaaktaq (and other species of fish).

We look for your help in collecting information on summer and fall harvests in lakes and streams of the region.

You can help by reading the following instructions and by filling out the datasheets in this notebook.

For more information, please contact **John Seigle at: jseigle@abrinc.com**

Your help is very much appreciated!

Quyanaqpak!

Instructions for using this logbook:

1. When you set a net in a river or lake, fill out your name, camp or cabin name and the approximate location of your net.
2. Enter the date each time you check your net.
3. Enter the length and mesh size for your net. Use ruler on cover of logbook to measure stretched mesh.
4. Every time you check your net, please enter the „Number Caught" for each „Fish Species". If you catch zero fish, then please enter a zero in the first line for „Number Caught".
5. If your net remains in the same location after checking, then you don't need to put in location information.
6. If you have more than one net, call the first net # 1, the second net #2, and so on.

….Continued on next page

7. Use the „General Comments“ section to make any comments you might have about the weather, water levels, ice conditions, and interesting fish or other wildlife. You can also write more specific information about the net location. This is not mandatory, but it makes for good journal that you will enjoy reading for many generations.

Common Fishes of the North Slope of Alaska

Whitefishes

Qaaktaq = Arctic cisco
Tiipuq = Bering cisco
Aanaakłiq = broad whitefish
Pikuktuuq = humpback whitefish
Iqalusaaq = least cisco
Savigunnaq = round whitefish
Sii´ruaq = inconnu (sheefish)

Char

Iqalukpik = Dolly Varden char
Paiqłuk = Arctic char
Iqaluaqpak = lake trout

Pacific Salmon

Iqalugruaq = chum salmon
Iqalugruaq = Chinook salmon
Amaqtuuq = pink salmon
Red salmon = sockeye salmon

Other freshwater fishes

Nimigiaq = Arctic lamprey
Sulukpaugaq = Arctic grayling
Tittaaliq = burbot
Milugiaq = longnose sucker
Siulik = northern pike
Ɬuuqiñiq = Alaska blackfish
Kakalisauraq = threespine stickleback
Kakalisauraq = ninespine stickleback
Kanayuq = slimy sculpin

Nearshore Marine/Brackish Water Fishes

Iɬhuaˊniq = rainbow smelt
Iqalugaq = Arctic cod
Uugaq = saffron cod
Nataaˊnaq = Arctic flounder
Nataaˊnaq = starry flounder
Paŋmaˊraq = capelin
Kanayuq = fourhorn sculpin
Uqsruqtuuq = Pacific herring

Common Loons of the North Slope of Alaska

Qaqsrauq = Pacific Loon
Qaqsraupiaġruk = Red-throated Loon
Tuullik = Yellow-billed Loon

Loons in your net?

Loons are commonly entangled in subsistence fishnets on the North Slope.

When you catch loons in your net please write down how many of each species were caught and whether they were found dead or released alive.

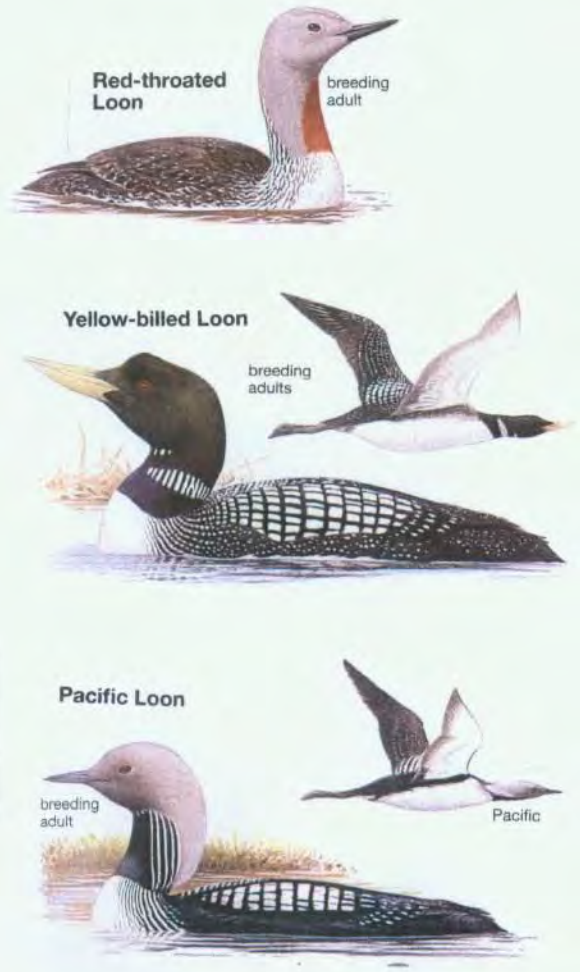
If any “Tuullik” or Yellow-billed Loons are kept for use in traditional crafts please make a note of this as well.

If you need assistance in removing entangled loons from your net please contact staff at the NSB Dept. of Wildlife Management **(907) 852-0350**.

Information you provide on Loon bycatch will help us estimate how many loons are accidentally caught in nets on the North Slope. **All Information you provide us is strictly confidential.**

Your participation is greatly appreciated.

Quyanaqpak!


Red-throated Loon
breeding adult
Yellow-billed Loon
breeding adults
Pacific Loon
breeding adult
Pacific

Name of Net Checker: John Smith

Camp or Cabin Name: Wood's Camp

Specific Net Location: In front of cabin

Net Number	Date Net Checked	Net Length	Mesh Size	Fish Species	Number Caught
1	11/5/2011	60 feet	3 in	Qaaktaq	27
				Iqalusaak	20
				Uugaq	10

General Comments:

Net Number	Date Net Checked	Net Length	Mesh Size	Fish Species	Number Caught
2	11/5/2011	100 feet	3-1/2 in	Qaaktaq	18
				Iqalusaak	15

General Comments:

Name of Net Checker: Jane Smith

Camp or Cabin Name: Elson Lagoon

Specific Net Location: Niksiuraq

Net Number	Date Net Checked	Net Length	Mesh Size	Fish Species	Number Caught
1	7/20/2001	90 feet	3 in	Aanaakliq	10
				Sulukpaugaq	20
				Iqalusaak	2
				Titaaliq	10

General Comments:

Net Number	Date Net Checked	Net Length	Mesh Size	Fish Species	Number Caught
2	7/20/2011	80 feet	3-1/2 in	Aanaakliq	6
				Sulukpaugaq	2

General Comments:

Appendix C. Age frequencies (expressed as percentages) of Arctic Cisco caught in 7.6 cm mesh nets, Colville Delta, Alaska, 1976–2013. Data were collected and analyzed by the North Slope Borough in 1976–1978, by MJM Research in 1985–2005, by LGL in 2006, and by ABR in 2007–2013.

Age Class (y)	1976	1977	1978	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
3	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.5	10.7	0.0	0.0	0.0	0.5	0.0	18.3	7.3	4.9	0.0	0.0	0.7	0.0	0.0	0.0	27.2	23.3	3.5	10.3	7.6	0.0	0.7	1.0	0.0	12.8	1.4	11.7	0.7	0.0	21.85	20.90
5	3.2	57.7	10.2	10.2	3.3	0.0	0.0	63.5	0.0	86.0	51.0	59.7	3.4	10.8	59.5	5.3	43.2	13.2	62.0	33.6	16.5	72.9	20.0	11.3	1.0	3.2	17.9	31.1	69.2	23.4	15.2	68.91	67.16
6	54.8	15.4	74.0	77.2	21.5	41.2	1.0	1.6	72.0	3.3	33.6	36.4	79.7	31.7	23.6	84.7	11.6	45.7	2.7	37.1	37.1	14.6	75.0	51.1	50.5	24.2	28.2	64.9	17.5	46.8	64.4	9.24	11.94
7	6.4	23.6	0.9	9.1	68.2	50.8	59.0	0.8	0.0	2.7	1.4	3.9	14.9	46.8	7.4	9.3	41.1	4.0	8.0	4.2	14.4	4.2	5.0	34.8	36.9	58.9	35.9	2.0	1.7	24.8	15.2	0.0	0.0
8	29.0	1.6	2.8	0.0	4.8	8.0	32.0	31.0	0.0	0.0	5.6	0.0	2.0	9.4	7.4	0.7	4.1	8.6	2.7	11.2	4.1	0.7	0.0	1.4	10.7	12.6	5.1	0.7	0.0	3.5	5.1	0.0	0.0
9	6.4	0.5	0.0	0.0	1.3	0.0	7.6	2.4	9.3	0.0	0.0	0.0	0.0	0.7	2.0	0.0	0.0	1.3	1.3	4.2	12.4	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.7	0.0	0.0	0.0
10	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	5.2	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n =	31	182	215	—[b]	—[b]	199	196	126	—[b]	150	143	154	148	139	148	150	146	151	150	143	97	144	—[b]	141	103	95	39	59	120	141	138	119	134

[a] 1984, 1985 and 1989 age distributions estimated by comparing length frequencies of Arctic cisco caught in gill nets to fish caught in fyke nets.
[b] Catch per unit effort (CPUE) for the 1984, 1985, 1989 and 2003 harvest seasons were estimated.

Appendix D. A summary of water chemistry results from 4 sampling locations on 3 dates during the fall subsistence harvest of Arctic Cisco in the Niġliq Channel, Colville River, Alaska, 2013.

	24 October 2013					
	ADEC Soil Quality Standards					
Analyte	Arctic Zone Direct Contact[a]	Station #1	Station #2	Station #3	Station #4	Station #5
Arsenic	6.1	10.1	5.9	7.9	7.0	6.3
Barium	27,400	470	269	618	562	408
Cadmium	110	0.291	0.096	0.346	0.326	0.315
Chromium	410	22.8	9.2	24.2	14.3	20.6
Lead	400	14.7	6.0	13.7	9.6	13.1
Mercury	41	0.063	0.027	0.066	0.041	0.063
Selenium	680	1.04	0.46	0.82	0.72	0.77
Silver	680	0.217	0.073	0.179	0.197	0.208
Diesel Range Organics	13,700[b]	26.9	12.0	34.1	26.4	26.7
Residual Range Organics	12,500[b]	96.2	36.4	173	134	144
Percent Solids	–	62.8	74.7	58.7	65.8	63.6

[a] from Table B1 in 18 AAC 75
[b] from Table B2 in 18 AAC 75; mg/Kg ingestion limit

Appendix E. Raw laboratory water chemistry results from Arctic Fox Laboratories, Inc., collected from 4 sampling locations during the fall subsistence harvest of Arctic Cisco, Niġliq Channel, Colville River, Alaska, October 2013.

Arctic Fox Environmental, Inc.
Pouch 340043 / Prudhoe Bay, AK 99734
Phone: (907) 659-2145 / Fax: (907) 659-2146
arcticfox@astacalaska.com / www.arcticfoxenv.com

Analytical Services Order and Chain of Custody Form

84505

1013-1098

Client Name and Address:
ABR, Inc.
PO Box
Anchorage, AK 99524
Contact Person: Joel Gottschalk

Account Number: 13-162
P.O. or Contract Number:
Authorization Number:
Sampled By: Joel Gottschalk
PWS Number:
Send Results to ADEC: ☐ YES ☑ No

Phone Number: 907-947-9161 Fax Number:
E-mail: jgottschalk@abrinc.com
Project Name: Colville Fall fishery
Data Deliverables: Level I ☐ Level II ☐ Level III ☐ EDD/Format:
Requested Turnaround Time and Special Instructions: Standard

Client Sample ID	Date Sampled	Time Sampled	Matrix	AF Sample ID	Number of Containers	Nitrates/Nitrites	DRO/RRO	Total metals					Remarks
						H2SO4	None	None					Preservative ←
Colville Fishery St. 1 H2O A	10/24/2013	2:04PM	W	AF49019	1	X							
Colville Fishery St 1 H2O B	10/24/2013	2:04 PM		↓	1		X						
Colville Fishery St 1 H2O C	10/24/2013	2:04PM		↓	1		[illegible]	X					
Colville Fishery St 2 H2O A	10/24/2013	3:15PM		AF49020	1	X							
Colville Fishery St 2 H2O B	10/24/2013	3:15 PM		↓	1		X						
Colville Fishery St 2 H2O C	10/24/2013	3:15 PM		↓	1		[illegible]	X					
Colville Fishery St 4 H2O A	10/24/2013	4:45PM		AF49021	1	X							
Colville Fishery St 4 H2O B	10/24/2013	4:45PM		↓	1		X						
Colville Fishery St 4 H2O C	10/24/2013	4:45PM		↓	1		[illegible]	X					

	Date:	Time:	
Relinquished By (1): Joel Gottschalk	10/25/2013	11:30am	Received By:
Relinquished By (2):	10-26-13	1530	Received By: [signature]
Relinquished By (3):	Date:	Time:	Received for lab by:

TO BE COMPLETED BY LABORATORY

Location Received/ Temp on Arrival: ANC ☐ ____ °C FBK ☐ ____ °C PB ☑ 12.7 °C 8178

Chain of Custody Seal ☐ INTACT ☐ BROKEN ☐ ABSENT

Shipping Bill Number: ____

Arctic Fox Environmental, Inc.
Pouch 340043 - Prudhoe Bay, AK 99734
Phone: (907) 659-2145 / Fax: (907) 659-2146 / arcticfox@astacalaska.com

ABR Inc. environmental Research & Services
PO BOX 24068
Anchorage, Alaska 99524

Report Date: 11/12/2013
Date Arrived: 10/26/2013
Date Sampled: 10/24/2013
Time Sampled: See Below
Collected By: Joel Gottschalk

Attn: Joel Gottschalk
Phone: (907) 947-9161
Fax:
Email: jgottschalk@abrinc.com

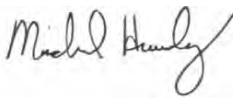
Arctic Fox Lab# AF49019-49021
Client Sample ID: See below
Location/Project: Colville Fall Fishery
COC#: 84505
Sample Matrix: Water

Comments: Attached are the results for analysis of your samples.
These samples were analyzed by Test America in Beaverton, OR.
Tracking information is as follows:

ABR Sample ID: Colville Fishery St. 1 H2O
Analysis Requested: Nitrate/Nitrite, Total Metals, DRO/RRO
Arctic Fox ID: AF49019
Test America ID: 250-15130-1

ABR Sample ID: Colville Fishery St. 2 H2O
Analysis Requested: Nitrate/Nitrite, Total Metals, DRO/RRO
Arctic Fox ID: AF49020
Test America ID: 250-15130-2

ABR Sample ID: Colville Fishery St. 4 H2O
Analysis Requested: Nitrate/Nitrite, Total Metals, DRO/RRO
Arctic Fox ID: AF49021
Test America ID: 250-15130-3



Reported By: Ralph E. Allphin/Michael J. Hawley/Max Greene
Arctic Fox Environmental, Inc.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Portland
9405 SW Nimbus Ave.
Beaverton, OR 97008
Tel: (503)906-9200

TestAmerica Job ID: 250-15130-1
Client Project/Site: 1013-1098/Colville Fall Fishery

For:
Arctic Fox Environmental, Inc
Pouch 340043
Prudhoe Bay, Alaska 99734

Attn: Max Greene

Vanessa Berry

Authorized for release by:
11/4/2013 11:14:02 AM

Vanessa Berry, Project Manager I
(503)906-9233
vanessa.frahs@testamericainc.com

Table of Contents

Sample Summary

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1098/Colville Fall Fishery

TestAmerica Job ID: 250-15130-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
250-15130-1	AF49019 St. 1	Water	10/24/13 14:04	10/30/13 08:50
250-15130-2	AF49020 St. 2	Water	10/24/13 15:15	10/30/13 08:50
250-15130-3	AF49021 St. 4	Water	10/24/13 16:45	10/30/13 08:50

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1098/Colville Fall Fishery

TestAmerica Job ID: 250-15130-1

Job ID: 250-15130-1

Laboratory: TestAmerica Portland

Narrative

Job Narrative
250-15130-1

Comments
No additional comments.

Receipt
The samples were received on 10/30/2013 8:50 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 5.3º C.

Except:

The following samples were received unpreserved and were preserved upon receipt to the laboratory: AF49019 St. 1 (250-15130-1), AF49020 St. 2 (250-15130-2), AF49021 St. 4 (250-15130-3). Regulatory documents require a 24-hour waiting period from the time of the addition of the acid preservative to the time of digestion.

10/30/13@0855 M030 by PSS

GC Semi VOA
No analytical or quality issues were noted.

Metals
No analytical or quality issues were noted.

General Chemistry
No analytical or quality issues were noted.

Organic Prep
No analytical or quality issues were noted.

Client Sample ID: AF49019 St. 1

Lab Sample ID: 250-15130-1

Date Collected: 10/24/13 14:04

Matrix: Water

Date Received: 10/30/13 08:50

Method: AK102 & 103 - Alaska - Diesel Range Organics & Residual Range Organics (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10-C25)	ND		0.11		mg/L		10/31/13 08:20	10/31/13 17:22	1
RRO (nC25-nC36)	ND		0.53		mg/L		10/31/13 08:20	10/31/13 17:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Triacontane	*61*		*50 - 150*	*10/31/13 08:20*	*10/31/13 17:22*	*1*
1-Chlorooctadecane	*81*		*50 - 150*	*10/31/13 08:20*	*10/31/13 17:22*	*1*

Method: 6020 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:06	1
Barium	**0.068**		0.0010		mg/L		10/31/13 08:35	10/31/13 17:06	1
Chromium	ND		0.0020		mg/L		10/31/13 08:35	10/31/13 17:06	1
Lead	**0.0032**		0.0010		mg/L		10/31/13 08:35	10/31/13 17:06	1
Silver	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:06	1
Selenium	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:06	1
Cadmium	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:06	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/31/13 15:10	10/31/13 20:24	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.10		mg/L			11/02/13 11:35	1

Client Sample ID: AF49020 St. 2

Lab Sample ID: 250-15130-2

Date Collected: 10/24/13 15:15

Matrix: Water

Date Received: 10/30/13 08:50

Method: AK102 & 103 - Alaska - Diesel Range Organics & Residual Range Organics (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10-C25)	ND		0.10		mg/L		10/31/13 08:20	10/31/13 17:41	1
RRO (nC25-nC36)	ND		0.52		mg/L		10/31/13 08:20	10/31/13 17:41	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Triacontane	*60*		*50 - 150*	*10/31/13 08:20*	*10/31/13 17:41*	*1*
1-Chlorooctadecane	*84*		*50 - 150*	*10/31/13 08:20*	*10/31/13 17:41*	*1*

Method: 6020 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:20	1
Barium	**0.076**		0.0010		mg/L		10/31/13 08:35	10/31/13 17:20	1
Chromium	ND		0.0020		mg/L		10/31/13 08:35	10/31/13 17:20	1
Lead	**0.0023**		0.0010		mg/L		10/31/13 08:35	10/31/13 17:20	1
Silver	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:20	1
Selenium	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:20	1
Cadmium	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:20	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/31/13 15:10	10/31/13 20:26	1

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1098/Colville Fall Fishery

TestAmerica Job ID: 250-15130-1

Client Sample ID: AF49020 St. 2

Lab Sample ID: 250-15130-2

Date Collected: 10/24/13 15:15

Matrix: Water

Date Received: 10/30/13 08:50

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.10		mg/L			11/02/13 11:47	1

Client Sample ID: AF49021 St. 4

Lab Sample ID: 250-15130-3

Date Collected: 10/24/13 16:45

Matrix: Water

Date Received: 10/30/13 08:50

Method: AK102 & 103 - Alaska - Diesel Range Organics & Residual Range Organics (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10-C25)	ND		0.11		mg/L		10/31/13 08:20	10/31/13 18:01	1
RRO (nC25-nC36)	ND		0.53		mg/L		10/31/13 08:20	10/31/13 18:01	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Triacontane	*62*		*50 - 150*	*10/31/13 08:20*	*10/31/13 18:01*	*1*
1-Chlorooctadecane	*88*		*50 - 150*	*10/31/13 08:20*	*10/31/13 18:01*	*1*

Method: 6020 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:23	1
Barium	**0.11**		0.0010		mg/L		10/31/13 08:35	10/31/13 17:23	1
Chromium	ND		0.0020		mg/L		10/31/13 08:35	10/31/13 17:23	1
Lead	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:23	1
Silver	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:23	1
Selenium	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:23	1
Cadmium	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 17:23	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.00033**		0.00020		mg/L		10/31/13 15:10	10/31/13 20:29	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.10		mg/L			11/02/13 11:37	1

Method: AK102 & 103 - Alaska - Diesel Range Organics & Residual Range Organics (GC)

Lab Sample ID: MB 250-21645/1-A
Matrix: Water
Analysis Batch: 21663

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 21645

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10-C25)	ND		0.10		mg/L		10/31/13 08:20	10/31/13 16:07	1
RRO (nC25-nC36)	ND		0.50		mg/L		10/31/13 08:20	10/31/13 16:07	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Triacontane	*65*		*50 - 150*	*10/31/13 08:20*	*10/31/13 16:07*	*1*
1-Chlorooctadecane	*86*		*50 - 150*	*10/31/13 08:20*	*10/31/13 16:07*	*1*

Lab Sample ID: LCS 250-21645/2-A
Matrix: Water
Analysis Batch: 21663

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 21645

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
DRO (C10-C25)			2.50	2.11		mg/L		84	75 - 125		
RRO (nC25-nC36)			1.50	1.20		mg/L		80	60 - 120		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Triacontane	*68*		*50 - 150*
1-Chlorooctadecane	*92*		*50 - 150*

Lab Sample ID: LCSD 250-21645/3-A
Matrix: Water
Analysis Batch: 21663

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 21645

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
DRO (C10-C25)			2.50	2.11		mg/L		85	75 - 125	0	20
RRO (nC25-nC36)			1.50	1.20		mg/L		80	60 - 120	0	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Triacontane	*68*		*50 - 150*
1-Chlorooctadecane	*92*		*50 - 150*

Method: 6020 - Metals (ICP/MS)

Lab Sample ID: MB 250-21646/1-A
Matrix: Water
Analysis Batch: 21673

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 21646

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 16:36	1
Barium	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 16:36	1
Chromium	ND		0.0020		mg/L		10/31/13 08:35	10/31/13 16:36	1
Lead	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 16:36	1
Silver	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 16:36	1
Selenium	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 16:36	1
Cadmium	ND		0.0010		mg/L		10/31/13 08:35	10/31/13 16:36	1

Method: 6020 - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 250-21646/2-A
Matrix: Water
Analysis Batch: 21673

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 21646

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	0.100	0.0911		mg/L		91	80 - 120
Barium	0.100	0.0908		mg/L		91	80 - 120
Chromium	0.100	0.0938		mg/L		94	80 - 120
Lead	0.100	0.0954		mg/L		95	80 - 120
Silver	0.0500	0.0466		mg/L		93	80 - 120
Selenium	0.100	0.0908		mg/L		91	80 - 120
Cadmium	0.100	0.0919		mg/L		92	80 - 120

Lab Sample ID: 250-15154-B-2-B MS
Matrix: Water
Analysis Batch: 21673

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 21646

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	0.0011		0.100	0.0946		mg/L		94	75 - 125
Barium	0.023		0.100	0.116		mg/L		92	75 - 125
Chromium	ND		0.100	0.0958		mg/L		96	75 - 125
Lead	0.0017		0.100	0.0969		mg/L		95	75 - 125
Silver	ND		0.0500	0.0471		mg/L		94	75 - 125
Selenium	ND		0.100	0.0914		mg/L		91	75 - 125
Cadmium	ND		0.100	0.0947		mg/L		95	75 - 125

Lab Sample ID: 250-15154-C-1-B DU
Matrix: Water
Analysis Batch: 21673

Client Sample ID: Duplicate
Prep Type: Total/NA
Prep Batch: 21646

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	0.0011		0.00115		mg/L		7	20
Barium	0.023		0.0239		mg/L		4	20
Chromium	ND		ND		mg/L		NC	20
Lead	ND		ND		mg/L		NC	20
Silver	ND		ND		mg/L		NC	20
Selenium	ND		ND		mg/L		NC	20
Cadmium	ND		ND		mg/L		NC	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 250-21667/11-A
Matrix: Water
Analysis Batch: 21676

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 21667

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/31/13 15:10	10/31/13 19:45	1

Lab Sample ID: LCS 250-21667/12-A
Matrix: Water
Analysis Batch: 21676

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 21667

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.00500	0.00527		mg/L		105	85 - 115

Method: 7470A - Mercury (CVAA) (Continued)

Lab Sample ID: 250-15140-B-3-B MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Dissolved**
Analysis Batch: 21676 — **Prep Batch: 21667**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	ND		0.00500	0.00524		mg/L		105	75 - 125

Lab Sample ID: 250-15140-B-3-C MSD — **Client Sample ID: Matrix Spike Duplicate**
Matrix: Water — **Prep Type: Dissolved**
Analysis Batch: 21676 — **Prep Batch: 21667**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	ND		0.00500	0.00506		mg/L		101	75 - 125	3	20

Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 280-199052/61 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 199052

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.10		mg/L			11/02/13 11:11	1

Lab Sample ID: LCS 280-199052/62 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 199052

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	5.00	5.20		mg/L		104	90 - 110

Lab Sample ID: LCSD 280-199052/63 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 199052

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	5.00	5.23		mg/L		105	90 - 110	1	10

Lab Sample ID: MRL 280-199052/18 MRL — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 199052

Analyte	Spike Added	MRL Result	MRL Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	0.100	ND		mg/L		85	50 - 150

Lab Sample ID: 250-15130-2 MS — **Client Sample ID: AF49020 St. 2**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 199052

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	ND		4.00	3.92		mg/L		98	90 - 110

Method: 353.2 - Nitrogen, Nitrate-Nitrite (Continued)

Lab Sample ID: 250-15130-2 MSD
Matrix: Water
Analysis Batch: 199052

Client Sample ID: AF49020 St. 2
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	ND		4.00	4.45	F	mg/L		111	90 - 110	13	10

Qualifiers

General Chemistry

Qualifier	Qualifier Description
F	MS/MSD Recovery and/or RPD exceeds the control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Certification Summary

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1098/Colville Fall Fishery

TestAmerica Job ID: 250-15130-1

Laboratory: TestAmerica Portland

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska (UST)	State Program	10	UST-012	12-26-13
California	State Program	9	2597	09-30-15
Oregon	NELAP	10	OR100021	01-09-14
USDA	Federal		P330-11-00092	02-17-14
Washington	State Program	10	C586	06-23-14

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	11-30-13
A2LA	ISO/IEC 17025		2907.01	11-30-13
Alabama	State Program	4	40730	09-30-12 *
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-13
Arkansas DEQ	State Program	6	88-0687	06-01-14
California	ELAP	9	2513	08-31-14
Colorado	State Program	8	N/A	09-30-14
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-14
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Louisiana	NELAP	6	30785	06-30-14 *
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-13
Nevada	State Program	9	CO0026	09-01-14
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-14
New Mexico	State Program	6	CO00026	06-30-14 *
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-13
North Dakota	State Program	8	R-034	06-30-14 *
Oklahoma	State Program	6	8614	08-31-14
Oregon	NELAP	10	CO200001	01-16-14
Pennsylvania	NELAP	3	68-00664	07-30-14
South Carolina	State Program	4	72002	06-30-14 *
Texas	NELAP	6	T104704183-08-TX	10-01-14
USDA	Federal		P330-13-00202	07-02-16
Utah	NELAP	8	CO000262012-4	07-31-14
Virginia	NELAP	3	460232	06-14-14
Washington	State Program	10	C583	08-03-14
West Virginia DEP	State Program	3	354	11-30-13
Wisconsin	State Program	5	999615430	08-31-14
Wyoming (UST)	A2LA	8		11-30-13

* Expired certification is currently pending renewal and is considered valid.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

11720 North Creek Pkwy N Ste 250-15130 Chain of Custody
11922 E. Firs
9405 SW Nimbus Ave, Beaverton, OR 97008-7145
2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

CHAIN OF CUSTODY REPORT

Work Order #:

CLIENT: **Arctic Fox Environmental Inc.**
REPORT TO: **Pouch 340043**
ADDRESS: **Prudhoe Bay, AK 99734**
arcticfox@astacalaska Attn: Ralph/Mike/Max
PHONE: 907-659-2145 FAX: 907-659-2146

INVOICE TO: **Arctic Fox Environmental Inc.**
Pouch 340043
Prudhoe Bay, AK 99734
Attn: Ralph Allphin/Michael Hawley/Max Greene
arcticfox@astacalaska.com
P.O. NUMBER: 1013-1098

PROJECT NAME: Colville Fall Fishery
PROJECT NUMBER:
SAMPLED BY: JG

PRESERVATIVE: NO | HCl | NO

REQUESTED ANALYSES

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	DRO/GRO	Nitrate/Nitrite	Total Metals RCRA 6020	MATRIX (W, S, O)	# OF CONT.	LOCATION/ COMMENTS	TA WO ID
1	AF49019	10-24-13 @ 1404	X	X	X	W	3	St. 1	
2	AF49020	@ 1515	X	X	X		3	St. 2	
3	AF49021	@ 1645	X	X	X		3	St. 4	
4									
5									
6									
7									
8									
9									
10									

TURNAROUND REQUEST
In Business Days *
Organic & Inorganic Analyses: 10 STD | 7 | 5 | 4 | 3 | 2 | 1 | <1
Petroleum Hydrocarbon Analyses: 5 STD. | 4 | 3 | 2 | 1 | <1
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

RELEASED BY: Max Greene DPM: AFE DATE: 10-29-13 TIME: 1500
RECEIVED BY: Phil Sviabt-Secor TAP DATE: 10/30/13 TIME: 0850
5.3

Login Sample Receipt Checklist

Client: Arctic Fox Environmental, Inc

Job Number: 250-15130-1

Login Number: 15130

List Source: TestAmerica Portland

List Number: 1

Creator: Svabik-Seror, Philip M

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	False	M030 HNO3 preserved in lab 10/30/13@0855 by PSS.
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	N/A	
Samples do not require splitting or compositing.	N/A	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: Arctic Fox Environmental, Inc

Job Number: 250-15130-1

Login Number: 15130
List Number: 1
Creator: Roman, Alex F

List Source: TestAmerica Denver
List Creation: 10/31/13 02:06 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Arctic Fox Environmental, Inc.
Pouch 340043 / Prudhoe Bay, AK 99734
Phone: (907) 659-2145 / Fax: (907) 659-2146
arcticfox@astacalaska.com / www.arcticfoxenv.com

Analytical Services Order and Chain of Custody Form

84502

1013-1078

Client Name and Address: ABR, INC. PO BOX 24068 Anchorage, AK 99524	Account Number:		1	H_2SO_4 2	3					Preservative ←
Contact Person: John C. Seigle	P.O. or Contract Number: 13-162	Number of Containers	RRO DRO (GLASS)	NITRATE / NITRITE (250ml)	TOTAL RCRA METALS (500ml)					
Phone Number: 907-223-2536 Fax Number:	Authorization Number:									
E-mail: jseigle@abrinc.com	Sampled By: John Seigle									
Project Name: Colville Fall Fishery	PWS Number:									
Data Deliverables: Level I ☐ Level II ☐ Level III ☐ EDD/Format:	Send Results to ADEC: ☐ YES ☐ No									
Requested Turnaround Time and Special Instructions: Rapid Turnaround										

Client Sample ID	Date Sampled	Time Sampled	Matrix	AF Sample ID									Remarks
Colville Station 4 - H_2O · A	10/17/2013	11:00am	W	AF48963	1	X							
Colville Station 4 - H_2O · B	10/17/2013	11:00am	W	AF48964	1		X						
Colville Station 4 - H_2O · C	10/17/2013	11:00am	W	AF48965	1			X					

Relinquished By (1): JOHN SEIGLE	Date: 10/17/13	Time: 11:30am	Received By:
Relinquished By (2):	Date: 10/17/13	Time: 1230	Received By:
Relinquished By (3):	Date:	Time:	Received for lab by:

TO BE COMPLETED BY LABORATORY

Location Received/ Temp on Arrival: ANC ☐ 7.2 °C FBK ☐ _____ °C PB ☐ _____ °C
8178

Chain of Custody Seal ☐ INTACT ☐ BROKEN ☐ ABSENT

Shipping Bill Number: _____

Arctic Fox Environmental, Inc.
Pouch 340043 - Prudhoe Bay, AK 99734
Phone: (907) 659-2145 / Fax: (907) 659-2146 / arcticfox@astacalaska.com

ABR Inc. environmental Research & Services
PO BOX 24068
Anchorage, Alaska 99524

Report Date: 10/24/2013
Date Arrived: 10/17/2013
Date Sampled: 10/17/2013
Time Sampled: 11:00 AM
Collected By: John Seigle

Attn: John Seigle
Phone: (907) 223-2536
Fax: (907) 770-1443
Email: jseigle@abrinc.com

Arctic Fox Lab# AF48963-48965
Client Sample ID: See below
Location/Project: Colville Fall Fishery
COC#: 84502
Sample Matrix: Water

Comments: Attached are the results for analysis of your samples.
These samples were analyzed by Test America in Beaverton, OR.
Tracking information is as follows:

ABR Sample ID: Colville Station 4-H2O A
Analysis Requested: DRO/RRO
Arctic Fox ID: AF48963
Test America ID: 250-14934-1

ABR Sample ID: Colville Station 4-H2O B
Analysis Requested: Nitrate/Nitrite
Arctic Fox ID: AF48964
Test America ID: 250-14934-2

ABR Sample ID: Colville Station 4-H2O C
Analysis Requested: Total Metals
Arctic Fox ID: AF48965
Test America ID: 250-14934-3

Reported By: Ralph E. Allphin/Michael J. Hawley/Max Greene
Arctic Fox Environmental, Inc.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Portland
9405 SW Nimbus Ave.
Beaverton, OR 97008
Tel: (503)906-9200

TestAmerica Job ID: 250-14934-1
Client Project/Site: 1013-1078/Colville Fall Fishery

For:
Arctic Fox Environmental, Inc
Pouch 340043
Prudhoe Bay, Alaska 99734

Attn: Max Greene

Authorized for release by:
10/24/2013 3:20:37 PM
Erica Fot, Project Mgmt. Assistant
erica.fot@testamericainc.com

Designee for

Vanessa Berry, Project Manager I
(503)906-9233
vanessa.frahs@testamericainc.com

Table of Contents

Sample Summary

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1078/Colville Fall Fishery

TestAmerica Job ID: 250-14934-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
250-14934-1	AF48963 Station 4 H2O A	Water	10/17/13 11:00	10/18/13 08:45
250-14934-2	AF48964 Station 4 H2O B	Water	10/17/13 11:00	10/18/13 08:45
250-14934-3	AF48965 Station 4 H2O C	Water	10/17/13 11:00	10/18/13 08:45

Job ID: 250-14934-1

Laboratory: TestAmerica Portland

Narrative

Job Narrative
250-14934-1

Comments
No additional comments.

Receipt
The samples were received on 10/18/2013 8:45 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were 3.3º C and 5.8º C.

Except:

The following samples were received unpreserved and were preserved upon receipt to the laboratory: AF48965 Station 4 H2O C (250-14934-3). Regulatory documents require a 24-hour waiting period from the time of the addition of the acid preservative to the time of digestion.

M030 10/18/13@0940

GC Semi VOA
No analytical or quality issues were noted.

Metals
No analytical or quality issues were noted.

General Chemistry
Method 353.2: The matrix spike (MS/MSD) recoveries associated with batch 197495 were outside control limits for NOXT: (280-47683-2 MS), (280-47683-2 MSD). Matrix interference is suspected. The parent sample was negative, with an absolute value greater than the reporting limit (RL), indicating a matrix interference. The associated laboratory control samples (LCS/LCSD) recoveries met acceptance criteria.

No other analytical or quality issues were noted.

Organic Prep
No analytical or quality issues were noted.

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1078/Colville Fall Fishery

TestAmerica Job ID: 250-14934-1

Client Sample ID: AF48963 Station 4 H2O A

Lab Sample ID: 250-14934-1

Date Collected: 10/17/13 11:00
Matrix: Water
Date Received: 10/18/13 08:45

Method: AK102 & 103 - Alaska - Diesel Range Organics & Residual Range Organics (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10-C25)	ND		0.11		mg/L		10/21/13 10:15	10/22/13 15:50	1
RRO (nC25-nC36)	ND		0.57		mg/L		10/21/13 10:15	10/22/13 15:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Triacontane	*89*		*50 - 150*	*10/21/13 10:15*	*10/22/13 15:50*	*1*
1-Chlorooctadecane	*97*		*50 - 150*	*10/21/13 10:15*	*10/22/13 15:50*	*1*

Client Sample ID: AF48964 Station 4 H2O B

Lab Sample ID: 250-14934-2

Date Collected: 10/17/13 11:00
Matrix: Water
Date Received: 10/18/13 08:45

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.10		mg/L			10/23/13 20:33	1

Client Sample ID: AF48965 Station 4 H2O C

Lab Sample ID: 250-14934-3

Date Collected: 10/17/13 11:00
Matrix: Water
Date Received: 10/18/13 08:45

Method: 6020 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:59	1
Barium	**0.072**		0.0010		mg/L		10/21/13 07:46	10/21/13 16:59	1
Chromium	ND		0.0020		mg/L		10/21/13 07:46	10/21/13 16:59	1
Lead	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:59	1
Silver	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:59	1
Selenium	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:59	1
Cadmium	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:59	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/22/13 14:45	10/22/13 21:27	1

Method: AK102 & 103 - Alaska - Diesel Range Organics & Residual Range Organics (GC)

Lab Sample ID: MB 250-21328/1-A
Matrix: Water
Analysis Batch: 21381

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 21328

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10-C25)	ND		0.10		mg/L		10/21/13 10:15	10/22/13 14:53	1
RRO (nC25-nC36)	ND		0.50		mg/L		10/21/13 10:15	10/22/13 14:53	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Triacontane	*94*		*50 - 150*	*10/21/13 10:15*	*10/22/13 14:53*	*1*
1-Chlorooctadecane	*99*		*50 - 150*	*10/21/13 10:15*	*10/22/13 14:53*	*1*

Lab Sample ID: LCS 250-21328/2-A
Matrix: Water
Analysis Batch: 21381

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 21328

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
DRO (C10-C25)			2.50	2.08		mg/L		83	75 - 125		
RRO (nC25-nC36)			1.50	1.32		mg/L		88	60 - 120		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Triacontane	*97*		*50 - 150*
1-Chlorooctadecane	*99*		*50 - 150*

Lab Sample ID: LCSD 250-21328/3-A
Matrix: Water
Analysis Batch: 21381

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 21328

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
DRO (C10-C25)			2.50	2.16		mg/L		86	75 - 125	4	20
RRO (nC25-nC36)			1.50	1.31		mg/L		87	60 - 120	1	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Triacontane	*97*		*50 - 150*
1-Chlorooctadecane	*100*		*50 - 150*

Method: 6020 - Metals (ICP/MS)

Lab Sample ID: MB 250-21318/1-A
Matrix: Water
Analysis Batch: 21348

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 21318

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:03	1
Barium	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:03	1
Chromium	ND		0.0020		mg/L		10/21/13 07:46	10/21/13 16:03	1
Lead	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:03	1
Silver	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:03	1
Selenium	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:03	1
Cadmium	ND		0.0010		mg/L		10/21/13 07:46	10/21/13 16:03	1

Method: 6020 - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 250-21318/2-A
Matrix: Water
Analysis Batch: 21348

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 21318

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	0.100	0.0915		mg/L		92	80 - 120
Barium	0.100	0.0923		mg/L		92	80 - 120
Chromium	0.100	0.0952		mg/L		95	80 - 120
Lead	0.100	0.0935		mg/L		93	80 - 120
Silver	0.0500	0.0459		mg/L		92	80 - 120
Selenium	0.100	0.0882		mg/L		88	80 - 120
Cadmium	0.100	0.0907		mg/L		91	80 - 120

Lab Sample ID: 250-14936-J-1-B MS
Matrix: Water
Analysis Batch: 21348

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 21318

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	ND		0.100	0.0925		mg/L		93	75 - 125
Barium	0.029		0.100	0.124		mg/L		94	75 - 125
Chromium	ND		0.100	0.0949		mg/L		95	75 - 125
Lead	ND		0.100	0.0951		mg/L		95	75 - 125
Silver	ND		0.0500	0.0456		mg/L		91	75 - 125
Selenium	ND		0.100	0.0898		mg/L		90	75 - 125
Cadmium	ND		0.100	0.0914		mg/L		91	75 - 125

Lab Sample ID: 250-14935-J-1-B DU
Matrix: Water
Analysis Batch: 21348

Client Sample ID: Duplicate
Prep Type: Total/NA
Prep Batch: 21318

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	ND		ND		mg/L		NC	20
Barium	0.043		0.0441		mg/L		3	20
Chromium	ND		ND		mg/L		NC	20
Lead	ND		ND		mg/L		NC	20
Silver	ND		ND		mg/L		NC	20
Selenium	ND		ND		mg/L		NC	20
Cadmium	ND		ND		mg/L		NC	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 250-21383/1-A
Matrix: Water
Analysis Batch: 21392

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 21383

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/22/13 14:45	10/22/13 21:22	1

Lab Sample ID: LCS 250-21383/2-A
Matrix: Water
Analysis Batch: 21392

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 21383

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.00500	0.00471		mg/L		94	85 - 115

Method: 7470A - Mercury (CVAA) (Continued)

Lab Sample ID: 250-14963-B-4-B MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 21392 — **Prep Batch: 21383**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.00020		0.00500	0.00492		mg/L		98	75 - 125

Lab Sample ID: 250-14963-B-4-C MSD — **Client Sample ID: Matrix Spike Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 21392 — **Prep Batch: 21383**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.00020		0.00500	0.00493		mg/L		99	75 - 125	0	20

Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 280-197495/40 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 197495

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.10		mg/L			10/23/13 20:15	1

Lab Sample ID: LCS 280-197495/41 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 197495

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	5.00	4.99		mg/L		100	90 - 110

Lab Sample ID: LCSD 280-197495/42 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 197495

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	5.00	5.15		mg/L		103	90 - 110	3	10

Lab Sample ID: MRL 280-197495/18 MRL — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 197495

Analyte	Spike Added	MRL Result	MRL Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	0.100	ND		mg/L		86	50 - 150

Lab Sample ID: 280-47683-D-2 MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Dissolved**
Analysis Batch: 197495

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	ND		4.00	3.48	F	mg/L		87	90 - 110

Method: 353.2 - Nitrogen, Nitrate-Nitrite (Continued)

Lab Sample ID: 280-47683-D-2 MSD
Matrix: Water
Analysis Batch: 197495

Client Sample ID: Matrix Spike Duplicate
Prep Type: Dissolved

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	ND		4.00	3.51	F	mg/L		88	90 - 110	1	10

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1078/Colville Fall Fishery

TestAmerica Job ID: 250-14934-1

Qualifiers

General Chemistry

Qualifier	Qualifier Description
F	MS/MSD Recovery and/or RPD exceeds the control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Certification Summary

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1078/Colville Fall Fishery

TestAmerica Job ID: 250-14934-1

Laboratory: TestAmerica Portland

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska (UST)	State Program	10	UST-012	12-26-13
California	State Program	9	2597	09-30-15
Oregon	NELAP	10	OR100021	01-09-14
USDA	Federal		P330-11-00092	02-17-14
Washington	State Program	10	C586	06-23-14

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-13
A2LA	ISO/IEC 17025		2907.01	10-31-13
Alabama	State Program	4	40730	09-30-12 *
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-13
Arkansas DEQ	State Program	6	88-0687	06-01-14
California	ELAP	9	2513	08-31-14
Colorado	State Program	8	N/A	09-30-14
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-14
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Louisiana	NELAP	6	30785	06-30-14 *
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-13
Nevada	State Program	9	CO0026	09-01-14
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-14
New Mexico	State Program	6	CO00026	06-30-14 *
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-13
North Dakota	State Program	8	R-034	06-30-14 *
Oklahoma	State Program	6	8614	08-31-14
Oregon	NELAP	10	CO200001	01-16-14
Pennsylvania	NELAP	3	68-00664	07-30-14
South Carolina	State Program	4	72002	06-30-14 *
Texas	NELAP	6	T104704183-08-TX	10-01-14
USDA	Federal		P330-13-00202	07-02-16
Utah	NELAP	8	CO000262012-4	07-31-14
Virginia	NELAP	3	460232	06-14-14
Washington	State Program	10	C583	08-03-14
West Virginia DEP	State Program	3	354	11-30-13
Wisconsin	State Program	5	999615430	08-31-14
Wyoming (UST)	A2LA	8		10-31-13

* Expired certification is currently pending renewal and is considered valid.

TestAmerica
ANALYTICAL TESTING CORPORATION

2000 [illegible] Bothell WA 98011-8244 425-420-9200 FAX 420-9210
509-924-9200 FAX 924-9290
503-906-9200 FAX 906-9210
907-563-9200 FAX 563-9210

250-14934 Chain of Custody

CHAIN OF CUSTODY REPORT

[illegible] er #: 84502

CLIENT:

REPORT TO: Arctic Fox Environmental, Inc.
ADDRESS: Pouch 340043
Prudhoe Bay, AK 99734
attn. Ralph E. Allphin/Michael Hawley
PHONE: (907)659 2145 FAX: (907)659-2146

INVOICE TO:
Arctic Fox Environmental, Inc.
Pouch 340043
Prudhoe Bay, AK 99734
attn. Ralph E. Allphin/arcticfox@astacalaska.com

P.O. NUMBER: 1013-1078

PROJECT NAME: Colville Fall Fishery

PROJECT NUMBER:

SAMPLED BY: J.S.

TURNAROUND REQUEST
In Business Days *
Organic & Inorganic Analyses
10 STD. | 7 | 5 | 4 | 3 | 2 | 1 | <1
Petroleum Hydrocarbon Analyses
5 STD. | 4 | 3 | 2 | 1 | <1
OTHER Specify: RUSH
* Turnaround Requests less than standard may incur Rush Charges.

PRESERVATIVE: H_2SO_4

REQUESTED ANALYSES: DRO, RRO, Nitrate Nitrite, Total RCRA Metals

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	DRO	RRO	Nitrate Nitrite	Total RCRA Metals	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1	AF48963	10/17/13 @ 1100	X				W	1	Station 4 H_2O A	
2	AF48964	↓			X		W	1	Station 4 H_2O B	
3	AF48965	↓				X	W	1	Station 4 H_2O C	
4										
5										
6										
7										
8										
9										
10										

RELEASED BY: [signature] DATE: 10/17/13
PRINT NAME: Michael Hawley FIRM: Arctic Fox TIME: 1400

RECEIVED BY: [signature] DATE: 10/18/13
PRINT NAME: Sarah-Sear FIRM: TAL TIME: 0845

RELEASED BY: DATE:
PRINT NAME: FIRM: TIME:

RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS:

5.8 TEMP: 3.3 PAGE 1 OF 1

Login Sample Receipt Checklist

Client: Arctic Fox Environmental, Inc

Job Number: 250-14934-1

Login Number: 14934

List Source: TestAmerica Portland

List Number: 1

Creator: Svabik-Seror, Philip M

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	False	AF48965 HNO3 preserved in lab.
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	N/A	
Samples do not require splitting or compositing.	N/A	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: Arctic Fox Environmental, Inc

Job Number: 250-14934-1

Login Number: 14934
List Number: 1
Creator: Roman, Alex F

List Source: TestAmerica Denver
List Creation: 10/19/13 02:27 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Arctic Fox Environmental, Inc.
Pouch 340043 / Prudhoe Bay, AK 99734
Phone: (907) 659-2145 / Fax: (907) 659-2146
arcticfox@astacalaska.com / www.arcticfoxenv.com

Analytical Services Order and Chain of Custody Form

84504

1013-1089

Client Name and Address: ABR, INC. PO Box 240268 Anchorage, AK 99524	Account Number:			H2SO4	None	None					Preservative ←
Contact Person: John C. Seigle	P.O. or Contract Number:	Number of Containers		Nitrate/Nitrite	PRO / RRO	Total Metals					
Phone Number: 907-223-2536 Fax Number:	Authorization Number:										
E-mail: jseigle@abrinc.com	Sampled By: J.S.										
Project Name: Colville Fall Fishery	PWS Number:										
Data Deliverables: Level I ☐ Level II ☐ Level III ☐ EDD/Format:	Send Results to ADEC: ☐ YES ☐ No										
Requested Turnaround Time and Special Instructions:											

Client Sample ID	Date Sampled	Time Sampled	Matrix	AF Sample ID									Remarks
Colville Fishery St 5 H2O A	10/21/2013	11:10	W	AF48994	1	X							
Colville Fishery St. 5 H2O B	10/21/2013	11:10	W	AF48995	1		X						
Colville Fishery St 5 H2O C	10/21/2013	11:10	W	AF48996	1			X					

Relinquished By (1): John C. Seigle	Date: 10/21/2013	Time: 12:00	Received By:
Relinquished By (2):	Date: 10/22/13	Time: 1615	Received By:
Relinquished By (3):	Date:	Time:	Received for lab by:

TO BE COMPLETED BY LABORATORY

Location Received/ Temp on Arrival: ANC ☐ 4.6 °C FBK ☐ _____ °C PB ☐ _____ °C
8178

Chain of Custody Seal ☐ INTACT ☐ BROKEN ☐ ABSENT

Shipping Bill Number: _____

Arctic Fox Environmental, Inc.
Pouch 340043 - Prudhoe Bay, AK 99734
Phone: (907) 659-2145 / Fax: (907) 659-2146 / arcticfox@astacalaska.com

ABR Inc. environmental Research & Services
PO BOX 24068
Anchorage, Alaska 99524

Report Date: 10/28/2013
Date Arrived: 10/21/2013
Date Sampled: 10/21/2013
Time Sampled: 11:10 AM
Collected By: John Seigle

Attn: John Seigle
Phone: (907) 223-2536
Fax: (907) 770-1443
Email: jseigle@abrinc.com

Arctic Fox Lab# AF48994-48996
Client Sample ID: See below
Location/Project: Colville Fall Fishery
COC#: 84504
Sample Matrix: Water

Comments: Attached are the results for analysis of your samples.
These samples were analyzed by Test America in Beaverton, OR.
Tracking information is as follows:

ABR Sample ID: Colville Fishery St. S H2O A
Analysis Requested: Nitrate/Nitrite
Arctic Fox ID: AF48994
Test America ID: 250-15006-1

ABR Sample ID: Colville Fishery St. S H2O B
Analysis Requested: DRO/RRO
Arctic Fox ID: AF48995
Test America ID: 250-15006-2

ABR Sample ID: Colville Fishery St. S H2O C
Analysis Requested: Total Metals
Arctic Fox ID: AF48996
Test America ID: 250-15006-3

Reported By: Ralph E. Allphin/Michael J. Hawley/Max Greene
Arctic Fox Environmental, Inc.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Portland
9405 SW Nimbus Ave.
Beaverton, OR 97008
Tel: (503)906-9200

TestAmerica Job ID: 250-15006-1
Client Project/Site: 1013-1089/Colville Fall Fishery

For:
Arctic Fox Environmental, Inc
Pouch 340043
Prudhoe Bay, Alaska 99734

Attn: Max Greene

Vanessa Berry

Authorized for release by:
10/28/2013 4:34:35 PM

Vanessa Berry, Project Manager I
(503)906-9233
vanessa.frahs@testamericainc.com

Table of Contents

Sample Summary

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1089/Colville Fall Fishery

TestAmerica Job ID: 250-15006-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
250-15006-1	AF48994 St5 H2O A	Water	10/21/13 11:10	10/23/13 08:45
250-15006-2	AF48995 St5 H2O B	Water	10/21/13 11:10	10/23/13 08:45
250-15006-3	AF48996 St5 H2O C	Water	10/21/13 11:10	10/23/13 08:45

Job ID: 250-15006-1

Laboratory: TestAmerica Portland

Narrative

Job Narrative
250-15006-1

Comments
No additional comments.

Receipt
The samples were received on 10/23/2013 8:45 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 4.1° C.

Except:

The following samples were received unpreserved and were preserved upon receipt to the laboratory: AF48996 St5 H2O C (250-15006-3). Regulatory documents require a 24-hour waiting period from the time of the addition of the acid preservative to the time of digestion.

M030 10/23/13@0915 by PSS.

GC Semi VOA
No analytical or quality issues were noted.

Metals
Method(s) 7470A: Due to the matrix, the initial volume(s) used for the following sample(s) deviated from the standard procedure: KT101513LC03P (250-14891-3). The reporting limits (RLs) have been adjusted proportionately.

No other analytical or quality issues were noted.

General Chemistry
No analytical or quality issues were noted.

Organic Prep
No analytical or quality issues were noted.

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1089/Colville Fall Fishery

TestAmerica Job ID: 250-15006-1

Client Sample ID: AF48994 St5 H2O A

Lab Sample ID: 250-15006-1

Date Collected: 10/21/13 11:10
Matrix: Water
Date Received: 10/23/13 08:45

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.10		mg/L			10/26/13 15:26	1

Client Sample ID: AF48995 St5 H2O B

Lab Sample ID: 250-15006-2

Date Collected: 10/21/13 11:10
Matrix: Water
Date Received: 10/23/13 08:45

Method: AK102 & 103 - Alaska - Diesel Range Organics & Residual Range Organics (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10-C25)	ND		0.11		mg/L		10/24/13 07:30	10/28/13 12:21	1
RRO (nC25-nC36)	ND		0.53		mg/L		10/24/13 07:30	10/28/13 12:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Triacontane	*62*		*50 - 150*	*10/24/13 07:30*	*10/28/13 12:21*	*1*
1-Chlorooctadecane	*83*		*50 - 150*	*10/24/13 07:30*	*10/28/13 12:21*	*1*

Client Sample ID: AF48996 St5 H2O C

Lab Sample ID: 250-15006-3

Date Collected: 10/21/13 11:10
Matrix: Water
Date Received: 10/23/13 08:45

Method: 6020 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:22	1
Barium	**0.079**		0.0010		mg/L		10/25/13 09:35	10/25/13 16:22	1
Chromium	ND		0.0020		mg/L		10/25/13 09:35	10/25/13 16:22	1
Lead	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:22	1
Silver	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:22	1
Selenium	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:22	1
Cadmium	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:22	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/24/13 15:17	10/24/13 20:45	1

Method: AK102 & 103 - Alaska - Diesel Range Organics & Residual Range Organics (GC)

Lab Sample ID: MB 250-21442/1-A
Matrix: Water
Analysis Batch: 21534

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 21442

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
DRO (C10-C25)	ND		0.10		mg/L		10/24/13 07:30	10/28/13 11:26	1
RRO (nC25-nC36)	ND		0.50		mg/L		10/24/13 07:30	10/28/13 11:26	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Triacontane	*72*		*50 - 150*	*10/24/13 07:30*	*10/28/13 11:26*	*1*
1-Chlorooctadecane	*92*		*50 - 150*	*10/24/13 07:30*	*10/28/13 11:26*	*1*

Lab Sample ID: LCS 250-21442/2-A
Matrix: Water
Analysis Batch: 21534

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 21442

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
DRO (C10-C25)			2.50	2.06		mg/L		82	75 - 125		
RRO (nC25-nC36)			1.50	1.20		mg/L		80	60 - 120		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Triacontane	*81*		*50 - 150*
1-Chlorooctadecane	*92*		*50 - 150*

Lab Sample ID: LCSD 250-21442/3-A
Matrix: Water
Analysis Batch: 21534

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 21442

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
DRO (C10-C25)			2.50	2.07		mg/L		83	75 - 125	0	20
RRO (nC25-nC36)			1.50	1.21		mg/L		81	60 - 120	1	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Triacontane	*61*		*50 - 150*
1-Chlorooctadecane	*91*		*50 - 150*

Method: 6020 - Metals (ICP/MS)

Lab Sample ID: MB 250-21483/1-A
Matrix: Water
Analysis Batch: 21499

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 21483

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:13	1
Barium	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:13	1
Chromium	ND		0.0020		mg/L		10/25/13 09:35	10/25/13 16:13	1
Lead	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:13	1
Silver	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:13	1
Selenium	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:13	1
Cadmium	ND		0.0010		mg/L		10/25/13 09:35	10/25/13 16:13	1

Method: 6020 - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 250-21483/2-A
Matrix: Water
Analysis Batch: 21499

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 21483

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	0.100	0.0960		mg/L		96	80 - 120
Barium	0.100	0.0977		mg/L		98	80 - 120
Chromium	0.100	0.0991		mg/L		99	80 - 120
Lead	0.100	0.101		mg/L		101	80 - 120
Silver	0.0500	0.0494		mg/L		99	80 - 120
Selenium	0.100	0.0968		mg/L		97	80 - 120
Cadmium	0.100	0.0966		mg/L		97	80 - 120

Lab Sample ID: 250-15053-V-2-B MS
Matrix: Water
Analysis Batch: 21499

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 21483

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	0.0011		0.100	0.0949		mg/L		94	75 - 125
Barium	0.047		0.100	0.142		mg/L		95	75 - 125
Chromium	ND		0.100	0.0961		mg/L		96	75 - 125
Lead	ND		0.100	0.0972		mg/L		97	75 - 125
Silver	ND		0.0500	0.0488		mg/L		98	75 - 125
Selenium	ND		0.100	0.0920		mg/L		92	75 - 125
Cadmium	ND		0.100	0.0995		mg/L		99	75 - 125

Lab Sample ID: 250-15053-H-1-B DU
Matrix: Water
Analysis Batch: 21499

Client Sample ID: Duplicate
Prep Type: Total/NA
Prep Batch: 21483

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	0.029		0.0284		mg/L		1	20
Barium	0.056		0.0567		mg/L		0.9	20
Chromium	ND		ND		mg/L		NC	20
Lead	ND		ND		mg/L		NC	20
Silver	ND		ND		mg/L		NC	20
Selenium	ND		ND		mg/L		NC	20
Cadmium	ND		ND		mg/L		NC	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 250-21466/11-A
Matrix: Water
Analysis Batch: 21476

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 21466

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/24/13 15:17	10/24/13 20:23	1

Lab Sample ID: LCS 250-21466/12-A
Matrix: Water
Analysis Batch: 21476

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 21466

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.00500	0.00513		mg/L		103	85 - 115

Method: 7470A - Mercury (CVAA) (Continued)

Lab Sample ID: 250-14891-N-3-C MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 21476 — **Prep Batch: 21466**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	ND		0.0500	0.0435		mg/L		87	75 - 125

Lab Sample ID: 250-14891-N-3-D MSD — **Client Sample ID: Matrix Spike Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 21476 — **Prep Batch: 21466**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	ND		0.0500	0.0473		mg/L		95	75 - 125	8	20

Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 280-197962/100 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 197962

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.10		mg/L			10/26/13 14:40	1

Lab Sample ID: LCS 280-197962/101 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 197962

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	5.00	4.70		mg/L		94	90 - 110

Lab Sample ID: LCSD 280-197962/102 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 197962

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	5.00	4.77		mg/L		95	90 - 110	2	10

Lab Sample ID: MRL 280-197962/18 MRL — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 197962

Analyte	Spike Added	MRL Result	MRL Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	0.100	0.124		mg/L		124	50 - 150

Lab Sample ID: 280-47873-AC-1 MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 197962

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	ND		4.00	5.32	F	mg/L		133	90 - 110

Method: 353.2 - Nitrogen, Nitrate-Nitrite (Continued)

Lab Sample ID: 280-47873-AC-1 MSD
Matrix: Water
Analysis Batch: 197962

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	ND		4.00	5.33	F	mg/L		133	90 - 110	0	10

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1089/Colville Fall Fishery

TestAmerica Job ID: 250-15006-1

Qualifiers

General Chemistry

Qualifier	Qualifier Description
F	MS/MSD Recovery and/or RPD exceeds the control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Certification Summary

Client: Arctic Fox Environmental, Inc
Project/Site: 1013-1089/Colville Fall Fishery

TestAmerica Job ID: 250-15006-1

Laboratory: TestAmerica Portland

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska (UST)	State Program	10	UST-012	12-26-13
California	State Program	9	2597	09-30-15
Oregon	NELAP	10	OR100021	01-09-14
USDA	Federal		P330-11-00092	02-17-14
Washington	State Program	10	C586	06-23-14

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-13
A2LA	ISO/IEC 17025		2907.01	10-31-13
Alabama	State Program	4	40730	09-30-12 *
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-13
Arkansas DEQ	State Program	6	88-0687	06-01-14
California	ELAP	9	2513	08-31-14
Colorado	State Program	8	N/A	09-30-14
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-14
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Louisiana	NELAP	6	30785	06-30-14 *
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-13
Nevada	State Program	9	CO0026	09-01-14
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-14
New Mexico	State Program	6	CO00026	06-30-14 *
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-13
North Dakota	State Program	8	R-034	06-30-14 *
Oklahoma	State Program	6	8614	08-31-14
Oregon	NELAP	10	CO200001	01-16-14
Pennsylvania	NELAP	3	68-00664	07-30-14
South Carolina	State Program	4	72002	06-30-14 *
Texas	NELAP	6	T104704183-08-TX	10-01-14
USDA	Federal		P330-13-00202	07-02-16
Utah	NELAP	8	CO000262012-4	07-31-14
Virginia	NELAP	3	460232	06-14-14
Washington	State Program	10	C583	08-03-14
West Virginia DEP	State Program	3	354	11-30-13
Wisconsin	State Program	5	999615430	08-31-14
Wyoming (UST)	A2LA	8		10-31-13

* Expired certification is currently pending renewal and is considered valid.

TestAmerica
ANALYTICAL TESTING CORPORATION

11720 North Cree
9405
2000 W International Air
FAX 420-9210
FAX 924-9290
FAX 906-9210 X
FAX 563-9210

250-15006 Chain of Custody

CHAIN OF CUSTODY REPORT

Work Order #: 84504

CLIENT:

REPORT TO: Arctic Fox Environmental, Inc.
ADDRESS: Pouch 340043
Prudhoe Bay, AK 99734
attn. Ralph E. Allphin/Michael Hawley
PHONE: (907)659 2145 FAX: (907)659-2146

INVOICE TO:
Arctic Fox Environmental, Inc.
Pouch 340043
Prudhoe Bay, AK 99734
attn. Ralph E. Allphin/arcticfox@astacalaska.com

P.O. NUMBER: 1013-1089

PROJECT NAME: Colville Fall Fishery
PROJECT NUMBER:
SAMPLED BY: J.S.

TURNAROUND REQUEST
in Business Days *
Organic & Inorganic Analyses: 10 STD. | 7 | 5 | 4 | 3 | 2 | 1 | <1
Petroleum Hydrocarbon Analyses: 5 STD. | 4 | 3 | 2 | 1 | <1
OTHER Specify: RUSH
* Turnaround Requests less than standard may incur Rush Charges.

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	PRESERVATIVE: H2SO4	REQUESTED ANALYSES: Total Metals	DRO/RRO	Nitrate Nitrite	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1	AF48994	10/21/13 @ 1110				X	W	1	St 5 H_2O A	
2	AF48995	↓ ↓			X		W	1	St 5 H_2O B	
3	AF48996	↓ ↓		X			W	1	St 5 H_2O C	
4										
5										
6										
7										
8										
9										
10										

RELEASED BY: Michael Hawley
PRINT NAME: Michael Hawley FIRM: Arctic Fox DATE: 10/22/13 TIME: 1400

RECEIVED BY: Phil Svaboda - Seroc
PRINT NAME: Phil Svaboda - Seroc FIRM: TAP DATE: 10/23/13 TIME: 0845

RELEASED BY:
PRINT NAME: FIRM: DATE: TIME:

RECEIVED BY:
PRINT NAME: FIRM: DATE: TIME:

ADDITIONAL REMARKS:

TEMP: 4.1

PAGE 1 OF 1

Login Sample Receipt Checklist

Client: Arctic Fox Environmental, Inc

Job Number: 250-15006-1

Login Number: 15006

List Source: TestAmerica Portland

List Number: 1

Creator: Svabik-Seror, Philip M

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	False	HNO3 preserved in lab 10/23/13@0915
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	N/A	
Samples do not require splitting or compositing.	N/A	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: Arctic Fox Environmental, Inc

Job Number: 250-15006-1

Login Number: 15006
List Number: 1
Creator: O'Tormey, Stephanie R

List Source: TestAmerica Denver
List Creation: 10/24/13 07:05 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Appendix F. A summary of benthic river bed chemistry results collected from 5 sampling locations during the fall subsistence harvest of Arctic Cisco, Niġliq Channel, Colville River, Alaska, 24 October 2013.

	10/17/2013	10/21/2013	10/24/2013	10/24/2013	10/24/2013
Analyte (mg/L)	Water Chemistry Station 4	Water Chemistry Station 5	Water Chemistry Station 1	Water Chemistry Station 2	Water Chemistry Station 4
Arsenic	ND	ND	ND	ND	ND
Barium	0.072	0.079	0.068	0.076	0.110
Cadmium	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND
Lead	ND	ND	0.0032	0.0023	ND
Mercury	ND	ND	ND	ND	0.00033
Silver	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND
Nitrate Nitrite as Total Nitrogen	ND	ND	ND	ND	ND
Diesel Range Organics	ND	ND	ND	ND	ND
Residual Range Organics	ND	ND	ND	ND	ND

ND = Not detected

Appendix G. Raw laboratory river bed chemistry results from SGS Environmental Services, Inc., collected from 5 sampling locations during the fall subsistence harvest of Arctic Cisco, Niġliq Channel, Colville River, Alaska, 24 October 2013.

Laboratory Report of Analysis

To: ABR, Inc.
PO Box 240268
Anchorage, AK 99524
(907) 344-6777

Report Number: **1138762**

Client Project: **13-162**

Dear Joel Gottschalk,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of five years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Steve at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Steve Crupi Date
Project Manager
steven.crupi@sgs.com

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Case Narrative

Customer: ABRINCN ABR, Inc.

Project: 1138762 13-162

Refer to the sample receipt form for information on sample condition.

1138762001 PS Station #1

2540G - Percent Solids - Sample received and analyzed outside of hold time per client request.

AK103 - Unknown hydrocarbon with several peaks is present.

AK102/103 - Sample received and analyzed outside of hold time per client request.

6020 - Metals - Sample received and analyzed outside of hold time for mercury per client request.

1138762002 PS Station #2

2540G - Percent Solids - Sample received and analyzed outside of hold time per client request.

AK102/103 - Sample received and analyzed outside of hold time per client request.

AK103 - Unknown hydrocarbon with several peaks is present.

6020 - Metals - Sample received and analyzed outside of hold time for mercury per client request.

1138762003 PS Station #3

2540G - Percent Solids - Sample received and analyzed outside of hold time per client request.

AK102/103 - Sample received and analyzed outside of hold time per client request.

AK102/103 - Unknown hydrocarbon with several peaks is present.

6020 - Metals - Sample received and analyzed outside of hold time for mecury per client request.

1138762004 PS Station #4

2540G - Percent Solids - Sample received and analyzed outside of hold time per client request.

AK102/103 - Sample received and analyzed outside of hold time per client request.

AK103 - Unknown hydrocarbon with several peaks is present.

6020 - Metals - Sample received and analyzed outside of hold time for mercury per client request.

1138762005 PS Station #5

2540G - Percent Solids - Sample received and analyzed outside of hold time per client request.

AK102/103 - Sample received and analyzed outside of hold time per client request.

AK103 - Unknown hydrocarbon with several peaks is present.

6020 - Metals - Sample received and analyzed outside of hold time for mercury per client request.

* QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to the associated field samples.

Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. If you have any questions regarding this report, or if we can be of any other assistance, please contact your SGS Project Manager at 907-562-2343. All work is provided under SGS general terms and conditions (<http://www.sgs.com/terms_and_conditions.htm>), unless other written agreements have been accepted by both parties.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020A, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035B, 6020, 7470A, 7471B, 8021B, 8082A, 8260B, 8270D, 8270D-SIM, 9040B, 9045C, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV	Continuing Calibration Verification
CL	Control Limit
D	The analyte concentration is the result of a dilution.
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
F	Indicates value that is greater than or equal to the DL
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
JL	The analyte was positively identified, but the quantitation is a low estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
M	A matrix effect was present.
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
Q	QC parameter out of acceptance range.
R	Rejected
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content.
All DRO/RRO analyses are integrated per SOP.

SGS North America Inc.
200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
Station #1	1138762001	10/24/2013	12/03/2013	Soil/Solid (dry weight)
Station #2	1138762002	10/24/2013	12/03/2013	Soil/Solid (dry weight)
Station #3	1138762003	10/26/2013	12/03/2013	Soil/Solid (dry weight)
Station #4	1138762004	10/24/2013	12/03/2013	Soil/Solid (dry weight)
Station #5	1138762005	10/25/2013	12/03/2013	Soil/Solid (dry weight)

Method	Method Description
AK102	Diesel/Residual Range Organics
AK103	Diesel/Residual Range Organics
SM21 2540G	Percent Solids SM2540G
SW6020	RCRA Metals by ICP-MS

Detectable Results Summary

Client Sample ID: **Station #1**
Lab Sample ID: 1138762001

	Parameter	Result	Units
Metals by ICP/MS	Arsenic	10.1	mg/Kg
	Barium	470	mg/Kg
	Cadmium	0.291J	mg/Kg
	Chromium	22.8	mg/Kg
	Lead	14.7	mg/Kg
	Mercury	0.0631	mg/Kg
	Selenium	1.04	mg/Kg
	Silver	0.217	mg/Kg
Semivolatile Organic Fuels	Diesel Range Organics	26.9J	mg/Kg
	Residual Range Organics	96.2	mg/Kg

Client Sample ID: **Station #2**
Lab Sample ID: 1138762002

	Parameter	Result	Units
Metals by ICP/MS	Arsenic	5.89	mg/Kg
	Barium	269	mg/Kg
	Cadmium	0.0956J	mg/Kg
	Chromium	9.22	mg/Kg
	Lead	6.03	mg/Kg
	Mercury	0.0270J	mg/Kg
	Selenium	0.457J	mg/Kg
	Silver	0.0730J	mg/Kg
Semivolatile Organic Fuels	Diesel Range Organics	12.0J	mg/Kg
	Residual Range Organics	36.4	mg/Kg

Client Sample ID: **Station #3**
Lab Sample ID: 1138762003

	Parameter	Result	Units
Metals by ICP/MS	Arsenic	7.93	mg/Kg
	Barium	618	mg/Kg
	Cadmium	0.346	mg/Kg
	Chromium	24.2	mg/Kg
	Lead	13.7	mg/Kg
	Mercury	0.0663	mg/Kg
	Selenium	0.822	mg/Kg
	Silver	0.179	mg/Kg
Semivolatile Organic Fuels	Diesel Range Organics	34.1	mg/Kg
	Residual Range Organics	173	mg/Kg

SGS North America Inc.
200 West Potter Drive, Anchorage, AK 99518
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Detectable Results Summary

Client Sample ID: **Station #4**
Lab Sample ID: 1138762004

	Parameter	Result	Units
Metals by ICP/MS	Arsenic	6.99	mg/Kg
	Barium	562	mg/Kg
	Cadmium	0.326	mg/Kg
	Chromium	14.3	mg/Kg
	Lead	9.58	mg/Kg
	Mercury	0.0406J	mg/Kg
	Selenium	0.721	mg/Kg
	Silver	0.197	mg/Kg
Semivolatile Organic Fuels	Diesel Range Organics	26.4J	mg/Kg
	Residual Range Organics	134	mg/Kg

Client Sample ID: **Station #5**
Lab Sample ID: 1138762005

	Parameter	Result	Units
Metals by ICP/MS	Arsenic	6.31	mg/Kg
	Barium	408	mg/Kg
	Cadmium	0.315	mg/Kg
	Chromium	20.6	mg/Kg
	Lead	13.1	mg/Kg
	Mercury	0.0634	mg/Kg
	Selenium	0.770	mg/Kg
	Silver	0.208	mg/Kg
Semivolatile Organic Fuels	Diesel Range Organics	26.7J	mg/Kg
	Residual Range Organics	144	mg/Kg

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Results of **Station #1**

Client Sample ID: **Station #1**
Client Project ID: **13-162**
Lab Sample ID: 1138762001
Lab Project ID: 1138762

Collection Date: 10/24/13 14:04
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 62.8

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Arsenic	10.1		1.53	0.474	mg/Kg	10		12/06/13 13:20
Barium	470		0.459	0.144	mg/Kg	10		12/06/13 13:20
Cadmium	0.291	J	0.306	0.0948	mg/Kg	10		12/06/13 13:20
Chromium	22.8		0.611	0.183	mg/Kg	10		12/06/13 13:20
Lead	14.7		0.306	0.0948	mg/Kg	10		12/06/13 13:20
Mercury	0.0631		0.0611	0.0183	mg/Kg	10		12/06/13 13:20
Selenium	1.04		0.764	0.229	mg/Kg	10		12/06/13 13:20
Silver	0.217		0.153	0.0474	mg/Kg	10		12/06/13 13:20

Batch Information

Analytical Batch: MMS8381
Analytical Method: SW6020
Analyst: ACF
Analytical Date/Time: 12/06/13 13:20
Container ID: 1138762001-A

Prep Batch: MXX27336
Prep Method: SW3050B
Prep Date/Time: 12/04/13 10:05
Prep Initial Wt./Vol.: 1.041 g
Prep Extract Vol: 50 mL

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Results of **Station #1**

Client Sample ID: **Station #1**
Client Project ID: **13-162**
Lab Sample ID: 1138762001
Lab Project ID: 1138762

Collection Date: 10/24/13 14:04
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 62.8

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	26.9	J	31.2	9.67	mg/Kg	1		12/05/13 17:59
Surrogates								
5a Androstane	77.2		50-150		%	1		12/05/13 17:59

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK102
Analyst: EAB
Analytical Date/Time: 12/05/13 17:59
Container ID: 1138762001-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.589 g
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	96.2		31.2	9.67	mg/Kg	1		12/05/13 17:59
Surrogates								
n-Triacontane-d62	78.3		50-150		%	1		12/05/13 17:59

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK103
Analyst: EAB
Analytical Date/Time: 12/05/13 17:59
Container ID: 1138762001-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.589 g
Prep Extract Vol: 1 mL

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Results of **Station #2**

Client Sample ID: **Station #2**
Client Project ID: **13-162**
Lab Sample ID: 1138762002
Lab Project ID: 1138762

Collection Date: 10/24/13 15:15
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 74.7

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Arsenic	5.89		1.34	0.415	mg/Kg	10		12/06/13 13:23
Barium	269		0.401	0.126	mg/Kg	10		12/06/13 13:23
Cadmium	0.0956	J	0.268	0.0830	mg/Kg	10		12/06/13 13:23
Chromium	9.22		0.535	0.161	mg/Kg	10		12/06/13 13:23
Lead	6.03		0.268	0.0830	mg/Kg	10		12/06/13 13:23
Mercury	0.0270	J	0.0535	0.0161	mg/Kg	10		12/06/13 13:23
Selenium	0.457	J	0.669	0.201	mg/Kg	10		12/06/13 13:23
Silver	0.0730	J	0.134	0.0415	mg/Kg	10		12/06/13 13:23

Batch Information

Analytical Batch: MMS8381
Analytical Method: SW6020
Analyst: ACF
Analytical Date/Time: 12/06/13 13:23
Container ID: 1138762002-A

Prep Batch: MXX27336
Prep Method: SW3050B
Prep Date/Time: 12/04/13 10:05
Prep Initial Wt./Vol.: 1 g
Prep Extract Vol: 50 mL

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Results of **Station #2**

Client Sample ID: **Station #2**
Client Project ID: **13-162**
Lab Sample ID: 1138762002
Lab Project ID: 1138762

Collection Date: 10/24/13 15:15
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 74.7

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	12.0	J	26.3	8.14	mg/Kg	1		12/05/13 18:19
Surrogates								
5a Androstane	83.7		50-150		%	1		12/05/13 18:19

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK102
Analyst: EAB
Analytical Date/Time: 12/05/13 18:19
Container ID: 1138762002-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.581 g
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	36.4		26.3	8.14	mg/Kg	1		12/05/13 18:19
Surrogates								
n-Triacontane-d62	86.8		50-150		%	1		12/05/13 18:19

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK103
Analyst: EAB
Analytical Date/Time: 12/05/13 18:19
Container ID: 1138762002-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.581 g
Prep Extract Vol: 1 mL

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Results of **Station #3**

Client Sample ID: **Station #3**
Client Project ID: **13-162**
Lab Sample ID: 1138762003
Lab Project ID: 1138762

Collection Date: 10/26/13 17:40
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 58.7

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Arsenic	7.93		1.53	0.475	mg/Kg	10		12/06/13 13:25
Barium	618		0.459	0.144	mg/Kg	10		12/06/13 13:25
Cadmium	0.346		0.306	0.0949	mg/Kg	10		12/06/13 13:25
Chromium	24.2		0.612	0.184	mg/Kg	10		12/06/13 13:25
Lead	13.7		0.306	0.0949	mg/Kg	10		12/06/13 13:25
Mercury	0.0663		0.0612	0.0184	mg/Kg	10		12/06/13 13:25
Selenium	0.822		0.765	0.230	mg/Kg	10		12/06/13 13:25
Silver	0.179		0.153	0.0475	mg/Kg	10		12/06/13 13:25

Batch Information

Analytical Batch: MMS8381
Analytical Method: SW6020
Analyst: ACF
Analytical Date/Time: 12/06/13 13:25
Container ID: 1138762003-A

Prep Batch: MXX27336
Prep Method: SW3050B
Prep Date/Time: 12/04/13 10:05
Prep Initial Wt./Vol.: 1.113 g
Prep Extract Vol: 50 mL

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Results of **Station #3**

Client Sample ID: **Station #3**
Client Project ID: **13-162**
Lab Sample ID: 1138762003
Lab Project ID: 1138762

Collection Date: 10/26/13 17:40
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 58.7

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	34.1		33.8	10.5	mg/Kg	1		12/05/13 18:39
Surrogates								
5a Androstane	83.5		50-150		%	1		12/05/13 18:39

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK102
Analyst: EAB
Analytical Date/Time: 12/05/13 18:39
Container ID: 1138762003-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.201 g
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	173		33.8	10.5	mg/Kg	1		12/05/13 18:39
Surrogates								
n-Triacontane-d62	83.2		50-150		%	1		12/05/13 18:39

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK103
Analyst: EAB
Analytical Date/Time: 12/05/13 18:39
Container ID: 1138762003-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.201 g
Prep Extract Vol: 1 mL

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Results of **Station #4**

Client Sample ID: **Station #4**
Client Project ID: **13-162**
Lab Sample ID: 1138762004
Lab Project ID: 1138762

Collection Date: 10/24/13 16:45
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 65.8

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Arsenic	6.99		1.33	0.413	mg/Kg	10		12/06/13 13:28
Barium	562		0.400	0.125	mg/Kg	10		12/06/13 13:28
Cadmium	0.326		0.267	0.0826	mg/Kg	10		12/06/13 13:28
Chromium	14.3		0.533	0.160	mg/Kg	10		12/06/13 13:28
Lead	9.58		0.267	0.0826	mg/Kg	10		12/06/13 13:28
Mercury	0.0406	J	0.0533	0.0160	mg/Kg	10		12/06/13 13:28
Selenium	0.721		0.666	0.200	mg/Kg	10		12/06/13 13:28
Silver	0.197		0.133	0.0413	mg/Kg	10		12/06/13 13:28

Batch Information

Analytical Batch: MMS8381
Analytical Method: SW6020
Analyst: ACF
Analytical Date/Time: 12/06/13 13:28
Container ID: 1138762004-A

Prep Batch: MXX27336
Prep Method: SW3050B
Prep Date/Time: 12/04/13 10:05
Prep Initial Wt./Vol.: 1.14 g
Prep Extract Vol: 50 mL

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Results of **Station #4**

Client Sample ID: **Station #4**
Client Project ID: **13-162**
Lab Sample ID: 1138762004
Lab Project ID: 1138762

Collection Date: 10/24/13 16:45
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 65.8

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	26.4	J	29.8	9.25	mg/Kg	1		12/05/13 18:59
Surrogates								
5a Androstane	82.1		50-150		%	1		12/05/13 18:59

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK102
Analyst: EAB
Analytical Date/Time: 12/05/13 18:59
Container ID: 1138762004-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.548 g
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	134		29.8	9.25	mg/Kg	1		12/05/13 18:59
Surrogates								
n-Triacontane-d62	81.6		50-150		%	1		12/05/13 18:59

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK103
Analyst: EAB
Analytical Date/Time: 12/05/13 18:59
Container ID: 1138762004-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.548 g
Prep Extract Vol: 1 mL

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Results of **Station #5**

Client Sample ID: **Station #5**
Client Project ID: **13-162**
Lab Sample ID: 1138762005
Lab Project ID: 1138762

Collection Date: 10/25/13 00:00
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 63.6

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Arsenic	6.31		1.54	0.477	mg/Kg	10		12/06/13 13:31
Barium	408		0.462	0.145	mg/Kg	10		12/06/13 13:31
Cadmium	0.315		0.308	0.0954	mg/Kg	10		12/06/13 13:31
Chromium	20.6		0.615	0.185	mg/Kg	10		12/06/13 13:31
Lead	13.1		0.308	0.0954	mg/Kg	10		12/06/13 13:31
Mercury	0.0634		0.0615	0.0185	mg/Kg	10		12/06/13 13:31
Selenium	0.770		0.769	0.231	mg/Kg	10		12/06/13 13:31
Silver	0.208		0.154	0.0477	mg/Kg	10		12/06/13 13:31

Batch Information

Analytical Batch: MMS8381
Analytical Method: SW6020
Analyst: ACF
Analytical Date/Time: 12/06/13 13:31
Container ID: 1138762005-A

Prep Batch: MXX27336
Prep Method: SW3050B
Prep Date/Time: 12/04/13 10:05
Prep Initial Wt./Vol.: 1.022 g
Prep Extract Vol: 50 mL

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Results of **Station #5**

Client Sample ID: **Station #5**
Client Project ID: **13-162**
Lab Sample ID: 1138762005
Lab Project ID: 1138762

Collection Date: 10/25/13 00:00
Received Date: 12/03/13 09:35
Matrix: Soil/Solid (dry weight)
Solids (%): 63.6

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	26.7	J	30.6	9.47	mg/Kg	1		12/05/13 19:19
Surrogates								
5a Androstane	81		50-150		%	1		12/05/13 19:19

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK102
Analyst: EAB
Analytical Date/Time: 12/05/13 19:19
Container ID: 1138762005-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.875 g
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	144		30.6	9.47	mg/Kg	1		12/05/13 19:19
Surrogates								
n-Triacontane-d62	81.2		50-150		%	1		12/05/13 19:19

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK103
Analyst: EAB
Analytical Date/Time: 12/05/13 19:19
Container ID: 1138762005-A

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/05/13 09:30
Prep Initial Wt./Vol.: 30.875 g
Prep Extract Vol: 1 mL

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Method Blank

Blank ID: MB for HBN 1493776 [MXX/27336]
Blank Lab ID: 1193319

Matrix: Soil/Solid (dry weight)

QC for Samples:
1138762001, 1138762002, 1138762003, 1138762004, 1138762005

Results by **SW6020**

Parameter	Results	LOQ/CL	DL	Units
Arsenic	0.500U	1.00	0.310	mg/Kg
Barium	0.150U	0.300	0.0940	mg/Kg
Cadmium	0.100U	0.200	0.0620	mg/Kg
Chromium	0.200U	0.400	0.120	mg/Kg
Lead	0.100U	0.200	0.0620	mg/Kg
Mercury	0.0200U	0.0400	0.0120	mg/Kg
Selenium	0.250U	0.500	0.150	mg/Kg
Silver	0.0500U	0.100	0.0310	mg/Kg

Batch Information

Analytical Batch: MMS8381
Analytical Method: SW6020
Instrument: Perkin Elmer Sciex ICP-MS P3
Analyst: ACF
Analytical Date/Time: 12/6/2013 12:45:34PM

Prep Batch: MXX27336
Prep Method: SW3050B
Prep Date/Time: 12/4/2013 10:05:00AM
Prep Initial Wt./Vol.: 1 g
Prep Extract Vol: 50 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1138762 [MXX27336]
Blank Spike Lab ID: 1193320
Date Analyzed: 12/06/2013 12:48

Matrix: Soil/Solid (dry weight)

QC for Samples: 1138762001, 1138762002, 1138762003, 1138762004, 1138762005

Results by **SW6020**

Blank Spike (mg/Kg)

Parameter	Spike	Result	Rec (%)	CL
Arsenic	50	54.9	110	(80-120)
Barium	50	52.8	106	(80-120)
Cadmium	5	5.52	110	(80-120)
Chromium	20	21.5	108	(80-120)
Lead	50	57.8	116	(80-120)
Mercury	0.5	0.553	111	(80-120)
Selenium	50	56.2	112	(80-120)
Silver	5	5.63	113	(80-120)

Batch Information

Analytical Batch: **MMS8381**
Analytical Method: **SW6020**
Instrument: **Perkin Elmer Sciex ICP-MS P3**
Analyst: **ACF**

Prep Batch: **MXX27336**
Prep Method: **SW3050B**
Prep Date/Time: **12/04/2013 10:05**
Spike Init Wt./Vol.: 50 mg/Kg Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1135656013
MS Sample ID: 1193322 MS
MSD Sample ID: 1193323 MSD

Analysis Date: 12/06/2013 12:50
Analysis Date: 12/06/2013 12:56
Analysis Date: 12/06/2013 12:58
Matrix: Soil/Solid (dry weight)

QC for Samples: 1138762001, 1138762002, 1138762003, 1138762004, 1138762005

Results by **SW6020**

		Matrix Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Arsenic	5.68	86.5	99.7	109	81.9	93.4	107	80-120	6.55	(< 20)
Barium	24.5	86.5	112	102	81.9	108	102	80-120	3.62	(< 20)
Cadmium	1.24	8.65	10.4	106	8.19	10.2	110	80-120	1.46	(< 20)
Chromium	14.2	34.5	52.6	111	32.8	51.7	115	80-120	1.75	(< 20)
Lead	1.34	86.5	93.2	106	81.9	88.7	107	80-120	5.09	(< 20)
Mercury	0.0629U	0.865	0.905	105	0.819	0.852	104	80-120	5.94	(< 20)
Selenium	2.17	86.5	99.0	112	81.9	89.4	106	80-120	10.20	(< 20)
Silver	0.157U	8.65	8.89	103	8.19	8.32	102	80-120	6.47	(< 20)

Batch Information

Analytical Batch: MMS8381
Analytical Method: SW6020
Instrument: Perkin Elmer Sciex ICP-MS P3
Analyst: ACF
Analytical Date/Time: 12/6/2013 12:56:19PM

Prep Batch: MXX27336
Prep Method: Soils/Solids Digest for Metals by ICP-MS
Prep Date/Time: 12/4/2013 10:05:00AM
Prep Initial Wt./Vol.: 1.00g
Prep Extract Vol: 50.00mL

Print Date: 12/12/2013 10:05:30AM

Method Blank

Blank ID: MB for HBN 1493765 [SPT/9215]
Blank Lab ID: 1193285

Matrix: Soil/Solid (dry weight)

QC for Samples:
1138762001, 1138762002, 1138762003, 1138762004, 1138762005

Results by **SM21 2540G**

Parameter	Results	LOQ/CL	DL	Units
Total Solids	100			%

Batch Information

Analytical Batch: SPT9215
Analytical Method: SM21 2540G
Instrument:
Analyst: MEV
Analytical Date/Time: 12/3/2013 5:45:00PM

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Duplicate Sample Summary

Original Sample ID: 1135785020
Duplicate Sample ID: 1193286
Analysis Date: 12/03/2013 17:45
Matrix: Soil/Solid (dry weight)

QC for Samples:

1138762001, 1138762002, 1138762003, 1138762004, 1138762005

Results by **SM21 2540G**

NAME	Original ()	Duplicate ()	RPD (%)	RPD CL
Total Solids	96.6	96.6	0.05	15.00

Batch Information

Analytical Batch: SPT9215
Analytical Method: SM21 2540G
Instrument:
Analyst: MEV

Print Date: 12/12/2013 10:05:31AM

Method Blank

Blank ID: MB for HBN 1494362 [XXX/30446]
Blank Lab ID: 1193399

Matrix: Soil/Solid (dry weight)

QC for Samples:
1138762001, 1138762002, 1138762003, 1138762004, 1138762005

Results by **AK102**

Parameter	Results	LOQ/CL	DL	Units
Diesel Range Organics	10.0U	20.0	6.20	mg/Kg
Surrogates				
5a Androstane	87.7	60-120		%

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK102
Instrument: HP 7890A FID SV E R
Analyst: EAB
Analytical Date/Time: 12/5/2013 4:39:00PM

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/5/2013 9:30:00AM
Prep Initial Wt./Vol.: 30 g
Prep Extract Vol: 1 mL

Print Date: 12/12/2013 10:05:32AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1138762 [XXX30446]
Blank Spike Lab ID: 1193400
Date Analyzed: 12/05/2013 16:59

Spike Duplicate ID: LCSD for HBN 1138762 [XXX30446]
Spike Duplicate Lab ID: 1193401
Matrix: Soil/Solid (dry weight)

QC for Samples: 1138762001, 1138762002, 1138762003, 1138762004, 1138762005

Results by **AK102**

	Blank Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Diesel Range Organics	167	149	90	167	155	93	(75-125)	3.50	(< 20)
Surrogates									
5a Androstane	3.33	84.2	84	3.33	87.8	88	(60-120)	4.30	

Batch Information

Analytical Batch: **XFC11184**
Analytical Method: **AK102**
Instrument: **HP 7890A FID SV E R**
Analyst: **EAB**

Prep Batch: **XXX30446**
Prep Method: **SW3550C**
Prep Date/Time: **12/05/2013 09:30**
Spike Init Wt./Vol.: 167 mg/Kg Extract Vol: 1 mL
Dupe Init Wt./Vol.: 167 mg/Kg Extract Vol: 1 mL

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Method Blank

Blank ID: MB for HBN 1494362 [XXX/30446]
Blank Lab ID: 1193399

Matrix: Soil/Solid (dry weight)

QC for Samples:
1138762001, 1138762002, 1138762003, 1138762004, 1138762005

Results by **AK103**

Parameter	Results	LOQ/CL	DL	Units
Residual Range Organics	10.0U	20.0	6.20	mg/Kg
Surrogates				
n-Triacontane-d62	91.4	60-120		%

Batch Information

Analytical Batch: XFC11184
Analytical Method: AK103
Instrument: HP 7890A FID SV E R
Analyst: EAB
Analytical Date/Time: 12/5/2013 4:39:00PM

Prep Batch: XXX30446
Prep Method: SW3550C
Prep Date/Time: 12/5/2013 9:30:00AM
Prep Initial Wt./Vol.: 30 g
Prep Extract Vol: 1 mL

Print Date: 12/12/2013 10:05:33AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1138762 [XXX30446]
Blank Spike Lab ID: 1193400
Date Analyzed: 12/05/2013 16:59

Spike Duplicate ID: LCSD for HBN 1138762 [XXX30446]
Spike Duplicate Lab ID: 1193401
Matrix: Soil/Solid (dry weight)

QC for Samples: 1138762001, 1138762002, 1138762003, 1138762004, 1138762005

Results by **AK103**

	Blank Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Residual Range Organics	167	143	86	167	149	89	(60-120)	4.20	(< 20)
Surrogates									
n-Triacontane-d62	3.33	88.4	88	3.33	92.1	92	(60-120)	4.10	

Batch Information

Analytical Batch: **XFC11184**
Analytical Method: **AK103**
Instrument: **HP 7890A FID SV E R**
Analyst: **EAB**

Prep Batch: **XXX30446**
Prep Method: **SW3550C**
Prep Date/Time: **12/05/2013 09:30**
Spike Init Wt./Vol.: 167 mg/Kg Extract Vol: 1 mL
Dupe Init Wt./Vol.: 167 mg/Kg Extract Vol: 1 mL

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

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Locations Nationwide

Alaska	Maryland
New Jersey	New York
North Carolina	Indiana
West Virgina	Kentucky

www.us.sgs.com

CLIENT: ABR, Inc

CONTACT: Joel Gottschalk PHONE NO: 907-344-6777 x248

PROJECT NAME: 13-162 PROJECT/ PWSID/ PERMIT#:

REPORTS TO: John Seigle E-MAIL: jseigle@abrinc.com

INVOICE TO: QUOTE #:

P.O. #:

Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.

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RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	# CONTAINERS	Preservative Used: (3)	TYPE C = COMP G = GRAB Mt = Multi Incremental Soils	DRO/RRO	RCRA metals	REMARKS/ LOC ID
(1) A	STATION #1	10/24/13			1			✓	✓	SEDIMENT
(2) A	STATION #2	10/24/13			1			✓	✓	
(3) A	" #3	10/26/13			1			✓	✓	
(4) A	" #4	10/24/13			1			✓	✓	
(5) A	" #5	10/25/13			1			✓	✓	SEDIMENT

	Date	Time		
Relinquished By: (1)	12-2-13	14:20	Received By:	12-2-13 1420
Relinquished By: (2)	12-2-13	1600	Received By:	
Relinquished By: (3)			Received By:	
Relinquished By: (4)	12/03/13	09:35	Received For Laboratory By:	

(4) DOD Project? YES (NO)

Cooler ID:

Data Deliverable Requirements:

Requested Turnaround Time and-or Special Instructions:

Std.

Temp Blank °C: 4.9°C

or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle)

INTACT BROKEN ABSENT

(See attached Sample Receipt Form)

[ ] 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301

[ ] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

http://www.sgs.com/terms_and_conditions.htm

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SAMPLE RECEIPT FORM

Review Criteria:	Condition:	Comments/Action Taken:
Were **custody seals** intact? Note # & location, if applicable. COC accompanied samples?	Yes No N/A Yes No N/A	1F 1B
Temperature blank compliant* (i.e., 0-6°C after CF)? * *Note: Exemption permitted for chilled samples collected less than 8 hours ago.* Cooler ID: ____ @ 4-9 w/ Therm.ID: 35 cooler temp Cooler ID: ____ @ ____ w/ Therm.ID: ____ Cooler ID: ____ @ ____ w/ Therm.ID: ____ Cooler ID: ____ @ ____ w/ Therm.ID: ____ Cooler ID: ____ @ ____ w/ Therm.ID: ____ *Note: If non-compliant, use form FS-0029 to document affected samples/analyses.* If samples are received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled." **If temperature(s) <0°C, were all sample containers ice free?**	Yes No N/A Yes No N/A	
Delivery method (specify all that apply): Client USPS Alert Courier C&D Delivery AK Air Lynden Carlile ERA PenAir FedEx UPS NAC Other: → *For WO# with airbills, was the WO# & airbill info recorded in the Front Counter eLog?*	Note ABN/ tracking # See Attached or N/A Yes No N/A	
→ For samples received with payment, note amount ($) and cash / check / CC (**circle one**) or note: → For samples **received in FBKS**, ANCH staff will verify all criteria are reviewed.		SRF Initiated by: JP N/A N/A
Were samples received within hold time? *Note: Refer to form F-083 "Sample Guide" for hold time information.* Do samples **match COC*** (i.e., sample IDs, dates/times collected)? * *Note: Exemption permitted if times differ <1hr; in that case, use times on COC.* Were analyses requested unambiguous?	Yes No N/A Yes No N/A Yes No N/A	DRO/RRO past hold, proceed per PM *No time of collection for (5), logged in with a collection time of 00:00
Were samples in **good condition** (no leaks/cracks/breakage)? Packing material used (specify all that apply): Bubble Wrap Separate plastic bags Vermiculite Other:	Yes No N/A	per PM Steve Crupi
Were all VOA vials **free of headspace** (i.e., bubbles ≤6 mm)? Were all soil VOAs **field extracted** with MeOH+BFB?	Yes No N/A Yes No N/A	
Were **proper containers** (type/mass/volume/preservative*) used? * *Note: Exemption permitted for waters to be analyzed for metals.* Were **Trip Blanks** (i.e., VOAs, LL-Hg) in cooler with samples?	Yes No N/A Yes No N/A	• Samples poured off into 8 oz amber jars from plastic bags. • Sample (5) poured into two 8 oz amber jars, (5) A & B
For **special handling** (e.g., "MI" or foreign soils, lab filter, limited volume, Ref Lab), were bottles/paperwork flagged (e.g., sticker)?	Yes No N/A	
For preserved waters (other than VOA vials, LL-Mercury or microbiological analyses), was **pH verified and compliant**? If pH was adjusted, were bottles flagged (i.e., stickers)?	Yes No N/A Yes No N/A	
For **RUSH/SHORT Hold Time**, were COC/Bottles flagged accordingly? Was Rush/Short HT email sent, if applicable?	Yes No N/A	
For **SITE-SPECIFIC QC, e.g. BMS/BMSD/BDUP**, were containers / paperwork flagged accordingly?	Yes No N/A	
For any question answered "No," has the PM been notified and the problem resolved (or paperwork put in their bin)?	Yes No N/A	SRF Completed by: MD 12/03/13 PM = SRC N/A
Was **PEER REVIEW** of ***sample numbering/labeling completed?***	Yes No N/A	Peer Reviewed by: N/A

Additional notes (if applicable):

• No times of Collection list on COC. Logged in using times on Sample labels.

(1) taken at 14:04
(2) taken at 15:15
(3) taken at 17:46
(4) taken at 16:45
~~(5) taken at MD~~

Note to Client: *Any "no" circled above indicates non-compliance with standard procedures and may impact data quality.*

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SAMPLE RECEIPT FORM FOR TRANSFERS

Note: This form is to be completed by Anchorage Sample Receiving staff for all shipments received at SGS-Anchorage from SGS-Fairbanks.

Were samples received numbered with all criteria on Sample Receipt Form F0004 documented by Fairbanks Sample Receiving staff? If "No," ***Anchorage Sample Receiving staff must complete the receiving process & document pH verification, sample condition, etc. on the SRF initiated by Fairbanks staff*** (attached).	Yes (No) N/A	Use space below for additional notes...

Review Criteria:	Condition:	Comments/Action Taken:
Were **custody seals** intact? Note # & location: COC accompanied samples?	(Yes) No N/A (Yes) No N/A	1F 1B
Temperature blank compliant (i.e., 0-6°C after correction factor)? Cooler ID: _____ @ -1.2 w/ Therm.ID: 240 Cooler ID: _____ @ _____ w/ Therm.ID: _____ Cooler ID: _____ @ _____ w/ Therm.ID: _____ Cooler ID: _____ @ _____ w/ Therm.ID: _____ Cooler ID: _____ @ _____ w/ Therm.ID: _____ ***Note: If non-compliant, use form FS-0029 to document affected samples/analyses.*** If samples are received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP** will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled." **If temperature(s) <0°C, were all containers ice free?**	Yes (No) N/A (Yes) No N/A	Out of temp, proceed per PM, Steve Crupi
Delivery method: (Lynden) Other:		
Completed by: MD 12/03/13		

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1138762001-A	No Preservative Required	OK			
1138762002-A	No Preservative Required	OK			
1138762003-A	No Preservative Required	OK			
1138762004-A	No Preservative Required	OK			
1138762005-A	No Preservative Required	OK			
1138762005-B	No Preservative Required	OK			

Container Condition Glossary

OK - The container was received at an acceptable pH for the analysis requested.

PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

BU - The container was received with headspace greater than 6mm.