FINAL REPORT

FALL 2012 SUBSISTENCE FISHERY MONITORING ON THE COLVILLE RIVER

JOHN C. SEIGLE
JOEL M. GOTTSCHALK

PREPARED FOR

CONOCOPHILLIPS ALASKA, INC.
ANCHORAGE, ALASKA

PREPARED BY

ABR, INC.–ENVIRONMENTAL RESEARCH & SERVICES
FAIRBANKS, ALASKA

FALL 2012 SUBSISTENCE FISHERY MONITORING ON THE COLVILLE RIVER

FINAL REPORT

Prepared for

ConocoPhillips Alaska, Inc.
P.O. Box 100360
700 G Street, ATO # 1902
Anchorage, AK 99510-0360

Prepared by

John C. Seigle
Joel M. Gottschalk

ABR, Inc.—Environmental Research & Services
P.O. Box 240268
Anchorage, AK 99524

June 2013

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACKNOWLEDGMENTS

This 2012 arctic cisco study was funded by ConocoPhillips Alaska, Inc. (CPAI), and we are grateful to Robyn McGhee and Justin Blank of CPAI for their logistic support. Field support was provided by ABR personnel John Seigle, John Rose, Laura Gutierrez, Joel Gottschalk, Nick Haxton, and by Nuiqsut residents Sam Kyle Sielak, Archie Nukapigak and Jerry Pausanna. Kim Allen assisted with otolith analysis and Chris Zimmerman (USGS) offered assistance with inter-laboratory age calibration. Dorte Dissing (GIS Specialist) and Pam Odom (Publications Specialist) of ABR helped prepare this report. Pam also arranged travel, and Tony LaCortiglia continued to expertly handle gear logistics and transport. Thanks to Steve Murphy, Tom DeLong, Bob Burgess and Terry Schick for their advice and managerial assistance.

We depend every year on the outstanding and welcoming support of the residents of Nuiqsut. They made our sixth year working out of the village a very satisfying one. 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 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 2012 fall fishery.

INTRODUCTION

In 2012, 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 2012 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 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 2012 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 quality (i.e., testing for metals and petroleum-based organic compounds) in primary fishing areas.
- Compare the 2011 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 down river 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, 2011 catch per unit of effort in the Colville River was one of the highest ever recorded (Seigle and Gottschalk 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. 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 1). 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 2 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

The *Qaaktaq* Panel, composed of expert fishers involved in the Colville River subsistence harvest near Nuiqsut, met on 5 November 2012 at the KSOPI office in Nuiqsut. The purpose of this meeting was to (1) summarize the 2011 fishing season and report results comparing 2011 harvest information to historical records, (2) continue to work with active fishers to get their perspective on the 2012 fall fishery, and (3) collect comments from the panel highlighting their concerns about the fishery to relay to CPAI. John Seigle and John Rose of ABR presented 2011 harvest data to the panel as well as information on the (at the time) ongoing 2012 fishery. The discussion covered a broad array of topics. Meeting attendees were: Lydia Sovalik, Dwayne Hopson, Sr., Sam Kunaknana, Frank Oyagak, Jr, Dora Leavitt, Robert Lampe, Thomas Nukapigak, Bruce Nukapigak, Eli Nukapigak, Archie Ahkiviana, Clarence Ahnupkana and Herbert Ipalook; ABR scientists, John Seigle and John Rose; and KSOPI

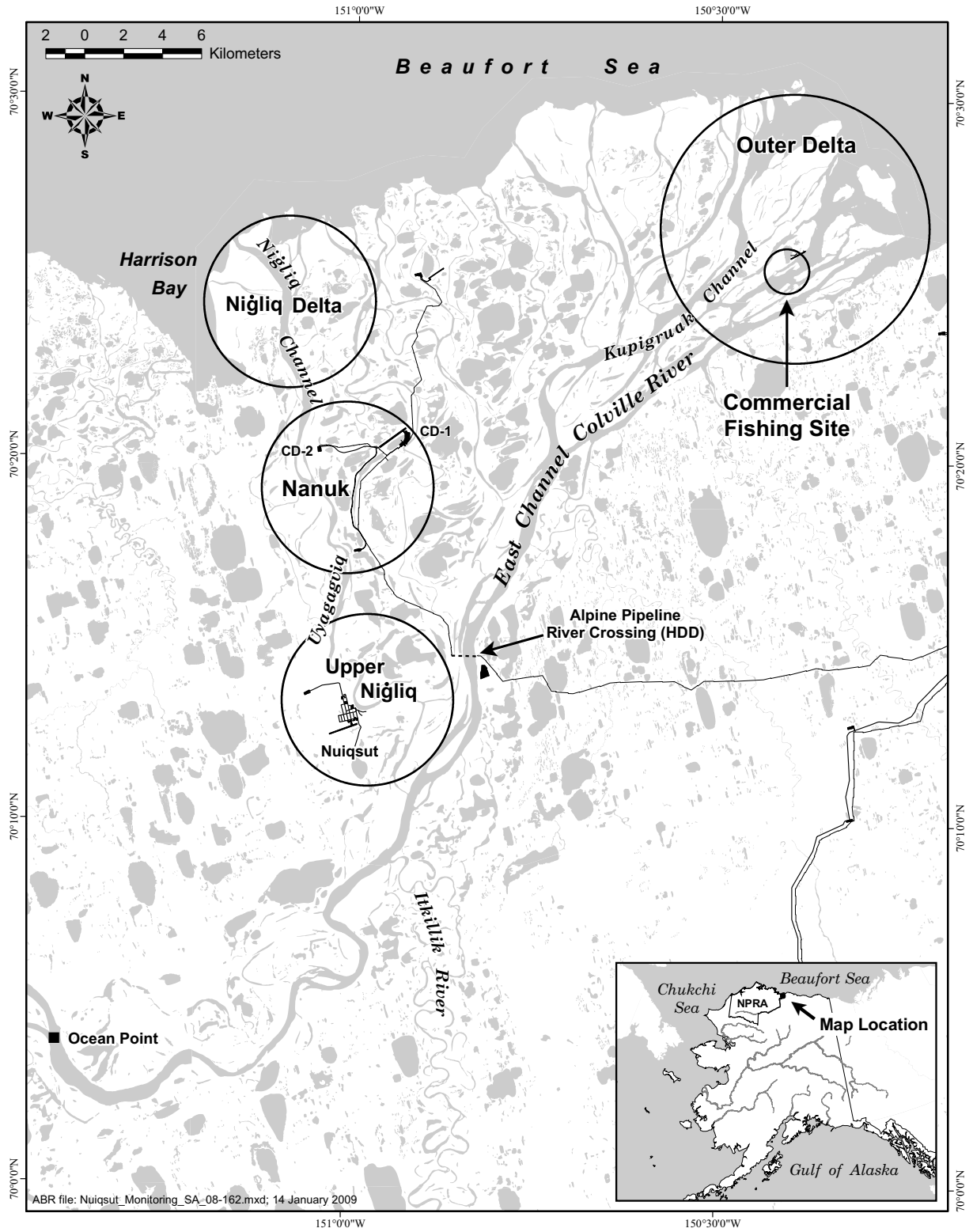


Figure 1. Three of the main subsistence fishing areas in the Niğliq Channel and the commercial/subsistence fishing area in the main channel historically used for harvesting arctic cisco in the Colville Delta (after Moulton and Seavey 2004).

representative, Eunice Brower.Notes on the community meetings held in November 2012 are presented in Appendix A.

FISHERY EFFORT AND HARVEST

Three traditional fishing areas hosted the majority of concentrated fishing efforts within the Niġliq channel in 2011 (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 minimally fished in 2012. For the third consecutive year, fishing effort also was observed in the Main Channel (Kupigruak Channel) of the Colville River following a multi-year hiatus where no fall harvest occurred.

The harvest monitoring team always included 2 scientists from ABR. The remaining team members were local residents of Nuiqsut: Sam Kyle Sielak, and Archie Nukapigak. Special assistance was frequently provided by past team member, Jerry Pausanna of Nuiqsut. Each day, ABR fishery monitors traveled 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 assist in the harvest or to conduct an interview and assess the recently completed harvest event (i.e., a fishing effort with a start and end time, particular net dimensions and a harvest result). During interviews, we recorded net length and 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 set durations. For example, if an 80 ft net was used during a 24-hour period, fishing effort (or standardized hours of fishing) was calculated as 80 ft/60 ft × 1 day = 1.3 days of adjusted effort. Catch per unit effort (CPUE) was calculated using these adjusted estimates of effort. In this report, CPUE is expressed as catch per net-day. 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 long has your net been actively fishing (helps define total season effort)?
- What are your net dimensions?
- How many *Qaaktaq* did you harvest?
- 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 out assisting the net owner so that monitors can focus on specific nets any given day)?
- Where is your net and has it been moved recently (helps monitors determine location and end times for calculating effort in specific river sections)?

Information 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 2012, ABR distributed a "North Slope Fisheries

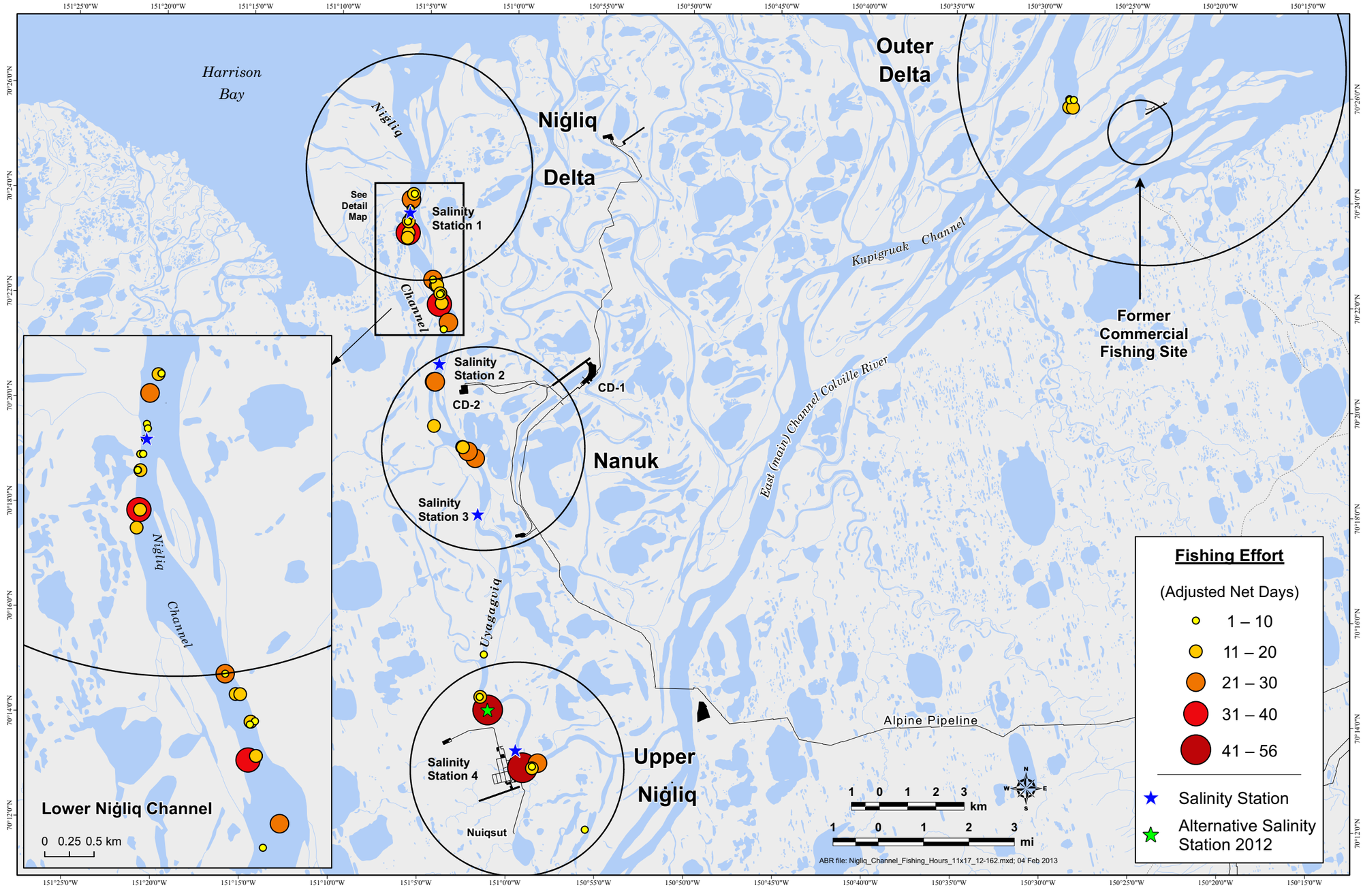


Figure 2. Salinity stations and net sites in each of the 3 main subsistence fishing areas in the Niġliq Channel of the Colville River, 2012. The amount of effort for each net set (adjusted net days) is depicted by both color and the size of the net symbol.

Logbook" to interested fishers as in previous years (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 harvested 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 (~10/day at $10/fish) or who otherwise provided detailed information about their fishing efforts and harvests outside of normal ice encounters. The monitoring team only accepted donated fish from nets of known mesh size and was primarily interested in fish caught with 7.6-cm mesh nets, although fish from other mesh sizes were accepted. The fish were kept frozen and transported to Anchorage where they were measured for fork length (mm) and weight (using a top-loading electronic scale).

Otoliths (sagittae) were extracted for ageing 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-0 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 sample preparation.

SALINITY MEASUREMENTS

Water salinity was measured every other day (weather permitting) at 4 traditional salinity sampling stations that corresponded to areas of intense fishing (Figure 2). Because ice conditions at certain locations on the river were unsafe in the early part of the sampling season an alternative upstream station was utilized in place of station 4 for salinity measurements on 31 October and 3 November. 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. At the end of each sampling event, a small piece of insulation was used to cover the hole in the ice. In this way, the sampling hole was only partially frozen upon return 48 hours later.

SEDIMENT ANALYSIS

On 8 and 16 November benthic sediment samples were collected at Water Stations 1 and 3 respectively (Figure 2) for later laboratory analysis of metals and polycyclic aromatic hydrocarbons (PAH's). Sediment samples were collected with an Ekmann dredge in approximately 7 meters of water and were immediately transferred to non-reactive plastic bottles and refrigerated until analysis.

Samples were transferred to coolers and shipped to SGS North America Inc. in Anchorage, AK for analysis. A full list of analytes can be found in Appendices D and E.

FISH TISSUE ANALYSIS

A random sample of five Niġliq Channel artic cisco were chosen from specimens originally donated to the sampling team for otolith extraction. These samples were selected for tissue analysis of polycyclic aromatic hydrocarbon (PAH) levels. A 60 gram section of skinless muscle tissue was removed from each fish using a sterilized scalpel. The entire liver of each fish also was removed and each tissue sample was individually sealed in non-reactive double bags. Samples were then placed in coolers with dry ice and shipped to Pace Analytical Services, Inc. in Green Bay, WI. A full list of analytes can be found in Appendices F and G.

RESULTS

FISHERY EFFORT AND HARVEST

ABR fishery biologists arrived in Nuiqsut on 15 October 2012, prior to the onset of the arctic cisco fishery. In 2012, the arctic cisco subsistence harvest began on 21 October following a slow freeze-up on the Colville River delta (Table 1). One fisher commenced fall fishing for broad whitefish (*Corregonus nasus*) with 5.5 inch mesh gill net on 15 October in the Upper Niġliq, south of Nuiqsut. This mesh size is too large for arctic cisco and was excluded from harvest estimates. The onset of arctic cisco fishing in 2012 was delayed by warm temperatures in early October that included daily high temperatures well above freezing, resulting in unstable ice conditions. These ice conditions forced partial overland travel to reach several favored fishing locations in the Niġliq Delta fishing area (Figure 1) throughout the month of November. The 21 October arctic cisco fishery start date is the second latest in 27 years of harvest monitoring. ABR harvest monitors recorded 267 unique harvest events in 2012. Twenty-Six households deployed 49 nets during the fall fishery in 2012 (Table 2, Figure 3), 21 fewer nets than were deployed in 2011 and below the average and median numbers deployed since 1986 (mean = 56, median = 55). The total number of nets deployed in 2012 was the lowest number deployed since 2005. Fifty-six sets of 43 unique nets occurred in the Niġliq Channel in 2012 (Table 2). An additional 6 net sets were located in the Main Channel, where fishing also began on 21 October and ceased on 3 November.

A total of 3 nets were deployed in the Niġliq Channel and 2 nets were deployed in the Main Channel on 21 October. The number of nets deployed rose steadily during the first 2 weeks of the fishing season (Table 2, Figure 4). Niġliq Channel active net fishing increased from 3 to 27 during the period from 21 October to 4 November, the peak of fishing effort for 2012. A total of 6 nets were set in the Main Channel between 21 October and 2 November when fishing ceased on that channel. The number of active nets fishing declined slowly from early November through the remainder of the season. The peak range of net activity on the Niġliq Channel in 2012 occurred 4 days later than in 2011. At the time of ABR's departure from Nuiqsut on 20 November 2012, 16 nets were actively fishing the Niġliq Channel as compared to 3 nets still active when ABR departed Nuiqsut on 21 November 2011. It was determined through daily contact with fishers via email and phone that all but one net had been pulled from the river by 26 November. A single net was kept active in the Niġliq Channel adjacent to town until 17 December.

After standardizing for net length, a total of 847 adjusted net-days of fishing effort were calculated for 2012 in the Niġliq and Main channels, 790 in the Niġliq Channel and 57 in the Main Channel (Table 2). This represents a 31% decrease in fishing effort compared to 2011. In the Niġliq Channel, fishing effort was highest in the Niġliq Delta area at 52% of total, followed by the Nanuk area at 26% of total and the Upper Niġliq at 21% of total (Figure 5).

The most frequently deployed mesh size of nets in the Nuiqsut fall fishery has traditionally been 7.6 cm and this continued in 2012. Twenty-six of 43 nets deployed in 2012 in the Niġliq Channel were 7.6-cm mesh nets (Table 2). In the Niġliq Channel, 6,812 arctic cisco were documented during harvest monitoring in 7.6-cm mesh nets, nearly 1,500 fish higher than the 5,325 arctic cisco observed in 7.6-cm mesh nets on average over the previous 26 years (Table 3,

Table 1. Estimated onset of fishing in the Niġliq Channel of the Colville River, Alaska, fall subsistence fishery, 1985–2012.

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

Table 2. Total adjusted fishing effort recorded for the fall fishery 2012, Niġliq and main channel, Colville River, Alaska.

Fisher Code	Fishing Location	Net	Net Code	Length (m)	Start Date	End Date	Stretched mesh (cm)	Net Days	Adjusted Net Days
7	Nanuq	A	127A1	18.3	11/11/2012	11/25/2012	7.0	14	14.0
24	Niġliq	A	1224A1	18.3	10/27/2012	11/25/2012	7.0	29	29.0
24	Nanuq	B	1224B1	18.3	11/3/2012	11/25/2012	7.6	22	22.0
25	Niġliq	A	1225A1	30.5	10/30/2012	11/9/2012	7.6	10	16.7
25	Niġliq	B	1225B1	18.3	10/30/2012	11/2/2012	8.9	3	3.0
25	Niġliq	C	1225C1	18.3	11/2/2012	11/9/2012	7.6	7	7.0
28	Niġliq	A	1228A1	18.3	10/24/2012	11/25/2012	8.9	32	32.0
31	Nanuq	A	1231A1	18.3	11/3/2012	11/14/2012	7.0	11	11.0
31	Nanuq	B	1231B1	18.3	11/3/2012	11/14/2012	7.6	11	11.0
31	Nanuq	C	1231C1	24.4	11/6/2012	11/14/2012	7.0	8	10.7
33	Upper Niġliq	A	1233A1	18.3	11/4/2012	11/12/2012	7.6	8	8.0
33	Upper Niġliq	B	1233B1	30.5	11/4/2012	11/12/2012	7.0	8	13.3
33	Nanuq	C	1233C1	30.5	11/12/2012	11/25/2012	7.6	13	21.7
33	Nanuq	D	1233D1	30.5	11/14/2012	11/25/2012	6.4	11	18.3
33	Nanuq	E	1233E1	30.5	11/15/2012	11/25/2012	7.6	10	16.7
49	Main	A	1249A1	24.4	10/28/2012	11/3/2012	7.6	6	8.0
49	Main	B	1249B1	24.4	10/28/2012	11/3/2012	7.6	6	8.0
54	Niġliq	A	1254A1	18.3	11/2/2012	11/6/2012	7.6	4	4.0
54	Niġliq	B	1254B1	24.4	10/31/2012	11/14/2012	7.0	14	18.7
55	Niġliq	A	1255A1	30.5	10/27/2012	10/29/2012	7.6	2	3.3
55	Nanuq	A	1255A2	30.5	11/3/2012	11/21/2012	7.6	18	30.0
56	Upper Niġliq	A	1256A1	24.4	10/15/2012	10/21/2012	14.0	6	8.0
56	Niġliq	B	1256B1	24.4	10/23/2012	11/7/2012	7.0	15	20.0
56	Niġliq	C	1256C1	24.4	10/23/2012	11/3/2012	7.6	11	14.7
59	Niġliq	A	1259A1	24.4	10/28/2012	11/3/2012	7.6	6	8.0
59	Niġliq	A	1259A2	24.4	11/8/2012	11/25/2012	7.6	17	22.7

Table 2. Continued.

Fisher Code	Fishing Location	Net	Net Code	Length (m)	Start Date	End Date	Stretched mesh (cm)	Net Days	Adjusted Net Days
65	Niġliq	A	1265A1	18.3	11/8/2012	11/26/2012	8.9	18	18.0
65	Nanuq	B	1265B1	24.4	11/9/2012	11/26/2012	7.6	17	22.7
66	Upper Niġliq	A	1266A1	24.4	10/24/2012	11/6/2012	7.6	13	17.3
66	Upper Niġliq	B	1266B1	24.4	10/30/2012	11/6/2012	7.6	7	9.3
70	Niġliq	A	1270A1	30.5	10/21/2012	10/27/2012	7.6	6	10.0
70	Niġliq	A	1270A2	30.5	10/29/2012	11/4/2012	7.6	6	10.0
70	Niġliq	B	1270B1	30.5	10/21/2012	10/27/2012	7.6	6	10.0
70	Niġliq	B	1270B2	30.5	10/29/2012	11/4/2012	7.6	6	10.0
70	Niġliq	C	1270C1	30.5	10/23/2012	10/27/2012	7.6	4	6.7
70	Niġliq	C	1270C2	30.5	10/29/2012	11/4/2012	7.6	6	10.0
72	Niġliq	A	1272A1	24.4	10/26/2012	10/29/2012	7.0	3	4.0
72	Niġliq	B	1272B1	18.3	11/7/2012	11/25/2012	8.9	18	18.0
72	Niġliq	A	1272A2	24.4	11/14/2012	11/25/2012	7.0	11	14.7
72	Niġliq	C	1272C1	18.3	11/16/2012	11/25/2012	7.6	9	9.0
74	Main	A	1274A1	24.4	10/21/2012	11/1/2012	7.6	11	14.7
74	Main	B	1274B1	24.4	10/21/2012	11/1/2012	6.4	11	14.7
77	Upper Niġliq	A	1277A1	15.2	10/22/2012	12/17/2012	6.4	56	46.7
78	Upper Niġliq	A	1278A1	18.3	11/4/2012	11/25/2012	7.6	21	21.0
79	Nanuq	A	1279A1	24.4	10/23/2012	11/12/2012	7.6	20	26.7
79	Nanuq	B	1284B1	24.4	11/8/2012	11/11/2012	8.9	3	4.0
88	Niġliq	A	1288A1	24.4	10/28/2012	11/25/2012	7.6	28	37.3
88	Niġliq	B	1288B1	24.4	10/28/2012	11/12/2012	7.6	15	20.0
89	Upper Niġliq	A	1289A1	24.4	10/22/2012	10/24/2012	7.6	2	2.7
89	Niġliq	A	1289A2	24.4	10/24/2012	11/7/2012	7.6	14	18.7
93	Upper Niġliq	A	1293A1	30.5	10/23/2012	11/17/2012	6.4	25	41.7

Table 2. Continued.

Fisher Code	Fishing Location	Net	Net Code	Length (m)	Start Date	End Date	Stretched mesh (cm)	Net Days	Adjusted Net Days
94	Niġliq	A	1294A1	18.3	10/21/2012	10/27/2012	7.6	6	6.0
94	Niġliq	A	1294A2	18.3	10/29/2012	11/5/2012	7.6	7	7.0
94	Niġliq	B	1294B1	30.5	10/23/2012	10/27/2012	7.6	4	6.7
94	Niġliq	B	1294B2	30.5	10/29/2012	11/5/2012	7.6	7	11.7
95	Niġliq	A	1295A1	18.3	10/27/2012	11/2/2012	7.6	6	6.0
99	Main	A	1299A1	30.5	10/22/2012	10/26/2012	7.6	4	6.7
99	Main	B	1299B1	24.4	10/22/2012	10/26/2012	7.6	4	5.3
Total									846.7

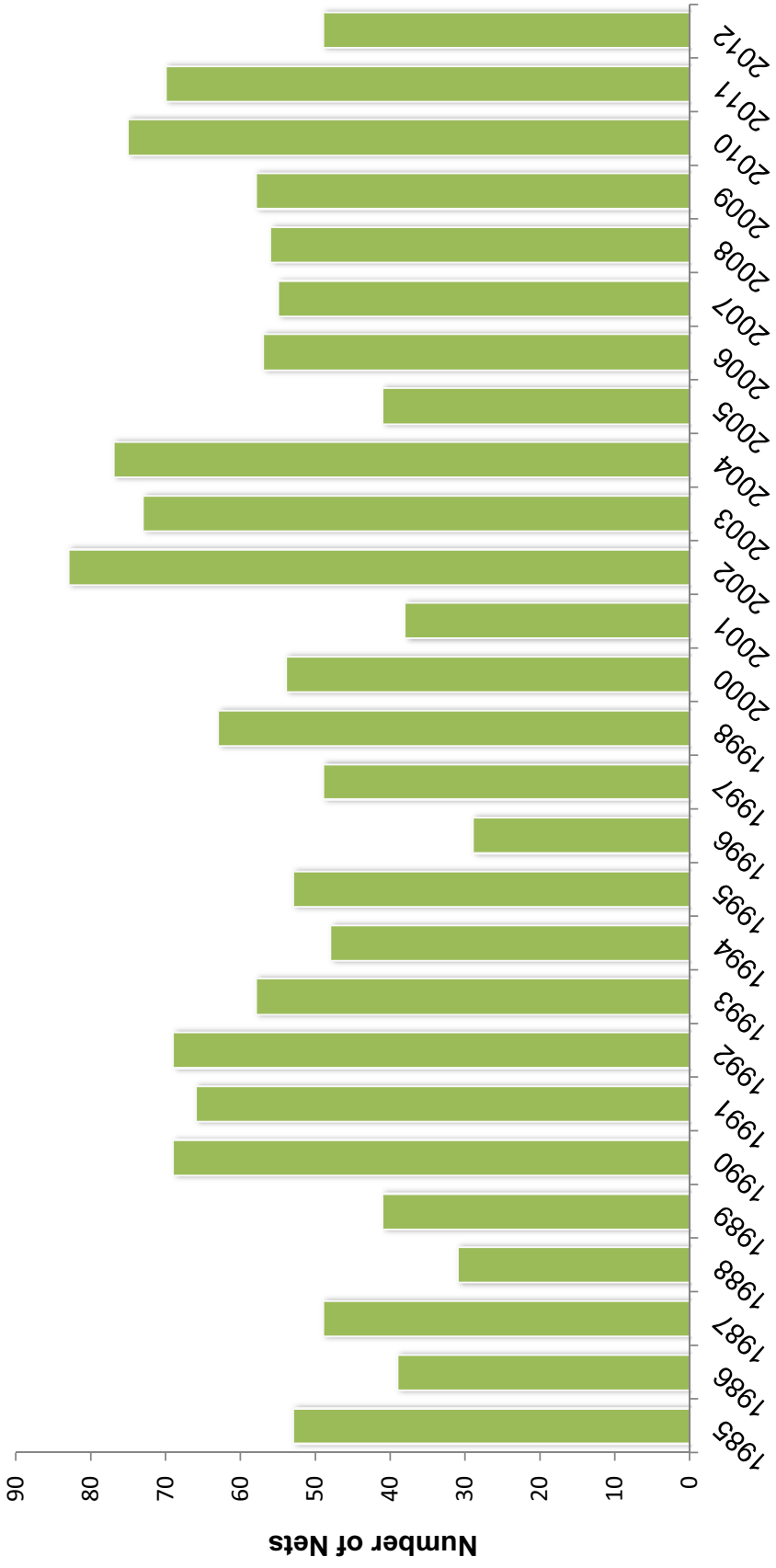


Figure 3. The number of gill nets deployed annually in the Colville River, Alaska, fall subsistence fishery, 1985–2012.

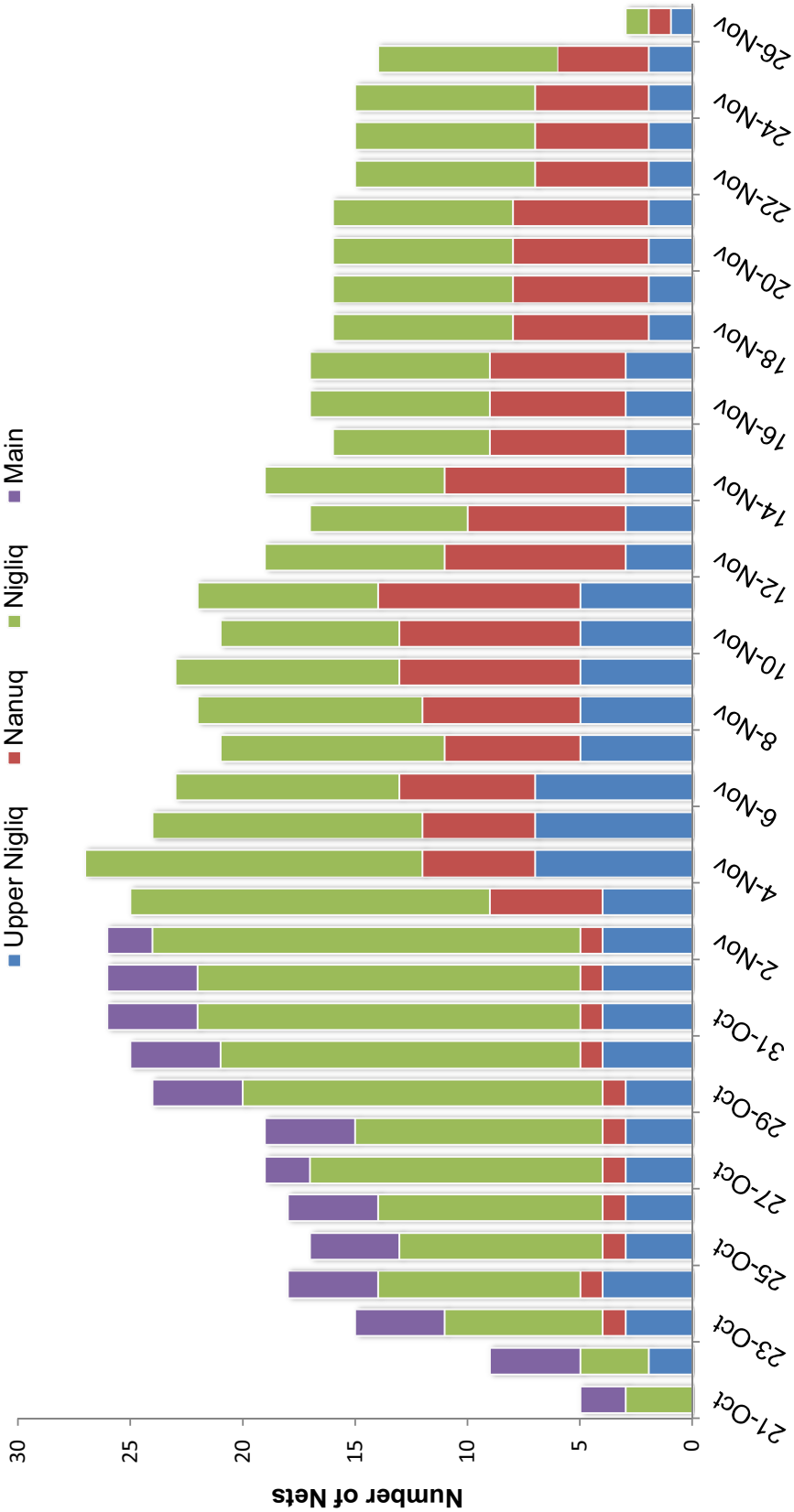


Figure 4. Number of nets fishing each day in each of 3 Nigliq Channel fishing areas and in the main channel, Colville River, 2012.

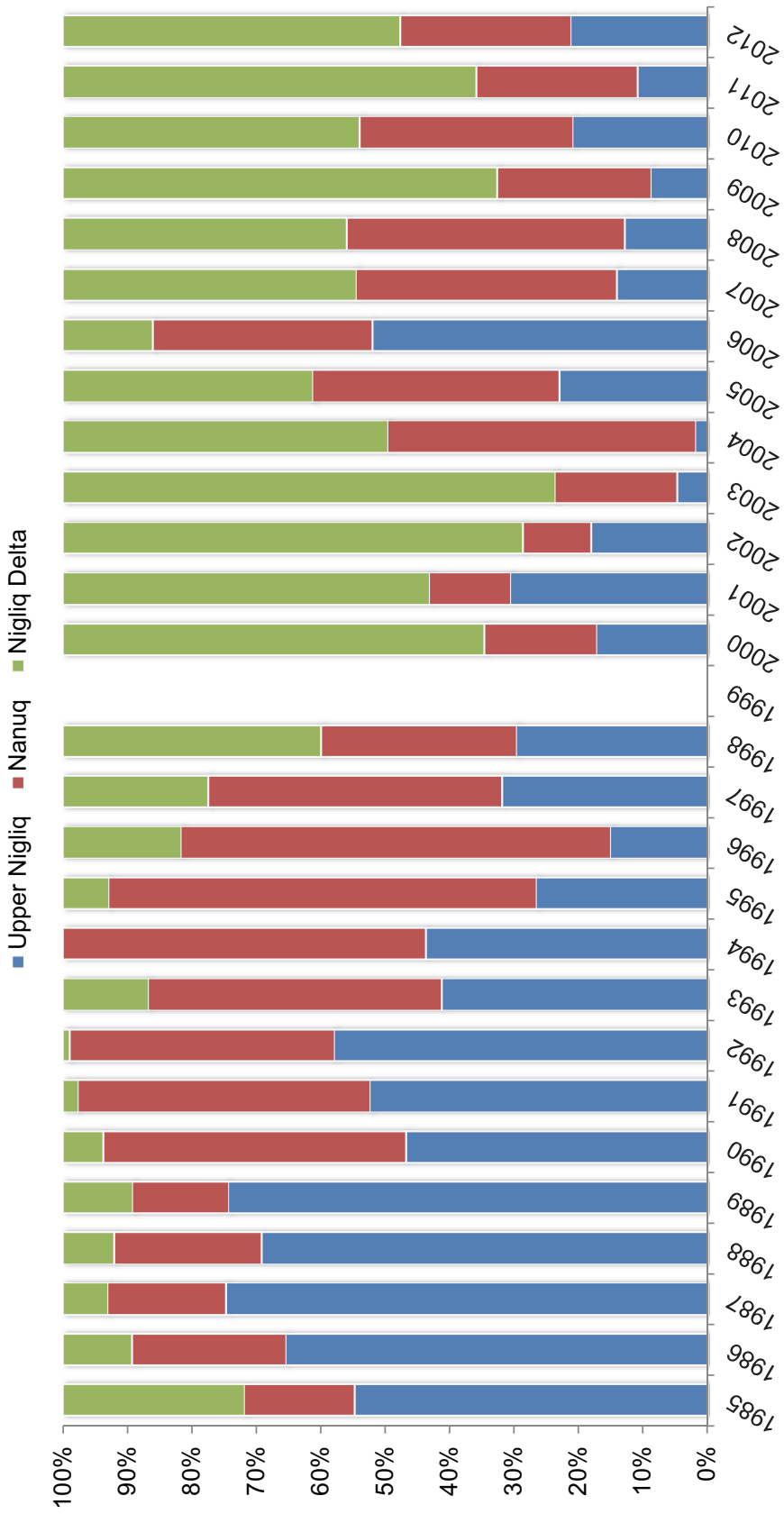


Figure 5. The percentage of annual fishing effort in each of 3 Nigliq Channel, Colville River fishing areas, 1985–2012. All nets are included, and the Uyagagviq area is combined with the Nanuq area.

Table 3. Observed catch of arctic 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, 1986–2012. 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	Observed 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

Table 3. Continued.

Year	Upper Niġliq			Nanuk			Niġliq Delta			Total Niġliq Channel		
	Observed Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
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
Total[b]	20,611	2,111.6	9.8	43,668	2,981.1	14.6	77,094	3,607.6	21.4	141,373	8,700.8	16.2

[a] Upper Niġliq catch and effort values include fish and net data from the Uyagagviq area (Area 630).
[b] Denotes average CPUE from 1986–2012.

Figure 6). The total documented harvest in 7.6-cm mesh nets decreased markedly in the Upper Niġliq and Niġliq sections of the Niġliq Channel while documented harvest numbers increased slightly in Nanuk compared to 2011 (Table 3). An additional harvest of 1,184 arctic cisco was documented for 7.6-cm nets in the Main Channel.

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 2012 CPUE in 7.6-cm mesh nets for arctic cisco in the Niġliq Channel was highest in the Niġliq Delta area (31.2 fish per adjusted net-day) followed by the Nanuk area (27.2 fish/adjusted net-day), and the Upper Niġliq area (3.6 fish/adjusted net-day) (Table 3). The total CPUE in 7.6-cm mesh nets for arctic cisco in the Niġliq Channel (27.7 fish/adjusted net-day) was tied for the fifth highest in the history of the monitoring program (Table 3, Figure 7). CPUE in 7.6-cm net in the Main Channel was 52.2 fish per adjusted net-day (Table 4). In 2012, the daily average CPUE in 7.6-cm mesh nets in the Niġliq Channel peaked during a 2 day period on 28 and 29 October (57 and 61 fish respectively). Between 28 October and 9 November an average of 36 arctic cisco were caught per adjusted net-day in 7.6-cm mesh nets in the Niġliq Channel (Figure 8).

A total of 10,804 arctic cisco were documented by the monitoring team in all mesh sizes combined for the Niġliq Channel in 2012 (Table 4). An additional 2,558 fish were documented in the Main Channel. The net-length adjusted CPUE for each individual mesh size from observed harvests in the Niġliq Channel reveals that harvest results ranged from 11.9 fish per adjusted net day in 8.9-cm mesh nets to 27.7 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 for each mesh size class, yields a total harvest estimate of ~19,284 arctic cisco from the Niġliq Channel and ~3,444 from the Main Channel of the Colville River for an estimated total harvest of ~22,728 arctic cisco in 2012 (Table 4).

In addition to arctic cisco, 7 other species of fish were documented in the Colville River fall fishery harvest in 2012, including fourhorn sculpin (*Myoxocephalus quadricornis*) which are observed but not enumerated for this monitoring project (Table 5). A total of 17,172 fish (all species and mesh sizes) were counted during interviews, with arctic cisco (77.8%) and least cisco (19.8%) comprising the bulk of the recorded harvest (Table 5). The proportion of least cisco in the observed harvest was close to the long-term average of 20.6% and the proportion of arctic cisco was above the historical average of 69.7%. Rainbow smelt (*Osmerus mordax*), saffron cod (*Eleginus gracilis*), broad whitefish (*C. nasus*), humpback whitefish (*C. pidschian*) and burbot (*Lota lota*) were observed but comprised a negligible proportion of the harvest.

The 7.6-cm mesh net CPUE in the Niġliq Channel for least cisco in 2012 was higher (4.0 fish per adjusted net day) than in 2011 (1.7 fish per adjusted net day) (Table 6). CPUE was the highest in 26 years of monitoring in Nanuk (12.1 fish per adjusted net day). The 2012 CPUE for least cisco in the Niġliq Channel was slightly higher than the long term average 1986–2012 (3.4 fish/day). No least cisco were reported from Main Channel interviews though they were very likely present as by-catch in nets that were fishing.

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 2,027 arctic cisco in 2012 compared to 1,914 arctic cisco in 2011 and 1,547 in 2010. Fish ranged in length from 209 to 436 mm (Figure 9). The middle 50% of fish ranged between 308 and 329 mm as compared to a middle 50% of 296 to 322 mm in 2011 and 280 to 331 mm in 2010. The median fork length was 316 mm (compared to a median of 310 mm in 2011) and the length distribution of arctic cisco appears normally distributed about the median. Only 4 different mesh sizes of gill nets were deployed in the Colville Delta in 2012, down from 6 mesh sizes in previous years. The median length of arctic cisco caught in these 4 nets was higher for each mesh size as compared to 2011 (Figure 10). Least cisco length distribution was similar to that of arctic cisco in 2012 and was normally distributed (Figure 9). Fork lengths ranged from 245 mm to 368 mm with a median of 307 mm, as compared to 2011

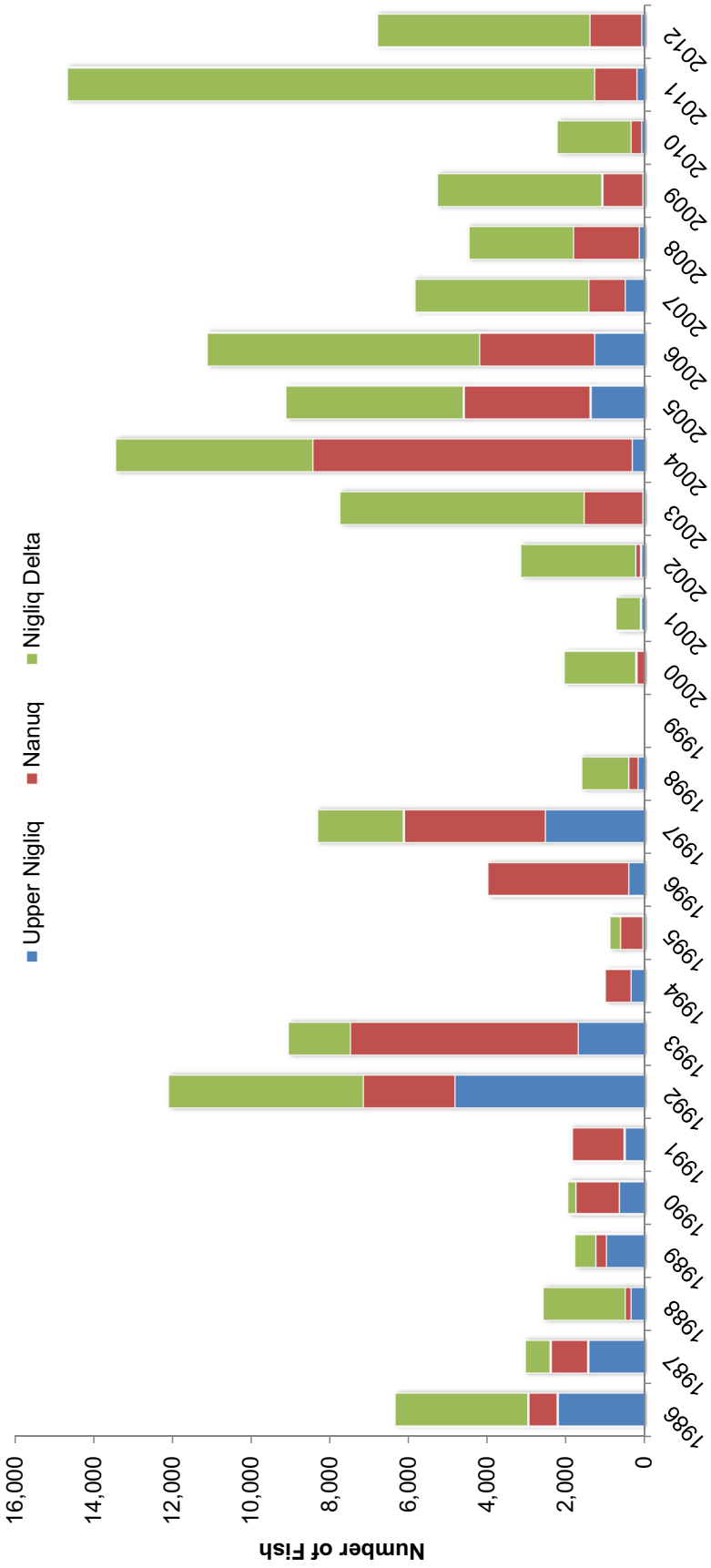


Figure 6. The observed number of arctic cisco harvested in 7.6 cm mesh gill nets in each of three Nigliq Channel fishing areas, 1986–2012. Data from 2005–2012 is not directly comparable to older data because the fishery was not monitored for the entire season.

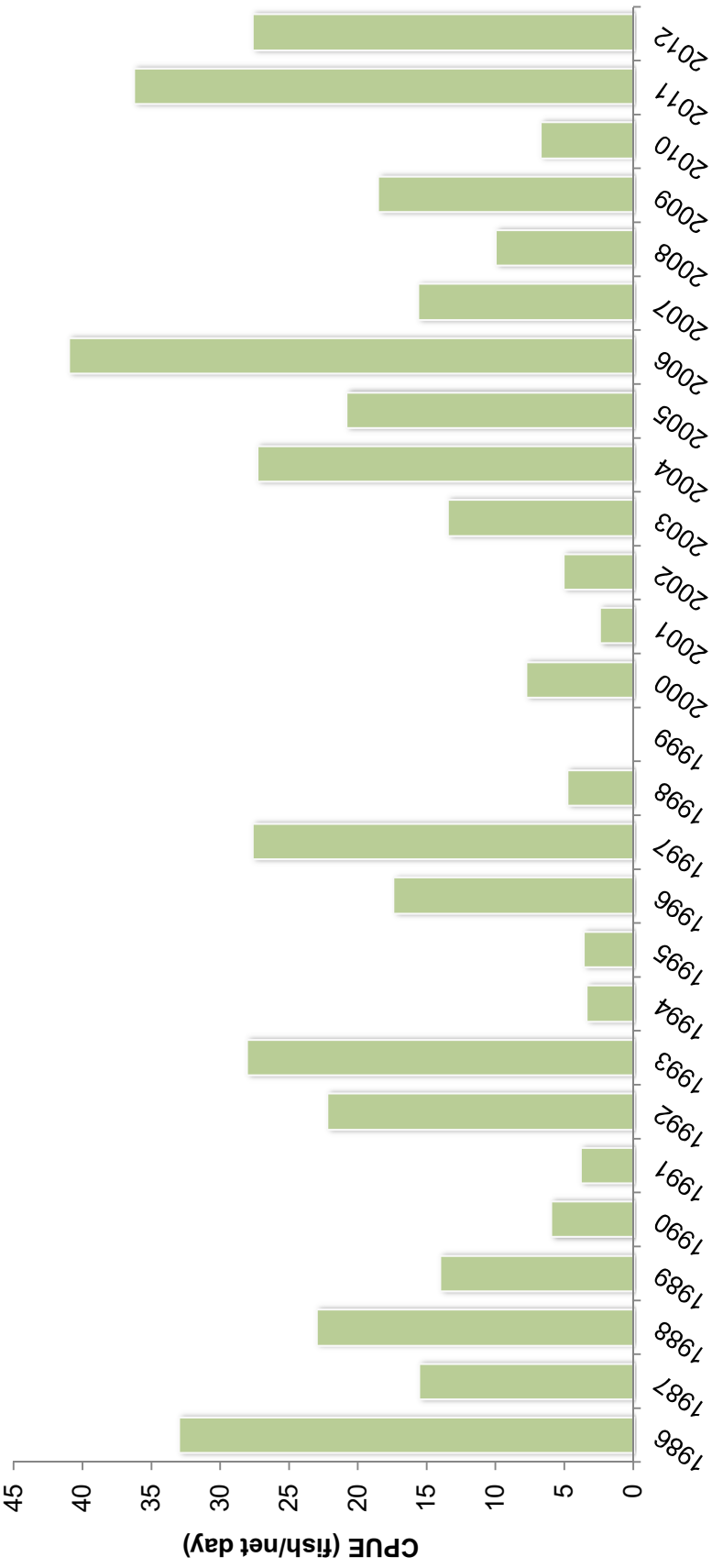


Figure 7. Catch per unit effort (CPUE) of arctic cisco in 7.6-cm gillnets, Nigliq Channel, Colville River, Alaska, 1986–2012. Effort is standardized to a 18 m net length.

Table 4. Observed harvest of arctic cisco (number of fish), effort (net days), and catch per unit effort (CPUE; fish/net day) for each fishing area in the Niğliq channel and Main channel, Colville River, Alaska, 1986–2012 by mesh size.

	Upper Niğliq			Nanuk			Niğliq Delta			Total Niğliq Channel			Main Channel			Total			Main				
Mesh Size (cm)	Observed Catch (# of fish)	Effort (net days)	CPUE (fish/net day)	Catch (# of fish)	Effort (net days)	CPUE (fish/net day)	Catch (# of fish)	Effort (net days)	CPUE (fish/net day)	Catch (# of fish)	Effort (net days)	CPUE (fish/net day)	Catch (# of fish)	Effort (net days)	CPUE (fish/net day)	Catch (# of fish)	Effort (net days)	CPUE (fish/net day)	Niğliq Actual Adjusted Net Days	Estimated Niğliq Channel Harvest	Actual Adjusted Net Days by Net Mesh	Estimated Main Channel Harvest	Estimated Harvest
6.4	1,378	55.0	25.1	--	--	--	--	--	--	1,378	55.0	25.1	331	4.0	82.8	1,709	59.0	29.0	106.7	2,673	14.7	1,214	
7.0	0	6.7	0.0	443	17.0	26.1	1,224	55.3	22.1	1,667	79.0	21.1	--	--	--	1,667	79.0	21.1	135.3	2,855	--	--	
7.6	86	24.0	3.6	1,313	48.3	27.2	5,413	173.7	31.2	6,812	246.0	27.7	1,184	22.7	52.2	7,996	268.7	29.8	464.6	12,865	42.7	2,230	
8.9	--	--	--	20	4.0	5.0	617	49.7	12.4	637	53.7	11.9	71	2.0	35.5	708	55.7	12.7	75.0	890	--	--	
Total																				19,284		3,444	22,728

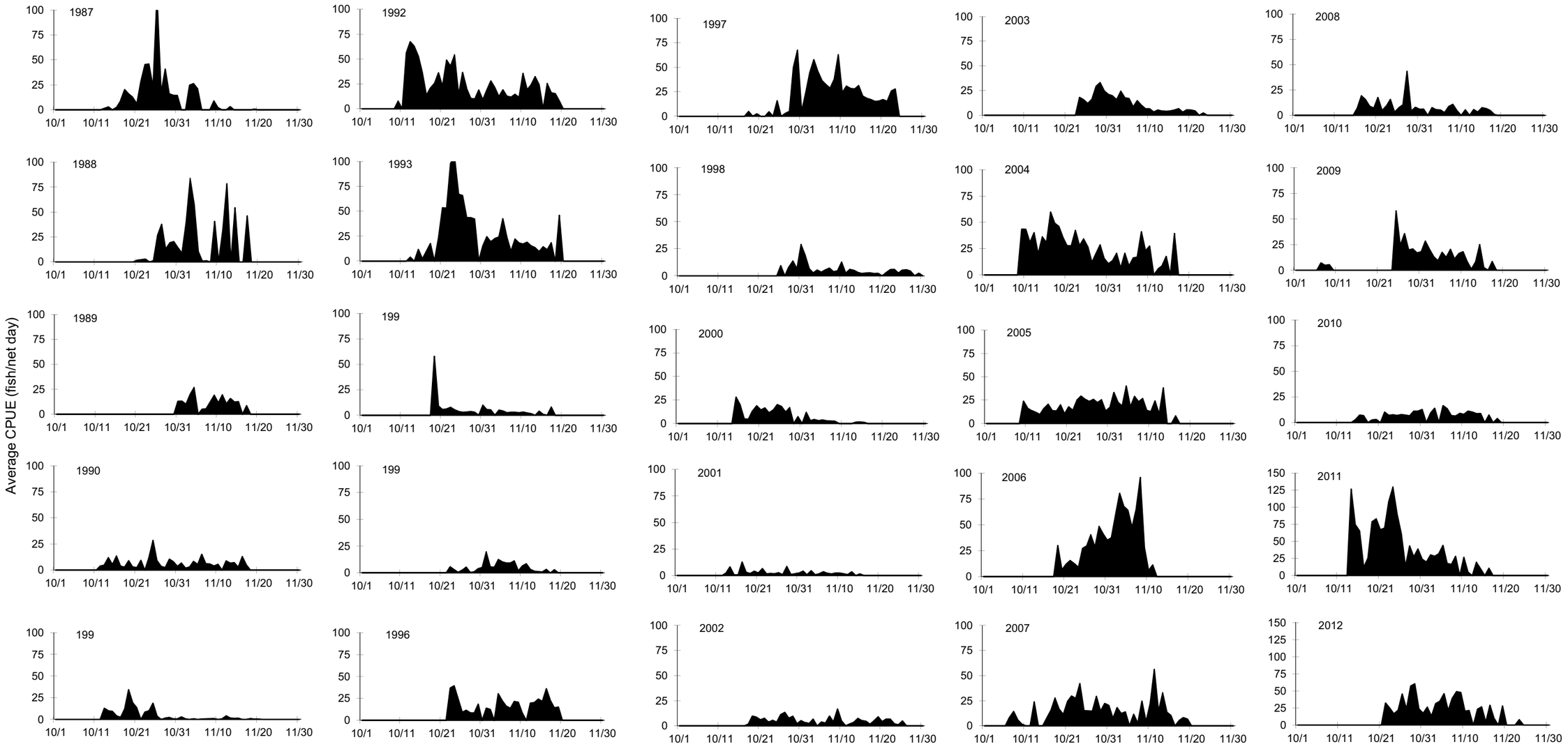


Figure 8. Average daily catch per unit effort (catch per net day) of arctic cisco in 7.6-cm gillnets, Niġliq Channel, 1987–2012. Effort is standardized to 18 m net length, as described in text.

Table 5. Species composition of the observed subsistence harvest from the Colville River fall fishery, expressed as a percent of the sampled catch, 1985–2012. Table includes all fish caught in every net, regardless of mesh size.

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

(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, 1986–2012. Catch and effort data are for 7.6-cm mesh.

	Upper Niġliq			Nanuk			Niġliq Delta			Total Niġliq Channel		
Year	Observed 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
Totals	7,449	2,101	3.5	11,659	2,915	4.0	10,202	3,571	2.9	29,310	8,587	3.4

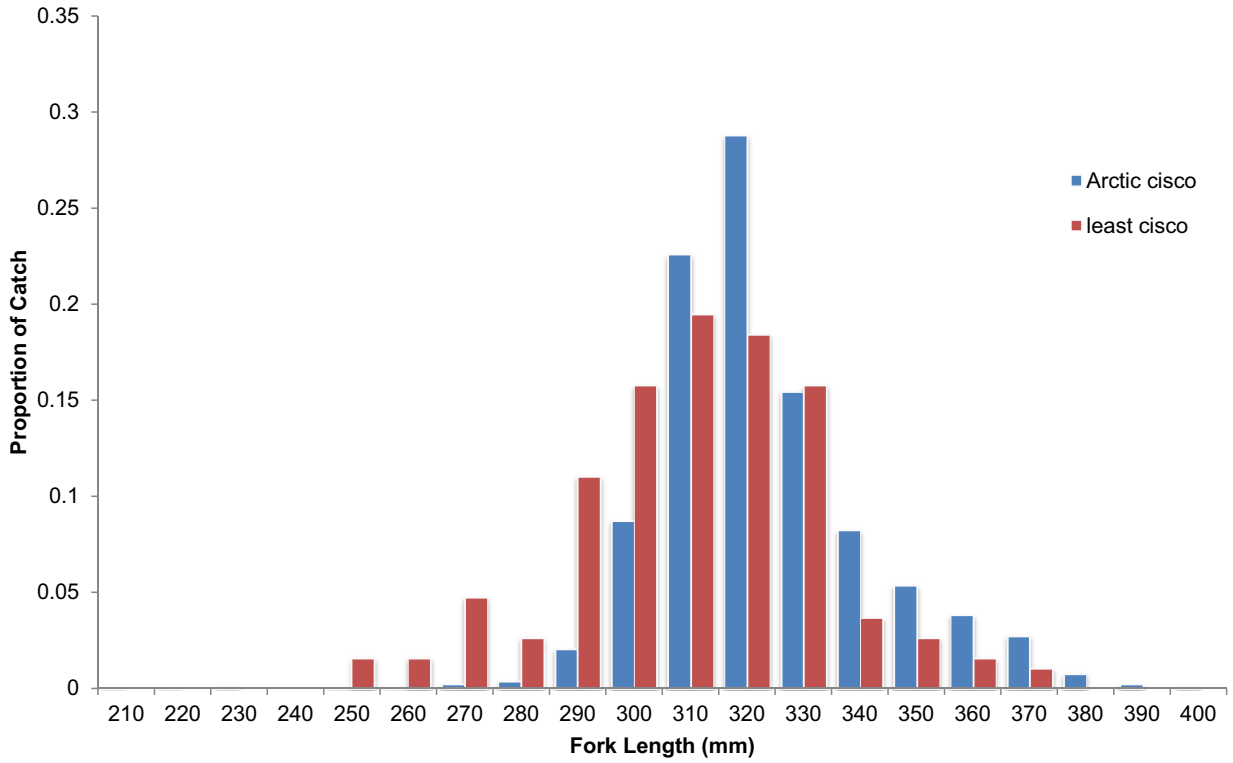


Figure 9. Length frequency (10 mm increments) of arctic cisco and least cisco captured in all mesh sizes in the fall subsistence fishery, Niġliq Channel, Colville River, 2012.

where fork lengths ranged from 250 mm to 366 mm with a median fork length of 316 mm. The middle 50% of the measured harvest was between 295 and 321 mm in 2012, as compared to 300 mm and 330 in 2011.

In 2012, ABR received donated fish samples (n = 238) from several fishers to be used for aging fish or 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 correlated (r^2 = 0.68) in arctic cisco in 2012 (Figure 11) but the correlation was weaker than in 2011 (r^2 = 0.78) and 2010 (r^2 = 0.90) (Figure 12). Analysis of otoliths revealed that arctic cisco in the 2012 harvest ranged in age from 4 to 6 years (all mesh sizes combined, n = 148) as compared to 2011 when the age range was between 5 and 8 years (Figure 13). Age composition was 71% age 5, 20% age 4, and 9% 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 = 119), age composition was approximately 69% age 5, 22% ages 4, and 9% age 6 (Figure 13, Appendix C). Harvest of age 5 fish made up the majority of the overall observed harvest in 2012 and yet that year class (2007) was absent in the fishery in 2011 when they were age 4 fish (Seigle and Gottschalk 2012). 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 2012, the largest fish tended to be spread out between ages 4 and 6 (Figure 14).

Using the age composition of the catch (as percentage of catch) and the overall CPUE of 27.7. fish/net-day in the Niġliq Channel (Table 3), age-specific CPUE was estimated for the 2012 arctic cisco harvest. For 7.6-cm mesh nets, the CPUE increased dramatically from age-4 (6.1 fish per adjusted net-day) to age-5 (19.1 fish per adjusted net day). CPUE dropped off in age-6 (2.1 fish per adjusted net day) arctic cisco (Figure 15,

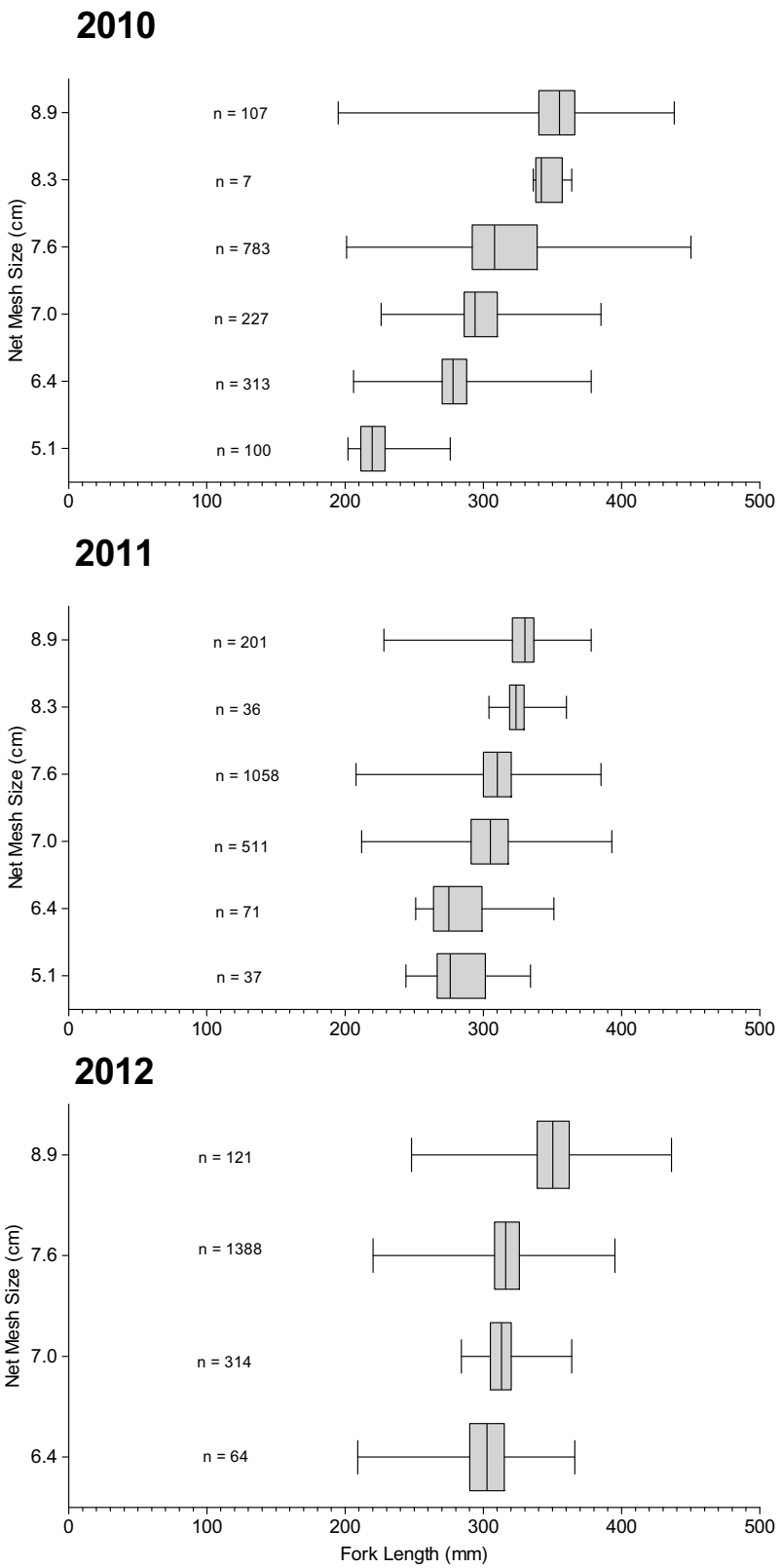


Figure 10. Cumulative length frequency of arctic cisco in the fall subsistence fishery by gillnet mesh size, Niġliq Channel and Main Channel, Colville River (2010–2012).

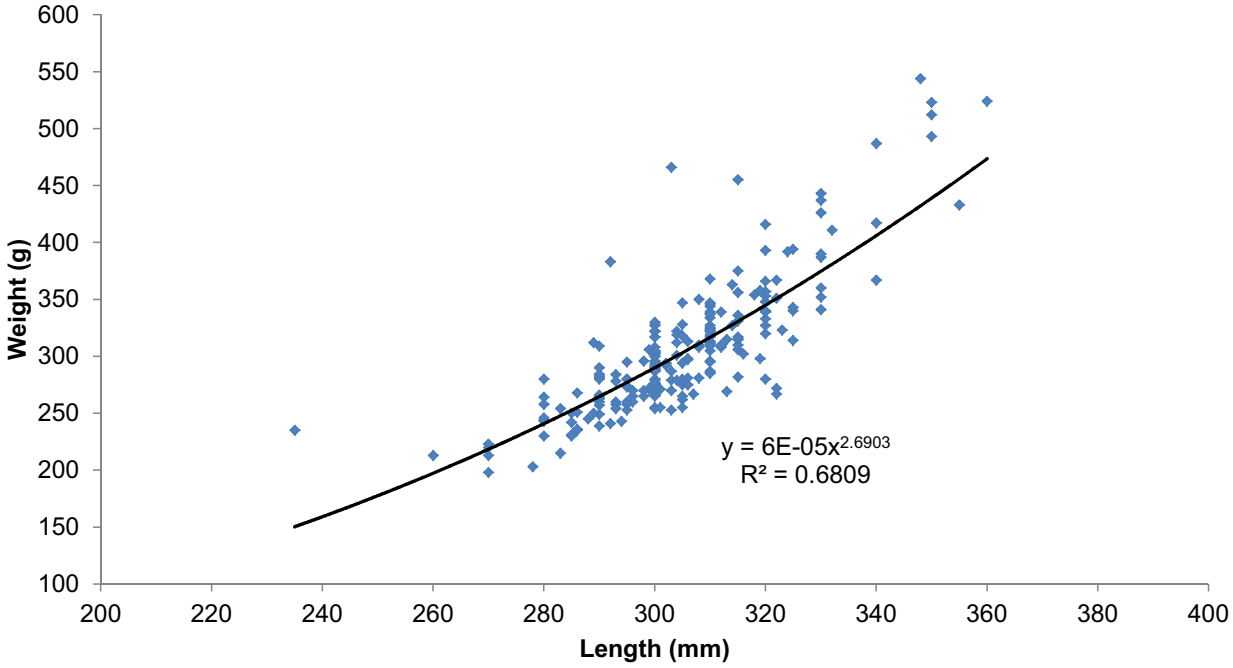


Figure 11. Length-weight relationships of arctic cisco captured in the Niġliq Channel, Colville River, 2012. Includes fish captured in all mesh sizes and all nets (n = 229).

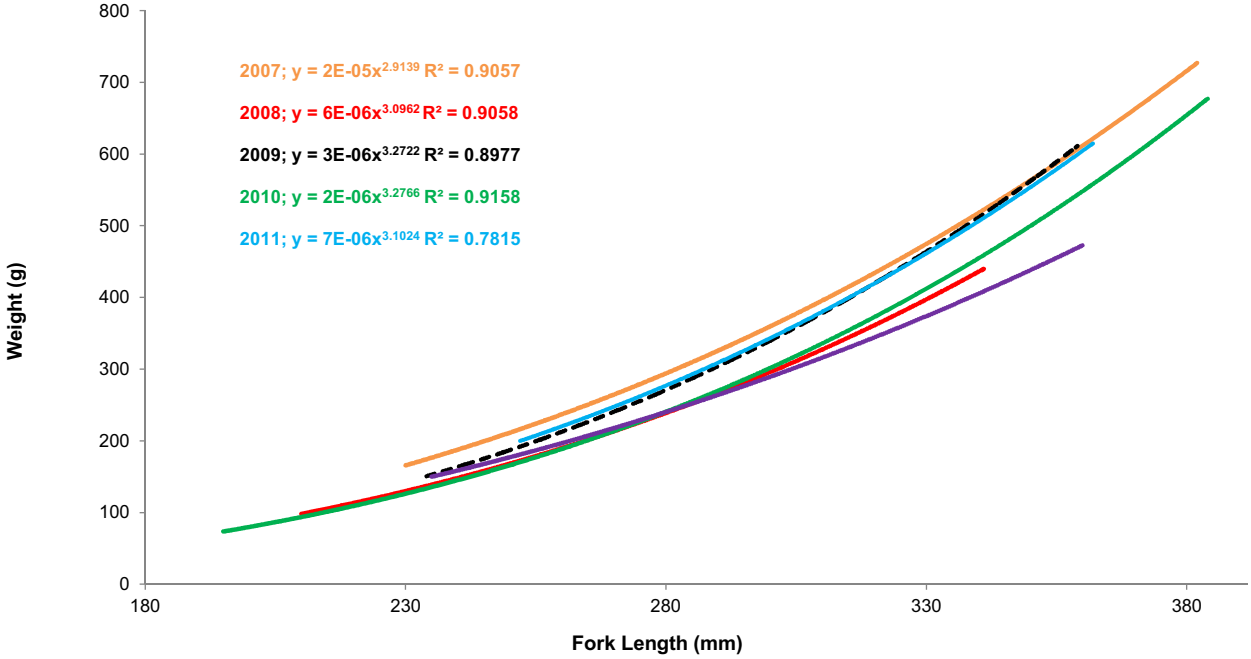


Figure 12. A six-year (2007–2012) comparison of length-weight regression lines for arctic cisco (all mesh sizes) in the Niġliq Channel, Colville River, Alaska.

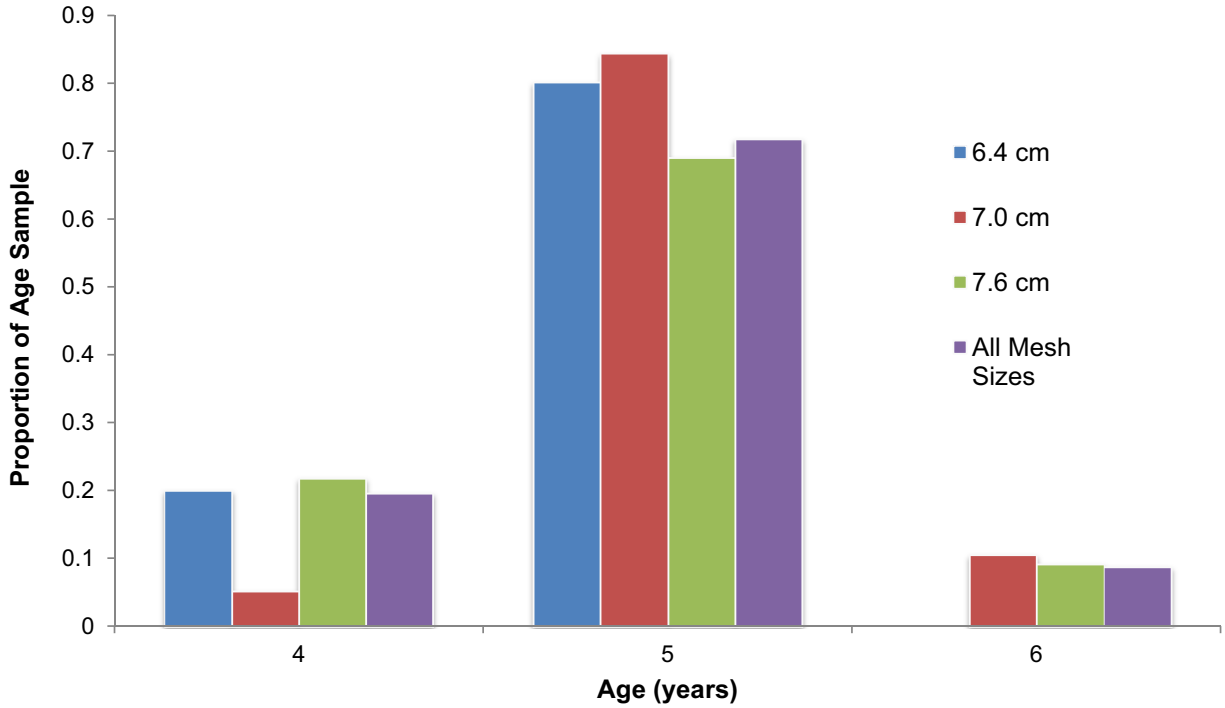


Figure 13. Age composition of arctic cisco harvested in 6.4-cm mesh nets (n=10), 7.0-cm mesh nets (n=19), 7.6-cm mesh nets (n=119), and all mesh sizes combined (n=148).

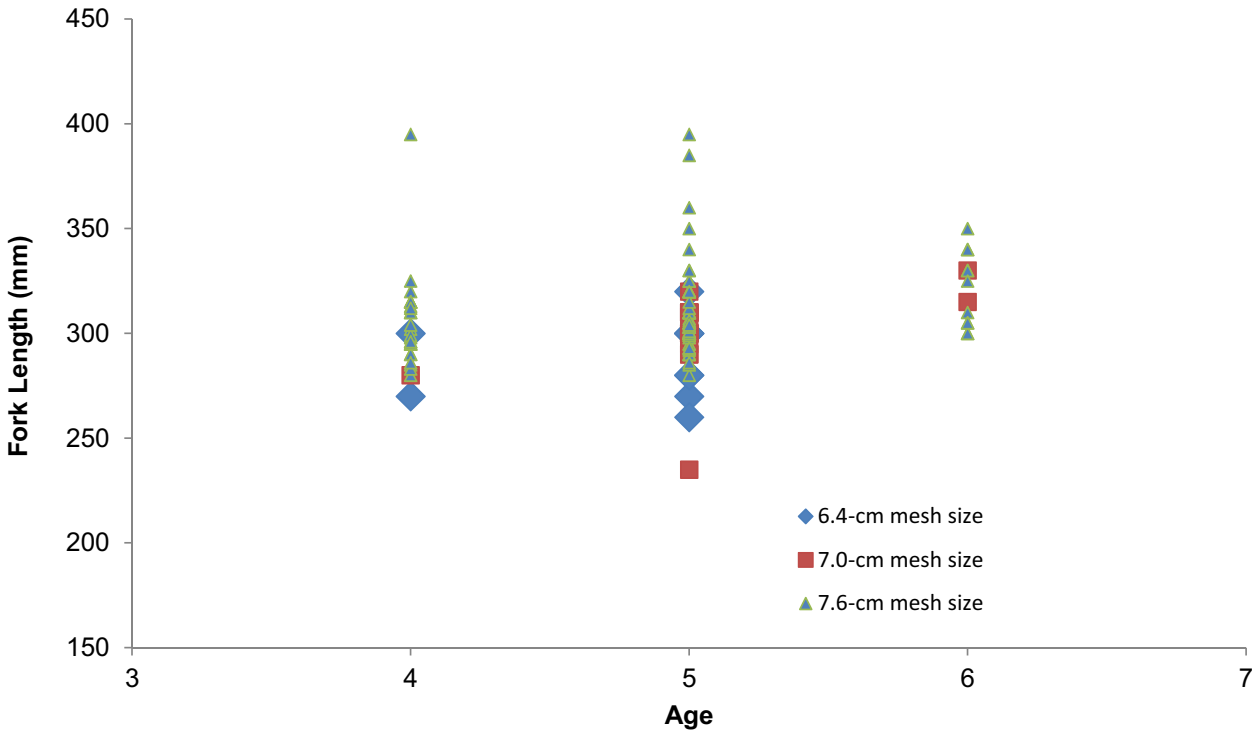


Figure 14. Age-specific length distribution of arctic cisco harvested in the fall subsistence fishery, Nigliq Channel, Colville River, Alaska, 2012.

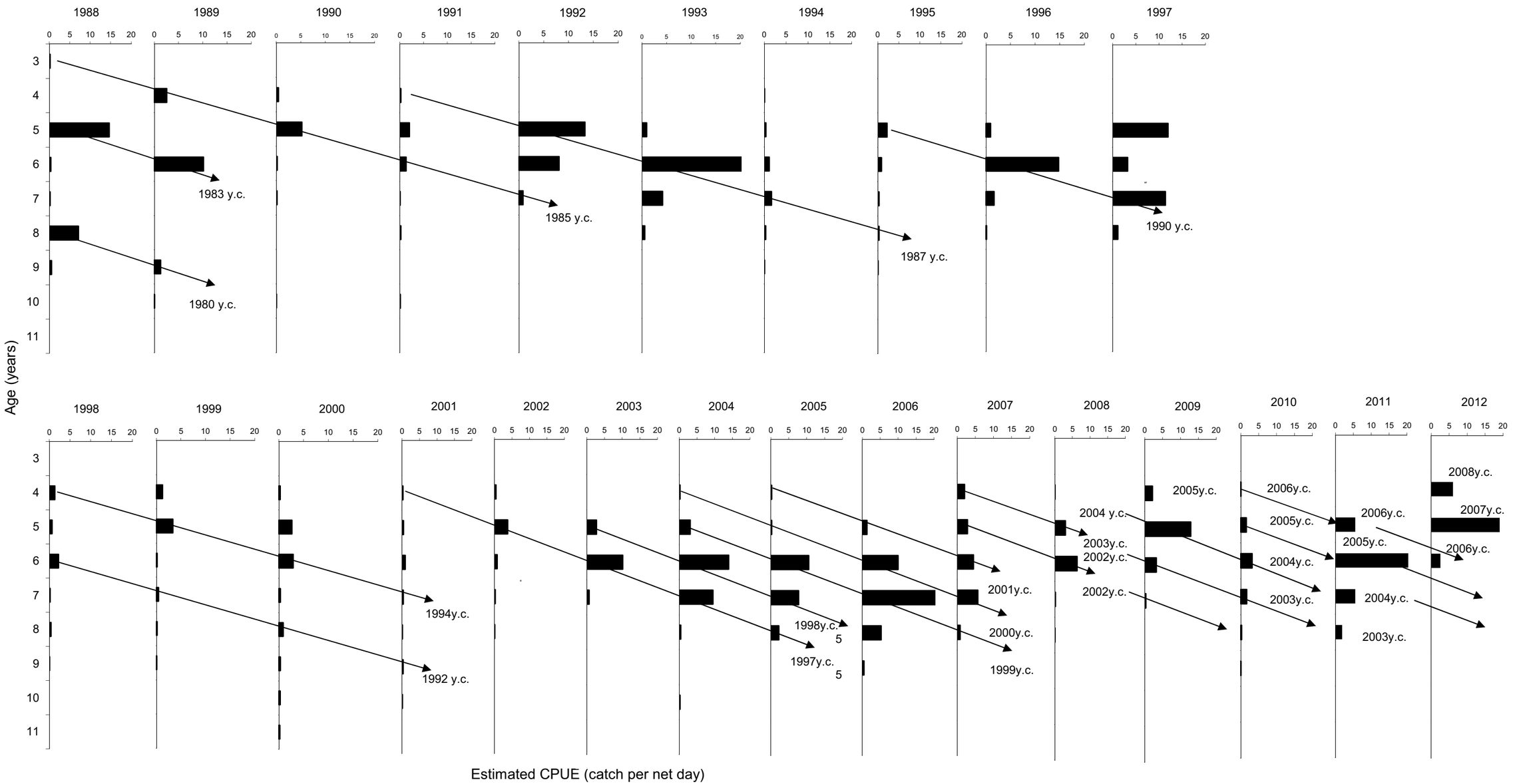


Figure 15. Catch per unit effort (CPUE) of arctic cisco by age class in the fall subsistence fishery, Nigliq channel, 1988–2012. Arrows demonstrate the progression of select year classes through the fishery. Only fish harvested in 7.6 cm mesh gill-nets are included and counts are standardized to 18 m net length, as described in text.

Appendix D). These fish represent the 2006–2008 year classes. Based on these estimates, there was little or no representation in the fishery by the 2004–2005 year classes. In fact, the 2005 year class appears to have disappeared completely from the fishery in 2012 (Figure 15). 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). While it is still possible that the 2005 year class could be represented in 2013, in all likelihood the contribution by the 2004 year class is complete. The cumulative total CPUE for the 2004 year class appears to have reached nearly 22 fish/adjusted net-day by age class. This is well above the average of 15 fish per adjusted net-day by year class from 1985 to 2003. The 2004 year class (age-8) has likely returned to spawn in the McKenzie River drainage. The 2005 year class (age-7) has accounted for a CPUE of 27 fish per adjusted net day as of 2012. The 2006 year class (age-6) has so far contributed 8 fish per adjusted net-day to the fishery while the 2007 year class (age-5) has already contributed 19 fish/net-day to the cumulative CPUE without making an appearance in the 2011 fishery (Figure 15).

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 did not begin salinity sampling until 23 October 2012 due to unsafe ice conditions hampering sampling efforts in several sections of the river. Salinity over the sampling season was steadily above 15 ppt at the 3 downstream sampling locations throughout the season (Figures 2 and 17). However, the upstream sampling station salinity did not reach 15 ppt until mid-November. The 3-m salinity levels at downstream stations (1, 2 and 3) were already well above the optimal (>15 ppt) during the peak period for arctic cisco harvest. As would be expected, the highest salinities were found closest to the delta and lowest salinities were found upstream, indicative of the "salt wedge" that moves up and down the channel with changing flow conditions. Salinity reached 15 ppt (3-m depth) at the farthest upstream station in the Upper Niġliq on 16 November (Figure 17) 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., 2009 and 2010). During the period of peak fishing in 2012 (28 October–9 November) salinity had already reached 15 ppt at the 3-m depth at the 3 downstream sampling stations (Figure 17).

SEDIMENT ANALYSIS

ABR biologists collected sediment samples at salinity stations 1 (downstream) and 3 (upstream) on 8 and 16 November respectively for analysis of total metals, diesel range and heavy oil range organics, and a suite of PAH's (Figure 2, Appendices D and E). All metals were present at each site with arsenic being the sole analyte above the Alaska Department of Environmental Conservation's (ADEC) Artic Zone direct contact level of 6.1 (mg/kg). However, localized areas of elevated arsenic are not uncommon in the state due both to atmospheric deposition and local geology (ADEC 2009). There was an elevated level of residual range organics detected at the upstream sampling location on 16 November (478 mg/kg). Still, this level is well below the ADEC direct contact and ingestion limit. The PAH levels at the two sampling stations were lower than those described at the CD2 and Wood's Camp areas of the Niġliq Channel during 2004 and 2005 in a study conducted by Mote Marine Laboratory (Wetzel and Mercurio 2006). PAH levels detected in this study are not unusual for an area of the Colville River that includes oil seeps and coal outcrops (Steinhaur and Boehm 1992).

FISH TISSUE ANALYSIS

Muscle tissue (60 g) and liver tissue (<3 g) were collected from each of 5 randomly selected, donated arctic cisco samples and tested for a suite of 10 PAH levels by Pace Analytical Services, Inc., in Green Bay, WI. The laboratory initially performed an analysis of PAH levels in a sub-sample of muscle tissue and a whole sample of

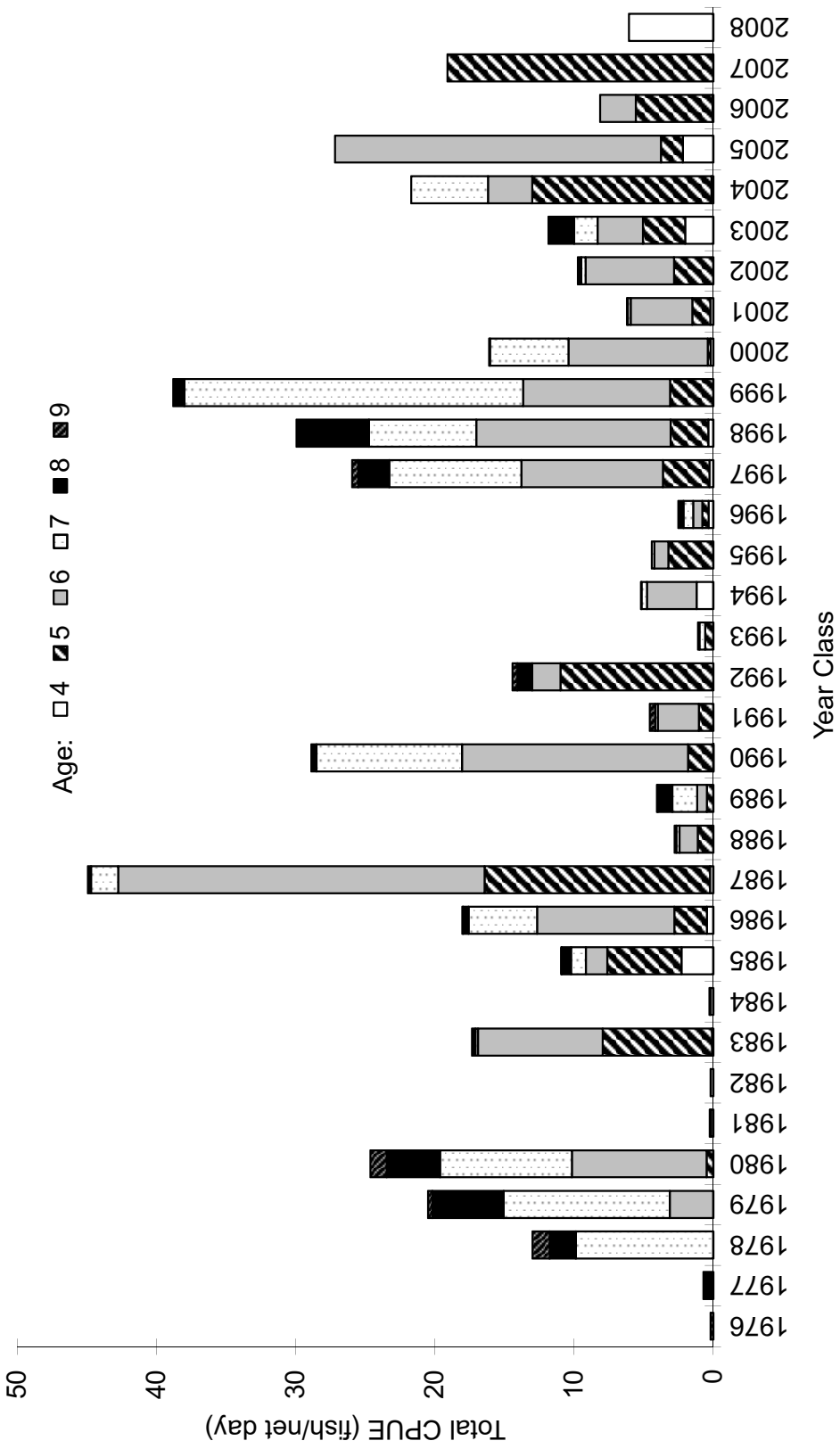


Figure 16. Cummulative catch per unit effort (catch per net day) of arctic cisco by year class (year of hatch) in the fall subsistence fishery, Nigliq Channel, Colville River, 1976–2008 (capture dates 1985–2012). Catch per unit effort was estimated only for fish captured in 7.6-cm mesh nets.

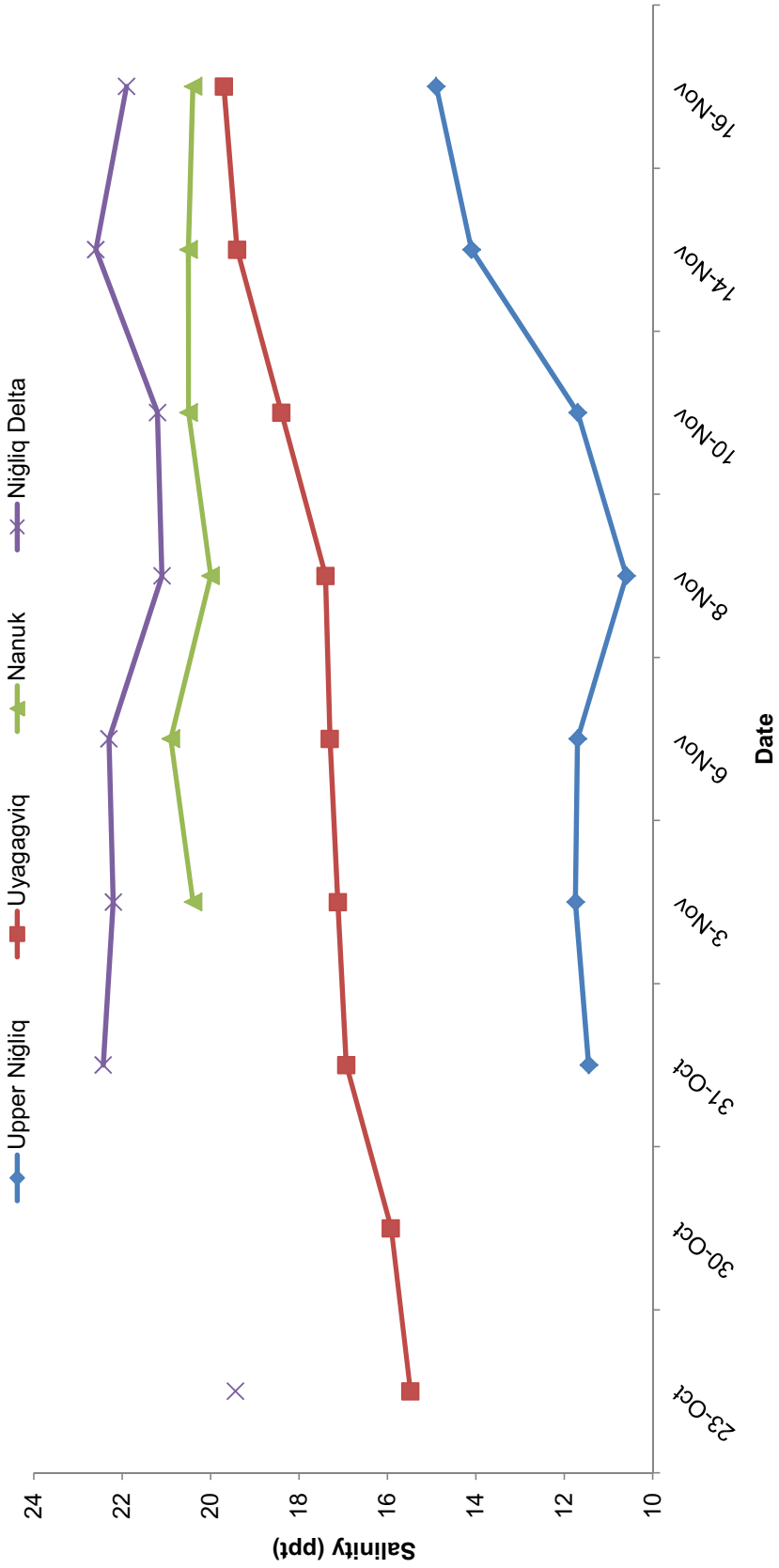


Figure 17. Water salinity (parts per thousand) at 3.0-m depth in each of 4 Nigliq Channel, Colville River fishing areas, 2012.

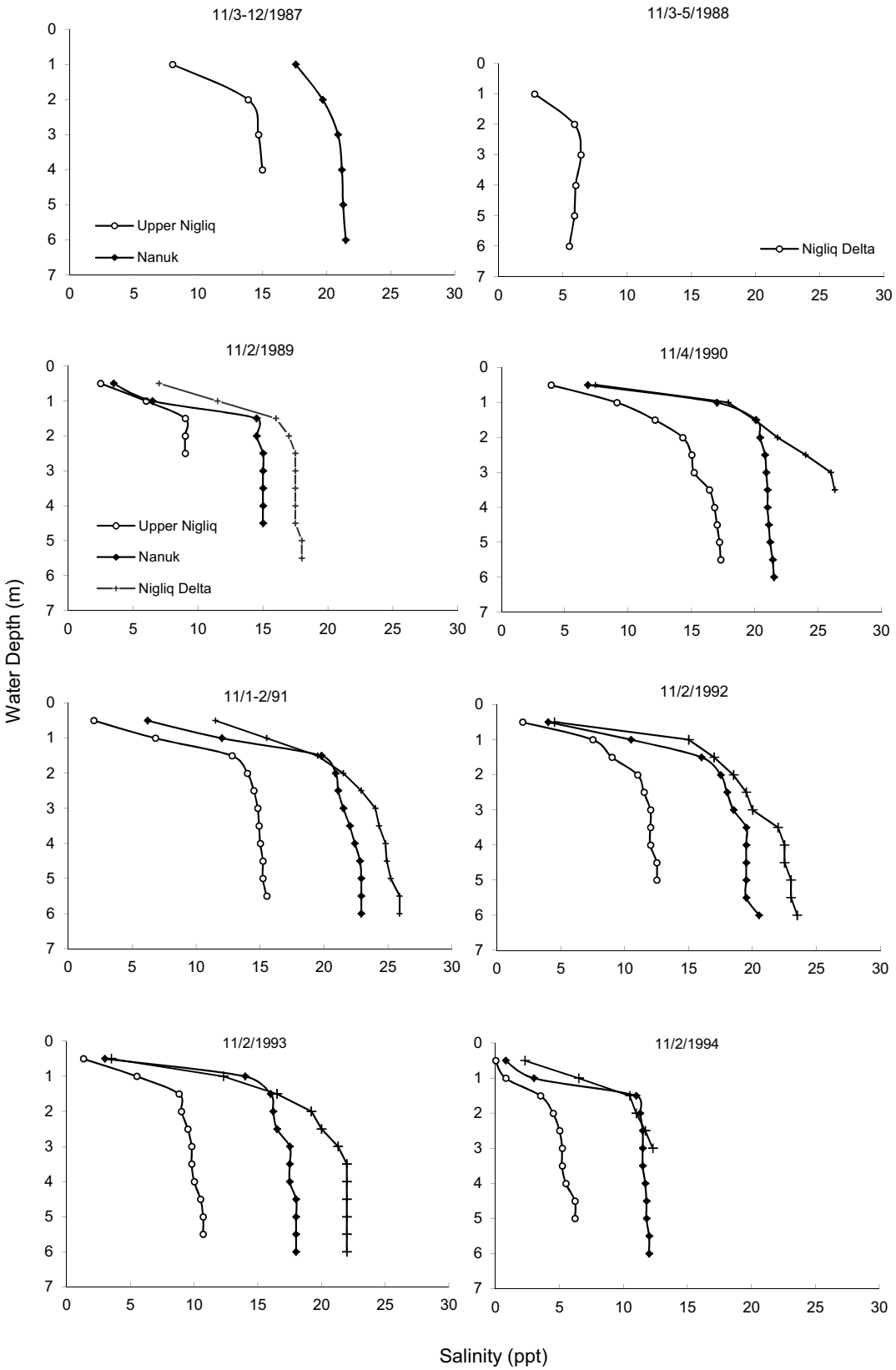


Figure 18a. Water salinity depth profiles in Niğliq Channel fishing areas, early November 1987–1994.

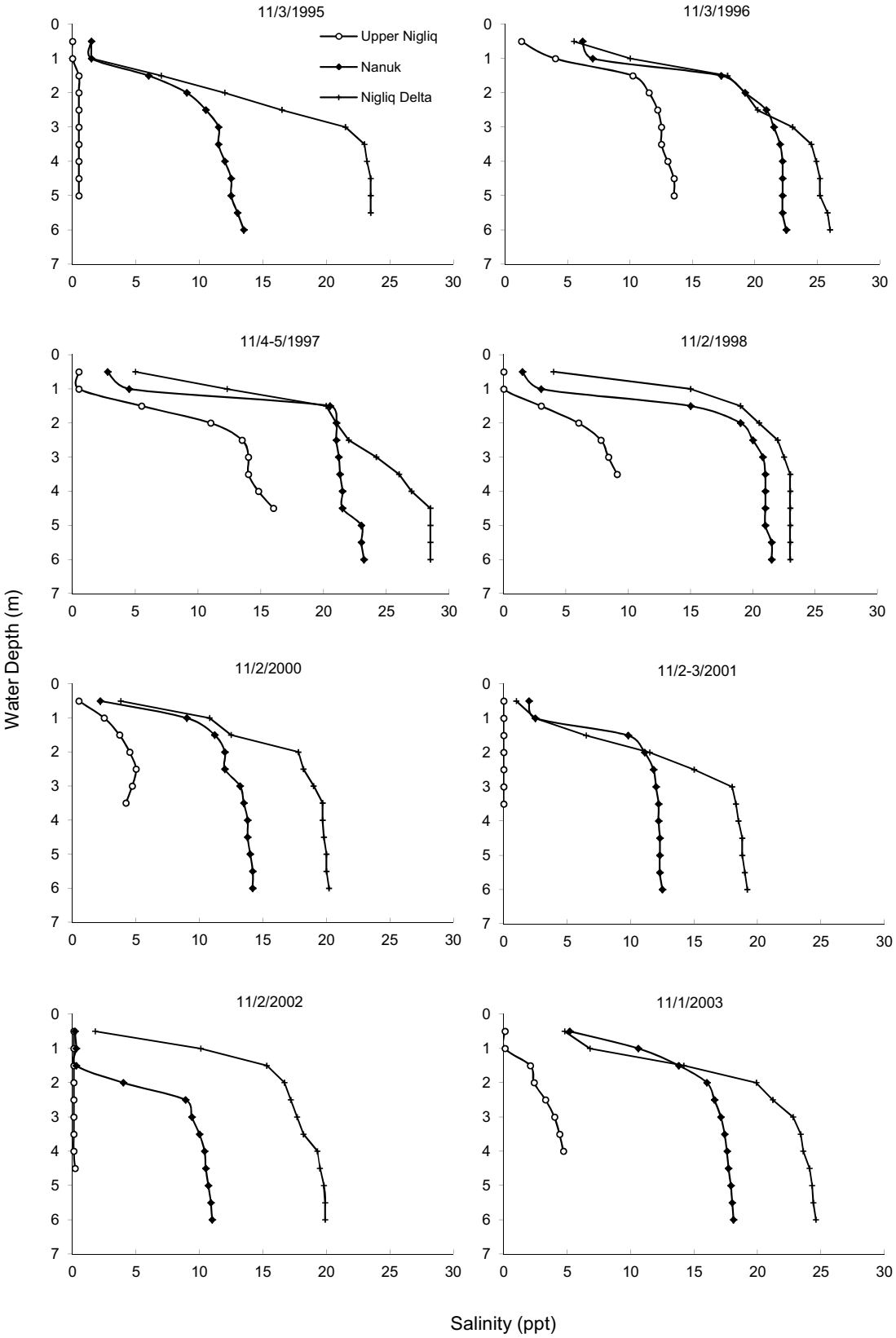


Figure 18b. Water salinity depth profiles in Niġliq Channel fishing areas, early November 1995–2003.

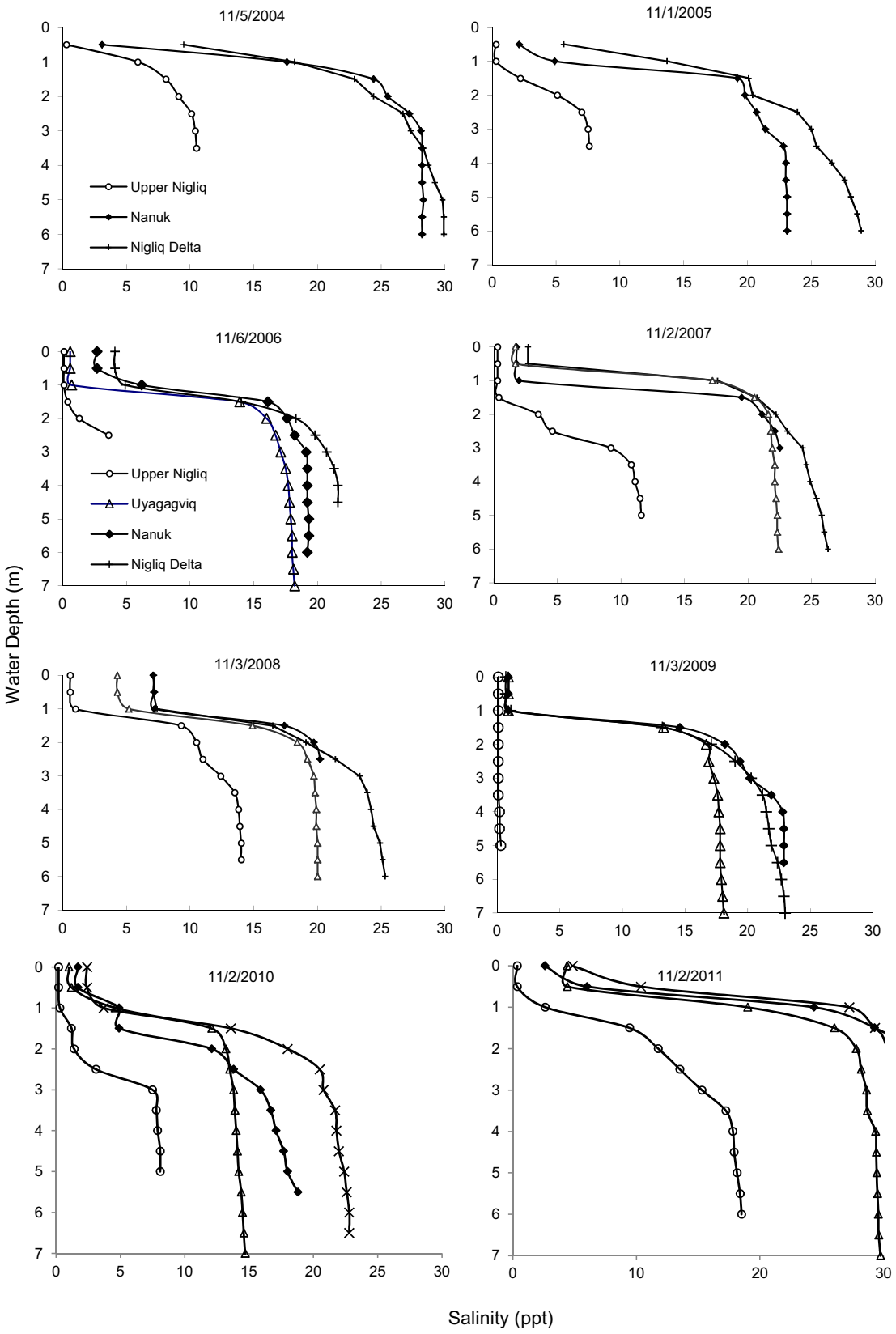


Figure 18c. Water salinity depth profiles in Niġliq Channel fishing areas, early November 2004–2011.

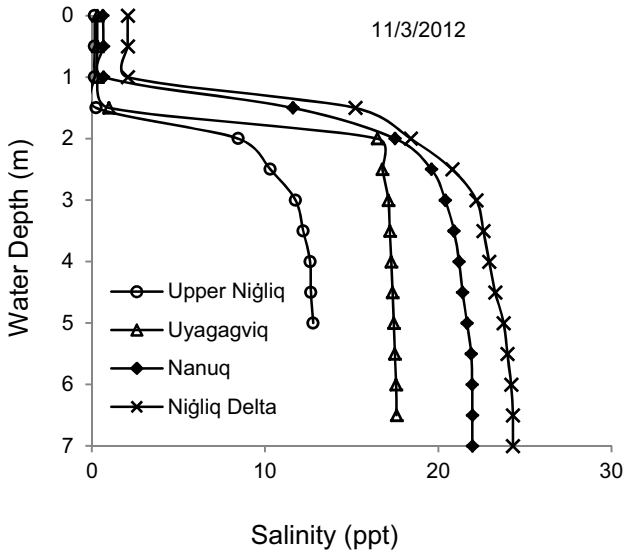


Figure 18d. Water salinity depth profiles in Niġliq Channel fishing areas, early November 2012.

liver tissue from each fish. The results were then compared to a laboratory control sample (PAH inoculated tuna fish). However, an out-of-limit spike in total PAH occurred in the laboratory control sample, thus rendering a proper interpretation of the results of the arctic cisco analysis impossible. This prompted a request by ABR that the laboratory reanalyze the remaining arctic cisco muscle tissue sample for proper interpretation of results. Because no liver sample remained for reanalysis, liver tissue analyses are not included in this report.

Of the 10 PAH analytes tested in arctic cisco muscle tissue samples, only napthalene and anthracene occurred at levels above minimum detection limits (MDL) after reanalysis. Napthalene values ranged from below MDL to 5.3 µg/kg while anthracene values ranged from below MDL to 2.9 µg/kg (Appendix F). These values are less than those found in a 2005 study of broad whitefish muscle tissue collected in Teshekpuk Lake and Joe Creek, but higher than those found in the same study in the Niġliq Channel (Wetzel and Mercurio 2007). Direct comparisons of PAH levels across species (i.e., broad whitefish and arctic cisco) is not recommended because of differential bioaccumulation of persistent organic pollutants. However, the range of napthalene and anthracene values in the arctic cisco tissue was well below established biologically harmful ingestion limits (Long et al. 1995).

DISCUSSION

In 2012, the fall fishery for arctic cisco began on 21 October, the second latest start date ever recorded for this long term monitoring project (Table 1). This late start to the fishery was the result of unseasonably warm temperatures in September and October 2012. These high temperatures persisted throughout October and delayed the formation of ice in the Niġliq Channel of the Colville River. Pockets of unstable ice persisted into early November and forced some fishers to avoid unsafe areas of the river by travelling over-land to preferred fishing locations. Following the commencement of net deployments in the Niġliq and Main Channels, ABR recorded 267 individual harvest events prior to the end of the fishing season in December 2012 (a decrease from 334 in 2011 and 423 in 2010). A total of 49 different nets with 62 distinct sets occurred over the length of the fishing season by twenty-six households. This was well below the effort

recorded in 2011 (70 nets and 89 distinct net sets) and below the long-term average effort in terms of net sets (56 nets) (Figure 3). The slow freeze-up in 2012 undoubtedly contributed to the reduced effort in 2012. After 20 November, fishing effort was indirectly monitored until 17 December via personal communication with several resident fishers. Unlike 2011 when most nets ceased fishing by the date of ABR's departure from Nuiqsut, several fishers continued fishing until 26 November and one fisher continued harvesting arctic cisco adjacent to town until 17 December. The observed fishing effort decreased again in 2012, down from 1,232 adjusted net days 2011 to 847 adjusted net days (Table 2).

In 2011, the number of active nets fishing at any one time reached a maximum of 45 nets by the end of October (Figure 4 *in* Seigle and Gottschalk 2012). However, peak net deployment did not occur until 4 November and did not rise above 27 nets in 2012. Active net deployment leveled off at around 16 nets by the middle of November and remained at that level until nearly the end of the effective fishing season (26 November) (Figure 4). This extended, late-season effort was reminiscent of 2010 when 30 nets were still active late in November due to another late start to the fishery. Likewise, the late start to the fishing season in 2012 played a large role in the high fishing effort so late in November. However, relatively high daily catch rates in the Niġliq Channel likely contributed further to the extended fishing effort in 2012 as fishers attempted to make up for the delayed start to their fishery (Figure 8).

Continuing a trend that has persisted since 1998, the majority of fishing effort occurred in the Niġliq Delta fishing area, followed by the Nanuk area, and then the farthest upstream Upper Niġliq area in 2012 (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. In fact, fishers that historically fished only in the Upper Niġliq or Nunuk areas have begun to place nets further out into the delta in recent years. Still, those fishers who chose to remain in the Nanuk area in 2012 were rewarded with high CPUE results in 2012 (27 fish per adjusted net day in 7.6-cm nets). This implies that there are opportunities for fish to move beyond the downstream nets to overwintering locations in the middle and upper portions of the Niġliq Channel (Table 3).

In the Niġliq Delta area, the CPUE of 31.2 arctic cisco per adjusted net days (7.6-cm mesh nets) was reduced considerably from 2011 (41.8 arctic cisco per adjusted net day) but was still the seventh highest recorded since 1986, well above the historic average of 21.4 fish (Table 3). The 27.2 fish per adjusted net day in the Nanuk area were the highest since 2006 and nearly double the historic average. CPUE has dramatically increased in the Nanuk area since 2010 when only 2.8 fish per adjusted net day were harvested in 7.6-cm mesh nets. The bias in relative fishing effort by residents of Nuiqsut toward the lower end of the Nanuk area as well as the Niġliq Delta area remains well justified and will likely continue so long as ever rising fuel costs do not render the 25–30 mile round trip economically untenable. Fishing effort and harvest in the Upper Niġliq was relatively low in 2012 (86 adjusted net days for all mesh sizes combined). The 3.6 fish per adjusted net day harvested in 7.6-cm nets was well below the historic average (Table 3). However, good harvest results did occur for one individual who was fishing with a small mesh size net (6.4-cm mesh) in this area of the channel (25 fish per adjusted net day). Unfortunately, no fish were measured from this net so it is difficult to determine whether smaller fish were more prevalent in this area of the river or whether the individual fisher had simply picked a good fishing location (Table 4). It should be noted that the bulk of this individual's harvest occurred after the fishery monitoring team had left Nuiqsut.

Limited, early season fishing effort also occurred on the Main Channel of the river for the second year in a row (7% of total adjusted net days for the Colville River) (Figures 1 and 4, Table 4). Traditionally, the Main Channel is fished by overnight campers because its distance from Nuiqsut precludes nets from being checked reliably on a daily or semi-daily basis. In 2012, six nets were deployed in the Main Channel by fishers with the intention of commuting daily to their nets from Nuqisut. However, due to a number of difficulties with fishers' snow mobiles, only a small number of

harvest events were recorded and all fishing effort there had ceased by 4 November. Nonetheless, those who fished the Main Channel were successful, with 7.6-cm mesh net CPUE nearly double that of the Niġliq Channel (52.2 versus 27.7 fish per adjusted net day) (Table 4).

Though CPUE of arctic cisco in 7.6-cm mesh nets deployed in the Colville River was not as high as in 2011, it was still one of the best harvest years on record (Table 3). As in 2011, once stable ice conditions developed and fishing effort commenced in late October of 2012, harvests were perceived as successful by subsistence fishers on the river and this perception was reflected in the data collected by ABR fishery monitors (Figure 7 and 8, Table 4). One likely factor for this success was that salinity levels in the Niġliq Delta and Nanuk fishing areas were optimal for over-wintering arctic cisco from the onset of sampling (15–25 ppt, Figure 17). Conversely, optimal levels of salinity for arctic cisco were not reached in the Upper Niġliq until late November 2012. This could be a factor in low harvests for this area of the river prior to the departure of the monitoring team. The late season arrival of the optimal salinity conditions in the Upper Niġliq likely contributed to the reports of successful fishing by the one individual who continued harvesting until mid-December, well after the monitoring team had departed from Nuiqsut. 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 2012. Peak observed daily CPUEs of arctic cisco occurred from 28 October until 9 November and corresponded with a period in which ideal salinity conditions were present for the upstream migration of arctic cisco in the Niġliq Delta and Nanuk fishing areas (Figures 8 and 17).

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). Therefore, it was not surprising to see the numbers of least cisco harvested in 2012 (particularly in the Nanuk and Upper Niġliq areas) rebound from near historic lows in 2011 (Table 5). Least cisco is traditionally the second-most harvested species during the fall fishery and that was true again in 2012. The late season movement of the salt wedge to the Upper Niġliq area near Nuiqsut likely contributed to this increase in CPUE.

As was the case in 2011, recruitment of young arctic cisco into the fishery probably contributed to the high harvest rates in 2012. 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). With successful annual recruitment of these young-of-the-year arctic cisco, harvest rates in the Colville River were predicted to begin to increase in 2011, and they did. Based on these data associated with young-of-the-year fish and the knowledge that 4 years is the age at which these fish tend to show up in the fishery, ABR anticipated a high percentage of 4-year-old arctic cisco from the 2007 year class to occur in the 2011 harvest in the Colville River. However, the age distribution of fish in 2011 showed that the fishery was dominated by arctic cisco in the 2004–2006 year classes (ages 5–7) (Figure 15 *in* Seigle and Gottschalk 2012). The 2007 year class was largely missing from the fishery in 2011. In 2012, the missing 2007 year class not only appeared but dominated the fishery in all mesh sizes of nets deployed (Figures 13 and 15).

The sudden appearance of the now 5-year-old arctic cisco in the Colville fishery answers some questions that were raised in 2011 about the recruitment success of these fish to the fishery. Still, their strong showing in the fishery in 2012 does not explain where they were overwintering as 4-year-old fish in 2011. In 2011, ABR suggested that a number of factors may contribute to the absence of a particular age class in the fishery. Chance sampling error or mis-ageing seemed unlikely as ABR had three different biologists age fish (Seigle and Gottschalk 2012). ABR speculated that a more likely explanation could be site selective overwintering behavior of various age classes leading to any given year class being present but located in another, unfished part of the Colville River delta or other large North Slope rivers. We also speculated that perhaps the year

class was present but that fish might have been too small to be consistently harvested in 7.6-cm mesh nets in 2011. Whatever the answer, the 2007 year class emerged in 2012 and made up the bulk of harvest composition.

In addition to the surprising appearance of a strong 2007 year class in the 2012 fishery, we were also surprised to see the small contribution of the 2005 year class after such a strong showing in 2011 (Figure 15). In fact, age results indicated that the 2006–2008 year classes were the primary contributors to harvests in 2012. This again raises questions about what happened to the 2004 and 2005 year classes. Perhaps these fish are selecting different areas of the river to overwinter. Another possibility is that they have reached maturity early and migrated back to the Mackenzie River to spawn. Either way, we do not expect to see the 2004 age class in 2013 and the 2005 year class may have moved on as well. It would be interesting to see if the Main Channel is now supporting most of the older age classes due to strong recruitment success in recent years, relegating younger age classes to the relatively smaller Niġliq Channel.

As in previous years, we continue to see a wide range of overlapping fish sizes being captured in each net mesh (Figure 10). Of equal interest is the size distribution at age of fish. arctic cisco continue to show great variability in size at age in the fishery (Figure 14). The size distributions of ages 4–6 arctic cisco were similar, even after accounting for the mesh size in which fish were captured, suggesting that older fish grew more slowly, or the young fish more rapidly, by comparison. Size differences among age classes could be caused by differences among years in the nutrient availability in offshore waters during summer months. The 2007 year class, which dominated the 2012 harvest, apparently experienced high survival and recruited in large numbers to the fishery, and displayed wide variability in size, particularly in 7.6-cm mesh nets (Figure 15). As one might expect from harvests dominated by younger year classes, fish harvested in 2012 also displayed wide variability in size as indicated by length-weight distributions. However, on the whole, these fish were smaller than in recent years (Figures 11 and 12). Still, as was the case in 2011, fishers expressed general satisfaction with the size of arctic cisco despite a younger year class dominating the fishery.

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 (Moulton et al. 2006). Though harvests are down from last year, the 2012 estimated harvest was still high, particularly given the late start to the fishing season (Table 3). Large numbers of young-of-the-year arctic cisco have continued to be captured during summer fyke net surveys near Prudhoe Bay (Larry Moulton, MJM, personal communication 2010) and we are optimistic that Colville River harvests will remain relatively high in the next few years assuming high recruitment into the fishery of 2008–2010 year classes already in the western Beaufort Sea and continued high production of young-of-the-year from the Mackenzie River system. We are just now seeing the 2008 year class in the fishery and expect to see a greater contribution by these fish to the fishery as 5-year-olds in 2013. However, harvest forecasts cannot account for other important and unpredictable variables such as wind, salinity, and natural mortality of younger age classes in any given year (Moulton and Seavey 2004), and the absence of 7 and 8-year-olds in the 2012 harvest remains unexplained. Furthermore, correlation between fyke net CPUE in Prudhoe Bay and subsistence harvests in the Niġliq Channel is associated with uncertainty since much can happen to a year class between ages 1–4 (Moulton et al. 2010).

ABR continues to improve communication with fishers in Nuiqsut through pre- and post-harvest season meetings. In November 2012, ABR met with the community to discuss issues related to the 2011 and 2012 fisheries as well as the forecast for the 2012 fishery and beyond (Appendix A). The *Qaaktaq* Panel will again meet in the spring of 2013 to discuss the fishery results from the 2012 season and to hear their concerns for the fishery moving forward. ABR continued to have success with personal log books which have been distributed to interested fishers. Though not everyone shares data from these logbooks, we believe that fishers are interested in monitoring their own records over time and this can only help the success of the monitoring program going forward. In 2012, ABR continued to receive

important feedback from the *Qaaktaq* Panel and enthusiastic on-ice participation.

Despite two consecutive years of later-than-usual starts to the arctic cisco fishery season, fishers expressed uniform pleasure with the 2012 arctic cisco harvest. Higher-than-average catch rates in the Niġliq Channel allowed fishers to achieve their harvest goals, though they had to fish later in the season than normal to do so. Most fishers expressed that they had harvested enough arctic cisco for their household, gifting, or trade purposes lending further credence to this analysis of harvests in the arctic cisco fall fishery which suggests that 2012 was one of the better seasons on record.

LITERATURE CITED

ABR, Inc.—Environmental Research & Services (ABR); 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. Eds), Special Publication, Can. J. Fish. Aquat. Sci. 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.—Environmental Research & Services, 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.

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 (February 15, 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. Qaaktaq panel meeting notes discussing the 2011 and 2012 fall fishery on the Colville River (5 November 2012).

The *Qaaktaq* Panel, composed of expert fishers involved in the Colville River subsistence harvest near Nuiqsut, met on 5 November 2012 at the KSOPI office in Nuiqsut. The purpose of this meeting was to (1) summarize the 2011 fishing season and to discuss the ongoing (at the time) 2012 fishery, (2) continue to work with active fishers to get their perspective on the ongoing 2012 fall fishery, and (3) collect comments from the panel highlighting their concerns about the fishery to relay to CPAI. John Seigle and John Rose of ABR presented 2011 harvest data results to the panel as well as other individuals who attended to listen in on the discussion. As is common, the panel touched on a variety of topics related to the fishery.

Attendees of this *Qaaktaq* Panel of Nuiqsut residents and fishers meeting were Lydia Sovalik, Dwayne Hopson, Sr., Sam Kunaknana, Frank Oyagak, Jr, Dora Leavitt, Robert Lampe, Thomas Nukapigak, Bruce Nukapigak, Eli Nukapigak, Archie Ahkiviana, Clarence Ahnupkana and Herbert Ipalook; ABR scientists, John Seigle and John Rose; and KSOPI representative, Eunice Brower.

Both during and following the presentation of 2011 results the panel had numerous questions and offered several insights. The panel questioned whether ABR will consider afishing and tagging effort in March. Presumably, the panel is interested in knowing the status of fish during the spring and several have expressed continuing the fishery in March before spring break-up. Mr. Seigle pointed out that it is probably not a goal of the monitoring effort to determine whether residents should fish in the spring. Mr. Seigle also suggested that if residents do fish in the spring, ABR would like to know the results of those efforts if possible.

Mr. Seigle mentioned that there is the potential for a floy tag study in which a small reward would be given to fishers for any fish returned to the monitoring team. He also expressed that he would need approval from the community before he considered tagging fish that would be caught in the fishery. The panel did express approval but Mr. Seigle pointed out that due to the late start to the 2012 season, it was unlikely that any tagging would occur in 2012. A more likely scenario would involve tagging fish at different times of the year.

The panel also asked whether summer studies would be taking place in 2013. ABR does not know if there are plans in the works to monitor summer fisheries in the Colville. The panel asked if near shore or offshore studies fish surveys were being conducted by agencies in the summer of 2013. Mr. Seigle pointed out some of the numerous offshore, nearshore and inland studies that are scheduled for 2013. Several panel members suggested that they would like to see somebody studying food resources important to arctic cisco in marine waters as well as the Colville River.

The panel also expressed an interest in the Mackenzie River and its delta. The conversation turned to their interest (and that of the monitoring team and other researchers) in understanding the connection between Colville River Mackenzie River stocks of arctic cisco. Everyone agreed that further understanding of the life history traits of arctic cisco could benefit their fishery. There was general agreement that the fishery has been successful in recent years. Somebody mentioned that they had observed arctic cisco in lakes in the summer. The suggestion was that perhaps there are spawning stocks of arctic cisco in the region.

The discussion turned to development activities in the Colville Delta, particularly recent exploratory drilling by Repsol. They were particularly concerned about the bridges over the Colville Delta channels. Their major concern is that creating ice bridges over shallow water would hinder fish passage and restrict the ability of fish to feed. They are also worried about offshore gray water dumping and the effect that this activity has on the food web (i.e., food resources for fish). Mr. Seigle mentioned that CPAI and ABR are working together to continue building the long-term database of analyte levels for sediment, water and fish tissues.

The meeting ended with the panel pointing out that it sometimes conducts a small burbot fishing derby in April. They inquired as to whether CPAI would be interested in sponsoring this activity. There was some housekeeping discussion regarding the membership on the panel and it was decided that John Seigle would work with Eunice Brower to update the member list and to determine how membership is handled in the future. Dora Leavitt pointed out that some people who attended are not actual members of the panel. She and others, including Mr. Seigle, would like to streamline communication between ABR, KSOPI and the *Qaaktaq* Panel. As has become the norm in recent years, this meeting was very well attended and enthusiastic.

Appendix B. Logbook

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.

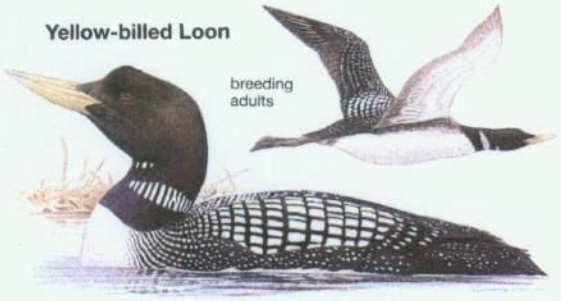
If you need assistance in removing entangled loons from your net please contact staff at the NSB Dept. of Wildlife Management **(907) 852-0350**.

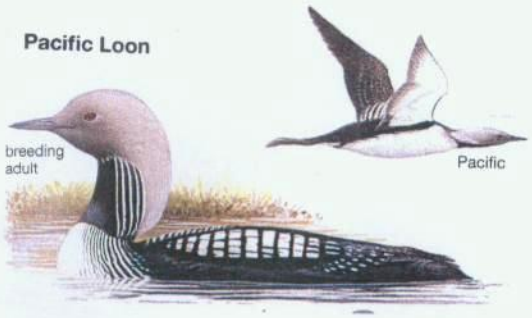
Information you provide on Loon bycatch will help us estimate how many loons are accidentally caught in nets on the North Slope. **All Information you provide us is strictly confidential.**

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, 1976–2012a. 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 2007–2011.

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
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
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
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
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
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
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
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
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
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
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

[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 benthic river bed chemistry results from 2 sampling locations collected on 8 November and 16 November 2012 during the subsistence harvest of arctic cisco in the Niġliq Channel, Colville River.

	11/8/2012	11/16/2012		
Analyte	Water Chemistry Station 1	Water Chemistry Station 3	Detection Limit	ADEC Soil Quality Standards– Arctic Zone Direct Contact[a] (mg/Kg)
Total Solids (%)	66.2	45.2		
Residual Range Organics (mg/Kg)	14.1	478	13.6	13,700[b]
Diesel Range Organics (mg/Kg)	11.4	84	13.6	12,500[b]
Arsenic (mg/Kg)	7.13	7.58	0.667	6.1
Barium (mg/Kg)	306	445	0.202	27,400
Cadmium (mg/Kg)	0.154	0.38	0.133	110
Chromium (mg/Kg)	14.2	18.5	0.258	410
Lead (mg/Kg)	8.5	13.1	0.133	400
Mercury (mg/Kg)	0.0346	0.0851	0.0258	41
Selenium (mg/Kg)	0.527	1.07	0.323	680
Silver (mg/Kg)	0.0591	0.211	0.0667	680
1-Methylnaphthalene (µg/Kg)	11.4	26.1	3.27	380
2-Methylnaphthalene (µg/Kg)	12.4	32.2	3.27	380
Acenaphthene (µg/Kg)	0	0	3.27	3,800
Acenaphthylene (µg/Kg)	0	0	3.27	380
Anthracene (µg/Kg)	0	0	3.27	27,800
Benzo(a)Anthracene (µg/Kg)	0	6.77	3.27	6.6
Benzo[a]pyrene (µg/Kg)	0	7.85	3.27	0.66
Benzo[b]Fluoranthene (µg/Kg)	0	16.7	3.27	6.6
Benzo[g,h,i]perylene (µg/Kg)	0	8.21	3.27	1,900
Benzo[k]fluoranthene (µg/Kg)	0	4.16	3.27	66
Chrysene (µg/Kg)	4.32	19.1	3.27	660
Dibenzo[a,h]anthracene (µg/Kg)	0	4.02	3.27	0.66
Fluoranthene (µg/Kg)	2.95	13.3	3.27	2,500
Fluorene (µg/Kg)	0	5.52	3.27	3,200
Indeno[1,2,3-c,d] pyrene (µg/Kg)	0	5.7	3.27	6.6
Naphthalene (µg/Kg)	6.36	13.8	3.27	1,900
Phenanthrene (µg/Kg)	11.3	34.7	3.27	27,800
Pyrene (µg/Kg)	2.92	15	3.27	1,900

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

Appendix E. Sample chemistry lab reports

SGS North America Inc.
Alaska Division
Level II Laboratory Data Report

Project:	12-162
Client:	ABR, Inc.
SGS Work Order:	1125729

Released by:

Contents:

Client Name: ABR, Inc.
Project Name: 12-162
Workorder No.: 1125729

Sample Comments

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

Lab Sample ID		Sample Type	Client Sample ID
1129339	*	MS	1125742002MS
		8270D SIM - MS/MSD recovery for multiple analytes is outside of QC criteria. Refer to LCS for accuracy. 8270D SIM - Elevated LOQs due to sample dilution. Sample diluted due to dark extract.	
1129340	*	MSD	1125742002MSD
		8270D SIM - MS/MSD recovery for multiple analytes is outside of QC criteria. Refer to LCS for accuracy. 8270D SIM - Elevated LOQs due to sample dilution. Sample diluted due to dark extract.	

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

Report of Manual Integrations

Print Date: 11/30/2012 4:50 pm

Laboratory ID	Client Sample ID	Analytical Batch	Method	Analyte	Reason
1125742002	LABREFQC	XMS7111	8270D SIMS (F	Benzo[b]Fluoranthene	BLC
1125742002	LABREFQC	XMS7111	8270D SIMS (F	Benzo[k]fluoranthene	BLC
1125742002	LABREFQC	XMS7111	8270D SIMS (F	Dibenzo[a,h]anthracene	RP
1129338	LCS for HBN 1398359 [XXX/28477	XMS7111	8270D SIMS (F	Benzo[k]fluoranthene	BLC
1129339	1125742002MS	XMS7111	8270D SIMS (F	Benzo[b]Fluoranthene	BLC
1129339	1125742002MS	XMS7111	8270D SIMS (F	Benzo[k]fluoranthene	SP
1129339	1125742002MS	XMS7111	8270D SIMS (F	Chrysene	BLC
1129340	1125742002MSD	XMS7111	8270D SIMS (F	Benzo[b]Fluoranthene	BLC
1129340	1125742002MSD	XMS7111	8270D SIMS (F	Benzo[k]fluoranthene	RP
1130261	CCV for HBN 1399601 [XMS/7111]	XMS7111	8270D SIMS (F	Benzo[k]fluoranthene	BLC

Manual Integration Reason Code Descriptions

Code	Description
O	Original Chromatogram
M	Modified Chromatogram
SS	Skimmed surrogate
BLG	Closed baseline gap
RP	Reassign peak name
PIR	Pattern integration required
IT	Included tail
SP	Split peak
RSP	Removed split peak
FPS	Forced peak start/stop
BLC	Baseline correction
PNF	Peak not found by software

All DRO/RRO analysis are integrated per SOP.

Laboratory Analytical Report

Client: **ABR, Inc.**
PO Box 240268
Anchorage, AK 99524

Attn: **Joel Gottschalk**
T: (907) 344-6777 F:
jgottschalk@abrinc.com

Project: **12-162**

Workorder No.: **1125729**

Certification:

This data package is in compliance with the terms and conditions of the contract, both technically and for completeness, unless otherwise noted on the sample data sheet(s) and/or case narrative. This certification applies only to the tested parameters and the specific sample(s) received at the laboratory. If you have any questions regarding this report, or if we can be of further assistance, please contact your SGS Project Manager.

Steve Crupi

steven.crupi@sgs.com
Project Manager

Contents (Bookmarked in PDF):

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/ISO 17025 (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
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., 2xDL)
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
RL	Reporting Limit
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.

Client Name: ABR, Inc.
Project Name: 12-162
Workorder No.: 1125729

Analytical Methods

Method Description	Analytical Method
8270 PAH SIM Semi-Volatiles GC/MS	8270D SIMS (PAH)
Diesel/Residual Range Organics	AK102
Diesel/Residual Range Organics	AK103
Percent Solids SM2540G	SM21 2540G
RCRA Metals by ICP-MS	SW6020

Sample ID Cross Reference

Lab Sample ID	Client Sample ID
1125729001	Water_1

Detectable Results Summary

Print Date: 11/30/2012 4:50 pm

Client Sample ID: **Water_1**
SGS Ref. #: 1125729001

Parameter	Result	Units
Metals by ICP/MS		
Arsenic	7.13	mg/Kg
Barium	306	mg/Kg
Cadmium	0.154J	mg/Kg
Chromium	14.2	mg/Kg
Lead	8.50	mg/Kg
Selenium	0.527J	mg/Kg
Silver	0.0591J	mg/Kg
Mercury	0.0346J	mg/Kg
Semivolatile Organic Fuels Department		
Diesel Range Organics	11.4J	mg/Kg
Residual Range Organics	14.1J	mg/Kg
Polynuclear Aromatics GC/MS		
Naphthalene	6.36J	ug/Kg
2-Methylnaphthalene	12.4	ug/Kg
1-Methylnaphthalene	11.4	ug/Kg
Phenanthrene	11.3	ug/Kg
Fluoranthene	2.95J	ug/Kg
Pyrene	2.92J	ug/Kg
Chrysene	4.32J	ug/Kg

Client Sample ID: **Water_1**
SGS Ref. #: 1125729001
Project ID: 12-162
Matrix: Soil/Solid (dry weight)
Percent Solids: 66.2

Collection Date/Time: 11/08/12 15:00
Receipt Date/Time: 11/16/12 14:30

Metals by ICP/MS

Parameter	Result	LOQ/CL	DL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Arsenic	7.13	1.28	0.398	mg/Kg	10	MMS7782	MXX26141	
Barium	306	0.385	0.121	mg/Kg	10	MMS7782	MXX26141	
Cadmium	0.154J	0.257	0.0796	mg/Kg	10	MMS7782	MXX26141	
Chromium	14.2	0.514	0.154	mg/Kg	10	MMS7782	MXX26141	
Lead	8.50	0.257	0.0796	mg/Kg	10	MMS7782	MXX26141	
Mercury	0.0346J	0.0514	0.0154	mg/Kg	10	MMS7782	MXX26141	
Selenium	0.527J	0.642	0.193	mg/Kg	10	MMS7782	MXX26141	
Silver	0.0591J	0.128	0.0398	mg/Kg	10	MMS7782	MXX26141	

Batch Information

Analytical Batch: MMS7782
Analytical Method: SW6020
Analysis Date/Time: 11/26/12 13:20
Dilution Factor: 10

Prep Batch: MXX26141
Prep Method: SW3050B
Prep Date/Time: 11/20/12 10:35

Initial Prep Wt./Vol.: 1.176 g
Prep Extract Vol.: 50 mL
Container ID:1125729001-A
Analyst: SCL

Client Sample ID: **Water_1**
SGS Ref. #: 1125729001
Project ID: 12-162
Matrix: Soil/Solid (dry weight)
Percent Solids: 66.2

Collection Date/Time: 11/08/12 15:00
Receipt Date/Time: 11/16/12 14:30

Semivolatile Organic Fuels Department

Parameter	Result	LOQ/CL	DL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Diesel Range Organics	11.4J	30.0	9.30	mg/Kg	1	XFC10734	XXX28476	
Residual Range Organics	14.1J	30.0	9.30	mg/Kg	1	XFC10734	XXX28476	
5a Androstane <surr>	100	50-150		%	1	XFC10734	XXX28476	
n-Triacontane-d62 <surr>	108	50-150		%	1	XFC10734	XXX28476	

Batch Information

Analytical Batch: XFC10734
Analytical Method: AK102
Analysis Date/Time: 11/21/12 14:29
Dilution Factor: 1
Prep Batch: XXX28476
Prep Method: SW3550C
Prep Date/Time: 11/20/12 08:20
Initial Prep Wt./Vol.: 30.207 g
Prep Extract Vol.: 1 mL
Container ID:1125729001-A
Analyst: MEM

Analytical Batch: XFC10734
Analytical Method: AK103
Analysis Date/Time: 11/21/12 14:29
Dilution Factor: 1
Prep Batch: XXX28476
Prep Method: SW3550C
Prep Date/Time: 11/20/12 08:20
Initial Prep Wt./Vol.: 30.207 g
Prep Extract Vol.: 1 mL
Container ID:1125729001-A
Analyst: MEM

Client Sample ID: **Water_1**
SGS Ref. #: 1125729001
Project ID: 12-162
Matrix: Soil/Solid (dry weight)
Percent Solids: 66.2

Collection Date/Time: 11/08/12 15:00
Receipt Date/Time: 11/16/12 14:30

Polynuclear Aromatics GC/MS

Parameter	Result	LOQ/CL	DL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
1-Methylnaphthalene	11.4	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
2-Methylnaphthalene	12.4	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Acenaphthene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Acenaphthylene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Anthracene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Benzo(a)Anthracene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Benzo[a]pyrene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Benzo[b]Fluoranthene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Benzo[g,h,i]perylene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Benzo[k]fluoranthene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Chrysene	4.32J	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Dibenzo[a,h]anthracene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Fluoranthene	2.95J	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Fluorene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Indeno[1,2,3-c,d] pyrene	4.50 U	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Naphthalene	6.36J	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Phenanthrene	11.3	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
Pyrene	2.92J	7.52	2.25	ug/Kg	1	XMS7111	XXX28477	
2-Fluorobiphenyl <surr>	72	45-105		%	1	XMS7111	XXX28477	
Terphenyl-d14 <surr>	89.9	30-125		%	1	XMS7111	XXX28477	

Batch Information

Analytical Batch: XMS7111
Analytical Method: 8270D SIMS (PAH)
Analysis Date/Time: 11/26/12 16:54
Dilution Factor: 1

Prep Batch: XXX28477
Prep Method: SW3550C
Prep Date/Time: 11/20/12 13:00

Initial Prep Wt./Vol.: 22.599 g
Prep Extract Vol.: 1 mL
Container ID:1125729001-A
Analyst: RTS

Client Sample ID: **Water_1**
SGS Ref. #: 1125729001
Project ID: 12-162
Matrix: Soil/Solid (dry weight)
Percent Solids: 66.2

Collection Date/Time: 11/08/12 15:00
Receipt Date/Time: 11/16/12 14:30

Solids

Parameter	Result	LOQ/CL	DL	Units	DF	Analytical Batch	Prep Batch	Qualifiers
Total Solids	66.2			%	1	SPT8866		

Batch Information

Analytical Batch: SPT8866
Analytical Method: SM21 2540G
Analysis Date/Time: 11/20/12 17:40
Dilution Factor: 1

Initial Prep Wt./Vol.: 1 mL
Container ID:1125729001-A
Analyst: CNP

SGS Ref.#	1129291	Method Blank	**Printed Date/Time**	11/30/2012 16:50
Client Name	ABR, Inc.		**Prep Batch**	XXX28476
Project Name/#	12-162		**Method**	SW3550C
Matrix	Soil/Solid (dry weight)		**Date**	11/20/2012

QC results affect the following production samples:

1125729001

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Semivolatile Organic Fuels Department					
Diesel Range Organics	12.4 U	20.0	6.20	mg/Kg	11/21/12
Surrogates					
5a Androstane <surr>	95.4	60-120		%	11/21/12
Batch XFC10734					
Method AK102					
Instrument HP 6890 Series II FID SV D F					
Residual Range Organics	12.4 U	20.0	6.20	mg/Kg	11/21/12
Surrogates					
n-Triacontane-d62 <surr>	103	60-120		%	11/21/12
Batch XFC10734					
Method AK103					
Instrument HP 6890 Series II FID SV D F					

SGS Ref.#	1129337	Method Blank	**Printed Date/Time**	11/30/2012 16:50
Client Name	ABR, Inc.		**Prep Batch**	XXX28477
Project Name/#	12-162		**Method**	SW3550C
Matrix	Soil/Solid (dry weight)		**Date**	11/20/2012

QC results affect the following production samples:

1125729001

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Polynuclear Aromatics GC/MS					
1-Methylnaphthalene	3.00 U	5.00	1.50	ug/Kg	11/26/12
2-Methylnaphthalene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Acenaphthene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Acenaphthylene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Anthracene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Benzo(a)Anthracene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Benzo[a]pyrene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Benzo[b]Fluoranthene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Benzo[g,h,i]perylene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Benzo[k]fluoranthene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Chrysene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Dibenzo[a,h]anthracene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Fluoranthene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Fluorene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Indeno[1,2,3-c,d] pyrene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Naphthalene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Phenanthrene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Pyrene	3.00 U	5.00	1.50	ug/Kg	11/26/12
Surrogates					
2-Fluorobiphenyl <surr>	75.5	45-105		%	11/26/12
Terphenyl-d14 <surr>	104	30-125		%	11/26/12

Batch XMS7111
Method 8270D SIMS (PAH)
Instrument HP 6890/5973 MS SVQA

SGS Ref.#	1129437	Method Blank	**Printed Date/Time**	11/30/2012 16:50
Client Name	ABR, Inc.		**Prep Batch**	MXX26141
Project Name/#	12-162		**Method**	SW3050B
Matrix	Soil/Solid (dry weight)		**Date**	11/20/2012

QC results affect the following production samples:

1125729001

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Metals by ICP/MS					
Arsenic	0.620 U	1.00	0.310	mg/Kg	11/26/12
Barium	0.188 U	0.300	0.0940	mg/Kg	11/26/12
Cadmium	0.124 U	0.200	0.0620	mg/Kg	11/26/12
Chromium	0.240 U	0.400	0.120	mg/Kg	11/26/12
Lead	0.124 U	0.200	0.0620	mg/Kg	11/26/12
Mercury	0.0240 U	0.0400	0.0120	mg/Kg	11/26/12
Selenium	0.300 U	0.500	0.150	mg/Kg	11/26/12
Silver	0.0620 U	0.100	0.0310	mg/Kg	11/26/12

Batch MMS7782
Method SW6020
Instrument Perkin Elmer Sciex ICP-MS P3

SGS Ref.#	1129612	Method Blank	**Printed Date/Time**	11/30/2012	16:50
Client Name	ABR, Inc.		**Prep Batch**		
Project Name/#	12-162		**Method**		
Matrix	Soil/Solid (dry weight)		**Date**		

QC results affect the following production samples:

1125729001

Parameter	Results	LOQ/CL	DL	Units	Analysis Date
Solids					
Total Solids	100			%	11/20/12
Batch SPT8866					
Method SM21 2540G					
Instrument					

SGS Ref.#	1129613	Duplicate	**Printed Date/Time**	11/30/2012 16:50
Client Name	ABR, Inc.		**Prep Batch**	
Project Name/#	12-162		**Method**	
Original	1125751001		**Date**	
Matrix	Soil/Solid (dry weight)			

QC results affect the following production samples:

1125729001

Parameter	Original Result	QC Result	Units	RPD	RPD Limits	Analysis Date
Solids						
Total Solids	96.9	96.9	%	0	(< 15)	11/20/2012
Batch SPT8866						
Method SM21 2540G						
Instrument						

SGS Ref.#	1129292	Lab Control Sample	**Printed Date/Time**	11/30/2012	16:50
	1129293	Lab Control Sample Duplicate	**Prep Batch**	XXX28476	
Client Name	ABR, Inc.		**Method**	SW3550C	
Project Name/#	12-162		**Date**	11/20/2012	
Matrix	Soil/Solid (dry weight)				

QC results affect the following production samples:

1125729001

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Semivolatile Organic Fuels Department								
Diesel Range Organics	LCS	155	93	(75-125)			167 mg/Kg	11/21/2012
	LCSD	178	107		13	(< 20)	167 mg/Kg	11/21/2012
Surrogates								
5a Androstane <surr>	LCS		92	(60-120)				11/21/2012
	LCSD		106		15			11/21/2012
Batch	XFC10734							
Method	AK102							
Instrument	HP 6890 Series II FID SV D F							
Residual Range Organics	LCS	154	92	(60-120)			167 mg/Kg	11/21/2012
	LCSD	179	107		15	(< 20)	167 mg/Kg	11/21/2012
Surrogates								
n-Triacontane-d62 <surr>	LCS		91	(60-120)				11/21/2012
	LCSD		106		16			11/21/2012
Batch	XFC10734							
Method	AK103							
Instrument	HP 6890 Series II FID SV D F							

SGS Ref.#	1129338 Lab Control Sample	**Printed Date/Time**		11/30/2012	16:50
		Prep	**Batch**	XXX28477	
Client Name	ABR, Inc.		**Method**	SW3550C	
Project Name/#	12-162		**Date**	11/20/2012	
Matrix	Soil/Solid (dry weight)				

QC results affect the following production samples:

1125729001

Parameter	QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date

Polynuclear Aromatics GC/MS

SGS Ref.#	1129338 Lab Control Sample		**Printed Date/Time**	11/30/2012	16:50
			Prep Batch	XXX28477	
Client Name	ABR, Inc.		**Method**	SW3550C	
Project Name/#	12-162		**Date**	11/20/2012	
Matrix	Soil/Solid (dry weight)				

Parameter		QC Results	Pct Recov		LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Polynuclear Aromatics GC/MS									
1-Methylnaphthalene	LCS	17.4	78		(44-107)			22.2 ug/Kg	11/26/2012
2-Methylnaphthalene	LCS	13.1	59		(45-105)			22.2 ug/Kg	11/26/2012
Acenaphthene	LCS	16.0	72		(45-110)			22.2 ug/Kg	11/26/2012
Acenaphthylene	LCS	15.4	69		(45-105)			22.2 ug/Kg	11/26/2012
Anthracene	LCS	17.9	81		(55-105)			22.2 ug/Kg	11/26/2012
Benzo(a)Anthracene	LCS	15.2	68		(50-110)			22.2 ug/Kg	11/26/2012
Benzo[a]pyrene	LCS	11.0	50	*	(50-110)			22.2 ug/Kg	11/26/2012
Benzo[b]Fluoranthene	LCS	14.6	66		(45-115)			22.2 ug/Kg	11/26/2012
Benzo[g,h,i]perylene	LCS	20.2	91		(40-125)			22.2 ug/Kg	11/26/2012
Benzo[k]fluoranthene	LCS	26.3	118		(45-125)			22.2 ug/Kg	11/26/2012
Chrysene	LCS	23.1	104		(55-110)			22.2 ug/Kg	11/26/2012
Dibenzo[a,h]anthracene	LCS	19.8	89		(40-125)			22.2 ug/Kg	11/26/2012
Fluoranthene	LCS	22.5	101		(55-115)			22.2 ug/Kg	11/26/2012
Fluorene	LCS	16.6	75		(50-110)			22.2 ug/Kg	11/26/2012
Indeno[1,2,3-c,d] pyrene	LCS	19.1	86		(40-120)			22.2 ug/Kg	11/26/2012
Naphthalene	LCS	15.0	68		(40-105)			22.2 ug/Kg	11/26/2012
Phenanthrene	LCS	15.2	69		(50-110)			22.2 ug/Kg	11/26/2012
Pyrene	LCS	21.6	97		(45-125)			22.2 ug/Kg	11/26/2012
Surrogates									
2-Fluorobiphenyl <surr>	LCS		73		(45-105)				11/26/2012
Terphenyl-d14 <surr>	LCS		96		(30-125)				11/26/2012

SGS Ref.#	1129338 Lab Control Sample	**Printed Date/Time**		11/30/2012	16:50
		Prep	**Batch**	XXX28477	
Client Name	ABR, Inc.		**Method**	SW3550C	
Project Name/#	12-162		**Date**	11/20/2012	
Matrix	Soil/Solid (dry weight)				

Parameter	QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date

Polynuclear Aromatics GC/MS

Batch	XMS7111
Method	8270D SIMS (PAH)
Instrument	HP 6890/5973 MS SVQA

SGS Ref.#	1129438 Lab Control Sample		**Printed Date/Time**	11/30/2012	16:50
			Prep Batch	MXX26141	
Client Name	ABR, Inc.		**Method**	SW3050B	
Project Name/#	12-162		**Date**	11/20/2012	
Matrix	Soil/Solid (dry weight)				

QC results affect the following production samples:

1125729001

Parameter		QC Results	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Metals by ICP/MS								
Arsenic	LCS	54.0	108	(80-120)			50 mg/Kg	11/26/2012
Barium	LCS	54.8	110	(80-120)			50 mg/Kg	11/26/2012
Cadmium	LCS	5.88	118	(80-120)			5 mg/Kg	11/26/2012
Chromium	LCS	22.7	114	(80-120)			20 mg/Kg	11/26/2012
Lead	LCS	57.1	114	(80-120)			50 mg/Kg	11/26/2012
Mercury	LCS	0.596	119	(80-120)			0.5 mg/Kg	11/26/2012
Selenium	LCS	55.8	112	(80-120)			50 mg/Kg	11/26/2012
Silver	LCS	5.39	108	(80-120)			5 mg/Kg	11/26/2012

Batch MMS7782
Method SW6020
Instrument Perkin Elmer Sciex ICP-MS P3

SGS Ref.#	1129339	Matrix Spike	**Printed Date/Time**		11/30/2012 16:50
	1129340	Matrix Spike Duplicate	**Prep**	**Batch**	XXX28477
				Method	Sonication Extraction Soil 8270
				Date	11/20/2012
Original	1125742002				
Matrix	Soil/Solid (dry weight)				

QC results affect the following production samples:

1125729001

Parameter	Qualifiers		Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Polynuclear Aromatics GC/MS											
1-Methylnaphthalene	MS	(17.9) U		20.7	79	(44-107)			26.2	ug/Kg	11/26/2012
	MSD			23.7	90		14	(< 30)	26.4	ug/Kg	11/26/2012
2-Methylnaphthalene	MS	(17.9) U		14.1	54	(45-105)			26.2	ug/Kg	11/26/2012
	MSD			14.9	56		6	(< 30)	26.4	ug/Kg	11/26/2012
Acenaphthene	MS	(17.9) U		21.6	82	(45-110)			26.2	ug/Kg	11/26/2012
	MSD			23.4	89		8	(< 30)	26.4	ug/Kg	11/26/2012
Acenaphthylene	MS	(17.9) U		19.7	75	(45-105)			26.2	ug/Kg	11/26/2012
	MSD			23.2	87		16	(< 30)	26.4	ug/Kg	11/26/2012
Anthracene	MS	(17.9) U		31.3	120*	(55-105)			26.2	ug/Kg	11/26/2012
	MSD			29.7	112*		5	(< 30)	26.4	ug/Kg	11/26/2012
Benzo(a)Anthracene	MS	43.4		61.9	71	(50-110)			26.2	ug/Kg	11/26/2012
	MSD			62.4	72		1	(< 30)	26.4	ug/Kg	11/26/2012
Benzo[a]pyrene	MS	71.2		81.4	39*	(50-110)			26.2	ug/Kg	11/26/2012
	MSD			81.5	39*		0	(< 30)	26.4	ug/Kg	11/26/2012
Benzo[b]Fluoranthene	MS	113		112	-1*	(45-115)			26.2	ug/Kg	11/26/2012
	MSD			112	-2*		0	(< 30)	26.4	ug/Kg	11/26/2012
Benzo[g,h,i]perylene	MS	63.4		76.7	51	(40-125)			26.2	ug/Kg	11/26/2012
	MSD			80.5	65		5	(< 30)	26.4	ug/Kg	11/26/2012
Benzo[k]fluoranthene	MS	40.1		65.5	97	(45-125)			26.2	ug/Kg	11/26/2012
	MSD			70.8	116		8	(< 30)	26.4	ug/Kg	11/26/2012
Chrysene	MS	93.2		106	48*	(55-110)			26.2	ug/Kg	11/26/2012
	MSD			114	79		8	(< 30)	26.4	ug/Kg	11/26/2012
Dibenzo[a,h]anthracene	MS	14.4J		33.5	73	(40-125)			26.2	ug/Kg	11/26/2012
	MSD			36.3	83		8	(< 30)	26.4	ug/Kg	11/26/2012
Fluoranthene	MS	100		106	21*	(55-115)			26.2	ug/Kg	11/26/2012
	MSD			114	53*		8	(< 30)	26.4	ug/Kg	11/26/2012
Fluorene	MS	(17.9) U		19.5	74	(50-110)			26.2	ug/Kg	11/26/2012
	MSD			20.8	79		7	(< 30)	26.4	ug/Kg	11/26/2012
Indeno[1,2,3-c,d] pyrene	MS	56.1		68.1	46	(40-120)			26.2	ug/Kg	11/26/2012
	MSD			75.0	72		10	(< 30)	26.4	ug/Kg	11/26/2012
Naphthalene	MS	(17.9) U		16.6	63	(40-105)			26.2	ug/Kg	11/26/2012
	MSD			19.8	75		18	(< 30)	26.4	ug/Kg	11/26/2012
Phenanthrene	MS	46.0		36.0	-38*	(50-110)			26.2	ug/Kg	11/26/2012
	MSD			38.4	-29*		6	(< 30)	26.4	ug/Kg	11/26/2012
Pyrene	MS	102		109	29*	(45-125)			26.2	ug/Kg	11/26/2012
	MSD			113	41*		3	(< 30)	26.4	ug/Kg	11/26/2012

Surrogates

SGS Ref.#	1129339	Matrix Spike	**Printed Date/Time**	11/30/2012 16:50
	1129340	Matrix Spike Duplicate	**Prep Batch**	XXX28477
			Method	Sonication Extraction Soil 8270
			Date	11/20/2012
Original	1125742002			
Matrix	Soil/Solid (dry weight)			

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount	Analysis Date
Polynuclear Aromatics GC/MS									
2-Fluorobiphenyl <surr>	MS		19.0	73	(45-105)				11/26/2012
	MSD		21.1	80		10			11/26/2012
Terphenyl-d14 <surr>	MS		21.3	81	(30-125)				11/26/2012
	MSD		27.4	103		25			11/26/2012

Batch XMS7111
Method 8270D SIMS (PAH)
Instrument HP 6890/5973 MS SVQA

SGS Ref.#	1129439	Bench Spike DIGESTED	**Printed Date/Time**	11/30/2012 16:50
			Prep Batch	MXX26141
			Method	Soils/Solids Digest for Metals b
			Date	11/20/2012
Original	1125739002			
Matrix	Soil/Solid (dry weight)			

QC results affect the following production samples:

1125729001

Parameter	Qualifiers	Original Result	QC Result	Pct Recov	MS/MSD Limits	RPD	RPD Limits	Spiked Amount		Analysis Date
Metals by ICP/MS										
Cadmium	BND	0.0807J	152	105	(75-125)			144	mg/Kg	11/26/2012

Batch MMS7782
Method SW6020
Instrument Perkin Elmer Sciex ICP-MS P3

SGS

SGS NORTH AMERICA INC.
CHAIN OF CUSTODY RECORD

ANN 1125729

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

Page 1 of 1

1

CLIENT: ABR, Inc.

CONTACT: Joel G. PHONE NO:

PROJECT NAME: 12-162 PROJECT/ PWSID/ PERMIT#:

REPORTS TO: Joel @ ABR E-MAIL:

INVOICE TO: Same QUOTE #: P.O. #:

2

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX/ MATRIX CODE	# CONTAINERS	Preservative Used:	TYPE C = COMP G = GRAB Mi = Multi Incremental Soils	3 DRO/RRO	PAHs 1M	RCRA Mtls	REMARKS/ LOC ID
1	Water_1	11/8/12	1500	SD	1	G		✓	✓	✓	

5

	Relinquished By:	Date	Time	Received By:
(1)		11/16/12	1430	
(2)				
(3)				
(4)		11/16/12	1430	Received For Laboratory By: Autumn R Cuyn

4

DOD Project? YES (NO)

Cooler ID: _____

Data Deliverable Requirements: L2 + DV

Requested Turnaround Time and-or Special Instructions:

Std.

Temp Blank °C: _____

or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle)

INTACT BROKEN ABSENT

(See attached Sample Receipt Form)

SGS-00082 (6/12)

[ ] 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

SGS

1125729

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	
Temperature blank compliant* (i.e., 0-6°C after correction factor)? * ***Note: Exemption permitted for chilled samples collected less than 8 hours ago.*** Cooler ID: _____ @ _____ w/ Therm.ID: _____ 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 <u>without</u> 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 <u>nor</u> 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)	Frozen Soil.
Delivery method (specify all that apply): (Client) USPS Alert Courier Road Runner 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: (N/A) → For samples **received in FBKS**, ANCH staff will verify all criteria are reviewed. SRF Initiated by: (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 which case, use times on COC.*** Were analyses requested unambiguous?	(Yes) No N/A (Yes) No N/A (Yes) No N/A	
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	
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)	
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** or **site-specific QC** (e.g., BMS/BMSD/BDUP) samples, were the COC & bottles flagged (e.g., stickers) accordingly? For RUSH/SHORT HT, was email sent?	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: PM = N/A
Was **PEER REVIEW** of ***sample numbering/labeling completed?***	Yes No (N/A)	Peer Reviewed by: N/A
Additional notes (if applicable):		

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

Laboratory Report of Analysis

To: ConocoPhillips AK-Anch
PO Box 240268
Anchorage, AK 99524
(907)344-9777

Report Number: **1125855**

Client Project: **12-162**

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 thirty (30) days from the date of this report unless other arrangements are requested.

If there are any questions about the report or services performed during this project, please call Justin 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.

Justin Nelson Date
Project Manager

Corrected Report: This report has been reissued to change the client from ABR, Inc. to ConocoPhillips Company - Anchorage.

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

SGS North America Inc.

Case Narrative

Customer: ARCOANP **ConocoPhillips AK-Anch**

Project: 1125855 **12-162**

NPDL WO:

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

1125855001 PS **Water_1**

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

AK102/103 - Sample was received with insufficient time remaining to meet the 14 day hold time for DRO/RRO extraction.

8270D SIM - Sample was received with insufficient time remaining to meet the 14 day hold time for PAH extraction.

1130833 MS **1125834001MS)**

6020 - Metals - MS recovery for barium was outside of acceptance criteria. Post digestion spike was successful.

1130834 MSD **1125834001MSD)**

6020 - Metals - MSD recoveries for lead and mercury were outside of acceptance criteria. Post digestion spike was successful.

1131037 MS **1125899001MS**

8270D SIM - MS/MSD recoveries for naphthalene, 1-methylnaphthalene and 2-methylnaphthalene are outside of QC criteria. Refer to LCS for accuracy.

1131038 MSD **1125899001MSD**

8270D SIM - MS/MSD RPDs for multiple analytes do not meet QC criteria.

8270D SIM - MS/MSD recoveries for naphthalene, 1-methylnaphthalene and 2-methylnaphthalene are outside of QC criteria. Refer to LCS for accuracy.

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

Report of Manual Integrations

Laboratory ID	Client Sample ID	Analytical Batch	Analyte	Reason
8270D SIMS (PAH)				
1125855001	Water_1	XMS7129	Benzo[k]fluoranthene	RP

Manual Integration Reason Code Descriptions

Code	Description
O	Original Chromatogram
M	Modified Chromatogram
SS	Skimmed surrogate
BLG	Closed baseline gap
RP	Reassign peak name
PIR	Pattern integration required
IT	Included tail
SP	Split peak
RSP	Removed split peak
FPS	Forced peak start/stop
BLC	Baseline correction
PNF	Peak not found by software

All DRO/RRO analysis are integrated per SOP.

Print Date: 12/26/2012 1:18:05PM

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
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., 2xDL)
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
RL	Reporting Limit
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
Water_1	1125855001	11/16/2012	11/30/2012	Soil/Solid (dry weight)

Method	Method Description
8270D SIMS (PAH)	8270 PAH SIM Semi-Volatiles GC/MS
AK102	Diesel/Residual Range Organics
AK103	Diesel/Residual Range Organics
SM21 2540G	Percent Solids SM2540G
SW6020	RCRA Metals by ICP-MS

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

Detectable Results Summary

Client Sample ID: **Water_1**
Lab Sample ID: 1125855001

	Parameter	Result	Units
Metals by ICP/MS	Arsenic	7.58	mg/Kg
	Barium	445	mg/Kg
	Cadmium	0.380J	mg/Kg
	Chromium	18.5	mg/Kg
	Lead	13.1	mg/Kg
	Mercury	0.0851J	mg/Kg
	Selenium	1.07J	mg/Kg
	Silver	0.211J	mg/Kg
Polynuclear Aromatics GC/MS	1-Methylnaphthalene	26.1	ug/Kg
	2-Methylnaphthalene	32.2	ug/Kg
	Benzo(a)Anthracene	6.77J	ug/Kg
	Benzo[a]pyrene	7.85J	ug/Kg
	Benzo[b]Fluoranthene	16.7	ug/Kg
	Benzo[g,h,i]perylene	8.21J	ug/Kg
	Benzo[k]fluoranthene	4.16J	ug/Kg
	Chrysene	19.1	ug/Kg
	Dibenzo[a,h]anthracene	4.02J	ug/Kg
	Fluoranthene	13.3	ug/Kg
	Fluorene	5.52J	ug/Kg
	Indeno[1,2,3-c,d] pyrene	5.70J	ug/Kg
	Naphthalene	13.8	ug/Kg
	Phenanthrene	34.7	ug/Kg
	Pyrene	15.0	ug/Kg
Semivolatile Organic Fuels	Diesel Range Organics	84.0	mg/Kg
	Residual Range Organics	478	mg/Kg

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

Results of **Water_1**

Client Sample ID: **Water_1**
Client Project ID: **12-162**
Lab Sample ID: 1125855001
Lab Project ID: 1125855

Collection Date: 11/16/12 12:00
Received Date: 11/30/12 10:15
Matrix: Soil/Solid (dry weight)
Solids (%): 45.2

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Date Analyzed
Arsenic	7.58		2.15	0.667	mg/Kg	10	12/03/12 17:08
Barium	445		0.645	0.202	mg/Kg	10	12/03/12 17:08
Cadmium	0.380	J	0.430	0.133	mg/Kg	10	12/03/12 17:08
Chromium	18.5		0.860	0.258	mg/Kg	10	12/03/12 17:08
Lead	13.1		0.430	0.133	mg/Kg	10	12/03/12 17:08
Mercury	0.0851	J	0.0860	0.0258	mg/Kg	10	12/03/12 17:08
Selenium	1.07	J	1.08	0.323	mg/Kg	10	12/03/12 17:08
Silver	0.211	J	0.215	0.0667	mg/Kg	10	12/03/12 17:08

Batch Information

Analytical Batch: MMS7790
Analytical Method: SW6020
Analyst: ACF
Analytical Date/Time: 12/03/12 17:08
Container ID: 1125855001-A

Prep Batch: MXX26169
Prep Method: SW3050B
Prep Date/Time: 12/03/12 11:45
Prep Initial Wt./Vol.: 1.029 g
Prep Extract Vol: 50 mL

Print Date: 12/26/2012 1:18:07PM

Results of **Water_1**

Client Sample ID: **Water_1**
Client Project ID: **12-162**
Lab Sample ID: 1125855001
Lab Project ID: 1125855

Collection Date: 11/16/12 12:00
Received Date: 11/30/12 10:15
Matrix: Soil/Solid (dry weight)
Solids (%): 45.2

Results by **Polynuclear Aromatics GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Date Analyzed
1-Methylnaphthalene	26.1		10.9	3.27	ug/Kg	1	12/06/12 14:31
2-Methylnaphthalene	32.2		10.9	3.27	ug/Kg	1	12/06/12 14:31
Acenaphthene	6.54	U	10.9	3.27	ug/Kg	1	12/06/12 14:31
Acenaphthylene	6.54	U	10.9	3.27	ug/Kg	1	12/06/12 14:31
Anthracene	6.54	U	10.9	3.27	ug/Kg	1	12/06/12 14:31
Benzo(a)Anthracene	6.77	J	10.9	3.27	ug/Kg	1	12/06/12 14:31
Benzo[a]pyrene	7.85	J	10.9	3.27	ug/Kg	1	12/06/12 14:31
Benzo[b]Fluoranthene	16.7		10.9	3.27	ug/Kg	1	12/06/12 14:31
Benzo[g,h,i]perylene	8.21	J	10.9	3.27	ug/Kg	1	12/06/12 14:31
Benzo[k]fluoranthene	4.16	J	10.9	3.27	ug/Kg	1	12/06/12 14:31
Chrysene	19.1		10.9	3.27	ug/Kg	1	12/06/12 14:31
Dibenzo[a,h]anthracene	4.02	J	10.9	3.27	ug/Kg	1	12/06/12 14:31
Fluoranthene	13.3		10.9	3.27	ug/Kg	1	12/06/12 14:31
Fluorene	5.52	J	10.9	3.27	ug/Kg	1	12/06/12 14:31
Indeno[1,2,3-c,d] pyrene	5.70	J	10.9	3.27	ug/Kg	1	12/06/12 14:31
Naphthalene	13.8		10.9	3.27	ug/Kg	1	12/06/12 14:31
Phenanthrene	34.7		10.9	3.27	ug/Kg	1	12/06/12 14:31
Pyrene	15.0		10.9	3.27	ug/Kg	1	12/06/12 14:31
Surrogates							
2-Fluorobiphenyl	80.2		45-105		%	1	12/06/12 14:31
Terphenyl-d14	117		30-125		%	1	12/06/12 14:31

Batch Information

Analytical Batch: XMS7129
Analytical Method: 8270D SIMS (PAH)
Analyst: RTS
Analytical Date/Time: 12/06/12 14:31
Container ID: 1125855001-A

Prep Batch: XXX28527
Prep Method: SW3550C
Prep Date/Time: 12/04/12 14:45
Prep Initial Wt./Vol.: 22.859 g
Prep 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

Results of **Water_1**

Client Sample ID: **Water_1**
Client Project ID: **12-162**
Lab Sample ID: 1125855001
Lab Project ID: 1125855

Collection Date: 11/16/12 12:00
Received Date: 11/30/12 10:15
Matrix: Soil/Solid (dry weight)
Solids (%): 45.2

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Date Analyzed
Diesel Range Organics	84.0		44.0	13.6	mg/Kg	1	12/04/12 20:33
Surrogates							
5a Androstane	98.1		50-150		%	1	12/04/12 20:33

Batch Information

Analytical Batch: XFC10747
Analytical Method: AK102
Analyst: MEM
Analytical Date/Time: 12/04/12 20:33
Container ID: 1125855001-A

Prep Batch: XXX28528
Prep Method: SW3550C
Prep Date/Time: 12/04/12 15:45
Prep Initial Wt./Vol.: 30.178 g
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Date Analyzed
Residual Range Organics	478		44.0	13.6	mg/Kg	1	12/04/12 20:33
Surrogates							
n-Triacontane-d62	94		50-150		%	1	12/04/12 20:33

Batch Information

Analytical Batch: XFC10747
Analytical Method: AK103
Analyst: MEM
Analytical Date/Time: 12/04/12 20:33
Container ID: 1125855001-A

Prep Batch: XXX28528
Prep Method: SW3550C
Prep Date/Time: 12/04/12 15:45
Prep Initial Wt./Vol.: 30.178 g
Prep 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 1400076 [MXX/26169]
Blank Lab ID: 1130831

Matrix: Soil/Solid (dry weight)

QC for Samples:
1125855001

Results by **SW6020**

Parameter	Results	LOQ/CL	DL	Units
Arsenic	0.620 U	1.00	0.310	mg/Kg
Barium	0.188 U	0.300	0.0940	mg/Kg
Cadmium	0.124 U	0.200	0.0620	mg/Kg
Chromium	0.240 U	0.400	0.120	mg/Kg
Lead	0.124 U	0.200	0.0620	mg/Kg
Mercury	0.0240 U	0.0400	0.0120	mg/Kg
Selenium	0.300 U	0.500	0.150	mg/Kg
Silver	0.0620 U	0.100	0.0310	mg/Kg

Batch Information

Analytical Batch: MMS7790
Analytical Method: SW6020
Instrument: Perkin Elmer Sciex ICP-MS P3
Analyst: ACF
Analytical Date/Time: 12/3/2012 2:13:02PM

Prep Batch: MXX26169
Prep Method: SW3050B
Prep Date/Time: 12/3/2012 11:45:00AM
Prep Initial Wt./Vol.: 1 g
Prep Extract Vol: 50 mL

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

Blank Spike Summary

Blank Spike ID: LCS for HBN 1125855 [MXX26169]
Blank Spike Lab ID: 1130832
Date Analyzed: 12/03/2012 14:15

Matrix: Soil/Solid (dry weight)

QC for Samples: 1125855001

Results by **SW6020**

Blank Spike (mg/Kg)

Parameter	Spike	Result	Rec (%)	CL
Arsenic	50	53.2	106	(80-120)
Barium	50	50.7	101	(80-120)
Cadmium	5	5.49	110	(80-120)
Chromium	20	21.4	107	(80-120)
Lead	50	55.9	112	(80-120)
Mercury	0.5	0.590	118	(80-120)
Selenium	50	54.7	109	(80-120)
Silver	5	5.26	105	(80-120)

Batch Information

Analytical Batch: **MMS7790**
Analytical Method: **SW6020**
Instrument: **Perkin Elmer Sciex ICP-MS P3**
Analyst: **ACF**

Prep Batch: **MXX26169**
Prep Method: **SW3050B**
Prep Date/Time: **12/03/2012 11:45**
Spike Init Wt./Vol.: 50 mg/Kg Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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

Matrix Spike Summary

Original Sample ID: 1125834001
MS Sample ID: 1130833 MS
MSD Sample ID: 1130834 MSD

QC for Samples: 1125855001

Analysis Date: 12/03/2012 14:17
Analysis Date: 12/03/2012 14:19
Analysis Date: 12/03/2012 14:21
Matrix: Soil/Solid (dry weight)

Results by **SW6020**

		Matrix Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Arsenic	1.10	50.7	55.5	107	50.5	53.9	105	80-120	3.04	(< 20)
Barium	89.3	50.7	161	141 *	50.5	148	116	80-120	8.61	(< 20)
Cadmium	0.295	5.07	5.97	112	5.05	5.94	112	80-120	0.40	(< 20)
Chromium	6.21	20.3	27.4	105	20.2	26.5	100	80-120	3.69	(< 20)
Lead	39.7	50.7	98.4	116	50.5	109	136 *	80-120	9.80	(< 20)
Mercury	0.0738	0.507	0.645	113	0.505	0.686	121 *	80-120	6.23	(< 20)
Selenium	(0.510) U	50.7	56.3	111	50.5	55.5	110	80-120	1.24	(< 20)
Silver	(0.102) U	5.07	5.36	106	5.05	5.31	105	80-120	0.93	(< 20)

Batch Information

Analytical Batch: MMS7790
Analytical Method: SW6020
Instrument: Perkin Elmer Sciex ICP-MS P3
Analyst: ACF
Analytical Date/Time: 12/3/2012 2:19:27PM

Prep Batch: MXX26169
Prep Method: Soils/Solids Digest for Metals by ICP-MS
Prep Date/Time: 12/3/2012 11:45:00AM
Prep Initial Wt./Vol.: 1.01g
Prep Extract Vol: 50.00mL

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

Bench Spike Summary

Original Sample ID: 1125834001
MS Sample ID: 1130835 BND
MSD Sample ID:

QC for Samples: 1125855001

Analysis Date: 12/03/2012 14:17
Analysis Date: 12/03/2012 14:23
Analysis Date:
Matrix: Soil/Solid (dry weight)

Results by **SW6020**

		Matrix Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Barium	89.3	256	347	101				75-125		
Lead	39.7	127	171	104				75-125		
Mercury	0.0738	2.56	2.60	99				75-125		

Batch Information

Analytical Batch: MMS7790
Analytical Method: SW6020
Instrument: Perkin Elmer Sciex ICP-MS P3
Analyst: ACF
Analytical Date/Time: 12/3/2012 2:23:43PM

Prep Batch: MXX26169
Prep Method: Soils/Solids Digest for Metals by ICP-MS
Prep Date/Time: 12/3/2012 11:45:00AM
Prep Initial Wt./Vol.: 1.01g
Prep Extract Vol: 50.00mL

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 1400075 [SPT/8871]
Blank Lab ID: 1130829

Matrix: Soil/Solid (dry weight)

QC for Samples:
1125855001

Results by **SM21 2540G**

Parameter	Results	LOQ/CL	DL	Units
Total Solids	100			%

Batch Information

Analytical Batch: SPT8871
Analytical Method: SM21 2540G
Instrument:
Analyst: CNP
Analytical Date/Time: 12/3/2012 9:10:00AM

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

Duplicate Sample Summary

Original Sample ID: 1125869001
Duplicate Sample ID: 1130830
QC for Samples:
1125855001

Analysis Date: 12/03/2012 09:10
Matrix: Soil/Solid (dry weight)

Results by **SM21 2540G**

NAME	Original (N)	Duplicate ()	RPD (%)	RPD CL
Total Solids	85.9	85.7	0.18	15.00

Batch Information

Analytical Batch: SPT8871
Analytical Method: SM21 2540G
Instrument:
Analyst: CNP

Print Date: 12/26/2012 1:18:11PM

Method Blank

Blank ID: MB for HBN 1400123 [XXX/28528]
Blank Lab ID: 1131057

Matrix: Soil/Solid (dry weight)

QC for Samples:
1125855001

Results by **AK102**

Parameter	Results	LOQ/CL	DL	Units
Diesel Range Organics	8.05J	20.0	6.20	mg/Kg
Surrogates				
5a Androstane	93.5	60-120		%

Batch Information

Analytical Batch: XFC10747
Analytical Method: AK102
Instrument: HP 6890 Series II FID SV D F
Analyst: MEM
Analytical Date/Time: 12/4/2012 7:00:00PM

Prep Batch: XXX28528
Prep Method: SW3550C
Prep Date/Time: 12/4/2012 3:45:00PM
Prep Initial Wt./Vol.: 30 g
Prep 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

Blank Spike Summary

Blank Spike ID: LCS for HBN 1125855 [XXX28528]
Blank Spike Lab ID: 1131058
Date Analyzed: 12/05/2012 14:17

Spike Duplicate ID: LCSD for HBN 1125855 [XXX28528]
Spike Duplicate Lab ID: 1131059
Matrix: Soil/Solid (dry weight)

QC for Samples: 1125855001

Results by **AK102**

	Blank Spike (mg/Kg)			Spike Duplicate ()					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Diesel Range Organics	167	173	104	167	176	106	(75-125)	1.70	(< 20)
Surrogates									
5a Androstane		100	100	3.33	101		(60-120)	0.66	

Batch Information

Analytical Batch: **XFC10750**
Analytical Method: **AK102**
Instrument: **HP 7890A FID SV E R**
Analyst: **MEM**

Prep Batch: **XXX28528**
Prep Method: **SW3550C**
Prep Date/Time: **12/04/2012 15:45**
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 1400123 [XXX/28528]
Blank Lab ID: 1131057

Matrix: Soil/Solid (dry weight)

QC for Samples:
1125855001

Results by **AK103**

Parameter	Results	LOQ/CL	DL	Units
Residual Range Organics	12.4 U	20.0	6.20	mg/Kg
Surrogates				
n-Triacontane-d62	108	60-120		%

Batch Information

Analytical Batch: XFC10747
Analytical Method: AK103
Instrument: HP 6890 Series II FID SV D F
Analyst: MEM
Analytical Date/Time: 12/4/2012 7:00:00PM

Prep Batch: XXX28528
Prep Method: SW3550C
Prep Date/Time: 12/4/2012 3:45:00PM
Prep Initial Wt./Vol.: 30 g
Prep 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

Blank Spike Summary

Blank Spike ID: LCS for HBN 1125855 [XXX28528]
Blank Spike Lab ID: 1131058
Date Analyzed: 12/05/2012 14:17

Spike Duplicate ID: LCSD for HBN 1125855 [XXX28528]
Spike Duplicate Lab ID: 1131059
Matrix: Soil/Solid (dry weight)

QC for Samples: 1125855001

Results by **AK103**

	Blank Spike (mg/Kg)			Spike Duplicate ()					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Residual Range Organics	167	188	113	167	190	114	(60-120)	0.74	(< 20)
Surrogates									
n-Triacontane-d62		95.3	95	3.33	95		(60-120)	0.28	

Batch Information

Analytical Batch: **XFC10750**
Analytical Method: **AK103**
Instrument: **HP 7890A FID SV E R**
Analyst: **MEM**

Prep Batch: **XXX28528**
Prep Method: **SW3550C**
Prep Date/Time: **12/04/2012 15:45**
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 1400115 [XXX/28527]
Blank Lab ID: 1131035

Matrix: Soil/Solid (dry weight)

QC for Samples:
1125855001

Results by **8270D SIMS (PAH)**

Parameter	Results	LOQ/CL	DL	Units
1-Methylnaphthalene	3.00 U	5.00	1.50	ug/Kg
2-Methylnaphthalene	3.00 U	5.00	1.50	ug/Kg
Acenaphthene	3.00 U	5.00	1.50	ug/Kg
Acenaphthylene	3.00 U	5.00	1.50	ug/Kg
Anthracene	3.00 U	5.00	1.50	ug/Kg
Benzo(a)Anthracene	1.64J	5.00	1.50	ug/Kg
Benzo[a]pyrene	3.00 U	5.00	1.50	ug/Kg
Benzo[b]Fluoranthene	2.19J	5.00	1.50	ug/Kg
Benzo[g,h,i]perylene	1.79J	5.00	1.50	ug/Kg
Benzo[k]fluoranthene	1.69J	5.00	1.50	ug/Kg
Chrysene	1.98J	5.00	1.50	ug/Kg
Dibenzo[a,h]anthracene	1.72J	5.00	1.50	ug/Kg
Fluoranthene	1.71J	5.00	1.50	ug/Kg
Fluorene	3.00 U	5.00	1.50	ug/Kg
Indeno[1,2,3-c,d] pyrene	1.78J	5.00	1.50	ug/Kg
Naphthalene	3.00 U	5.00	1.50	ug/Kg
Phenanthrene	3.00 U	5.00	1.50	ug/Kg
Pyrene	1.70J	5.00	1.50	ug/Kg
Surrogates				
2-Fluorobiphenyl	68.2	45-105		%
Terphenyl-d14	106	30-125		%

Batch Information

Analytical Batch: XMS7126
Analytical Method: 8270D SIMS (PAH)
Instrument: HP 6890/5973 MS SVQA
Analyst: RTS
Analytical Date/Time: 12/5/2012 9:42:00AM

Prep Batch: XXX28527
Prep Method: SW3550C
Prep Date/Time: 12/4/2012 2:45:00PM
Prep Initial Wt./Vol.: 22.5 g
Prep Extract Vol: 1 mL

Print Date: 12/26/2012 1:18:15PM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1125855 [XXX28527]
Blank Spike Lab ID: 1131036
Date Analyzed: 12/05/2012 10:00

Matrix: Soil/Solid (dry weight)

QC for Samples: 1125855001

Results by **8270D SIMS (PAH)**

	Blank Spike (ug/Kg)			
Parameter	Spike	Result	Rec (%)	CL
1-Methylnaphthalene	22.2	12.1	54	(44-107)
2-Methylnaphthalene	22.2	11.4	52	(45-105)
Acenaphthene	22.2	13.7	62	(45-110)
Acenaphthylene	22.2	13.3	60	(45-105)
Anthracene	22.2	17.1	77	(55-105)
Benzo(a)Anthracene	22.2	23.0	103	(50-110)
Benzo[a]pyrene	22.2	20.8	94	(50-110)
Benzo[b]Fluoranthene	22.2	24.1	108	(45-115)
Benzo[g,h,i]perylene	22.2	21.0	95	(40-125)
Benzo[k]fluoranthene	22.2	22.6	102	(45-125)
Chrysene	22.2	22.9	103	(55-110)
Dibenzo[a,h]anthracene	22.2	21.2	95	(40-125)
Fluoranthene	22.2	21.7	98	(55-115)
Fluorene	22.2	14.7	66	(50-110)
Indeno[1,2,3-c,d] pyrene	22.2	21.9	98	(40-120)
Naphthalene	22.2	11.1	50	(40-105)
Phenanthrene	22.2	17.9	81	(50-110)
Pyrene	22.2	21.3	96	(45-125)
Surrogates				
2-Fluorobiphenyl		59	59	(45-105)
Terphenyl-d14		114	114	(30-125)

Batch Information

Analytical Batch: **XMS7126**
Analytical Method: **8270D SIMS (PAH)**
Instrument: **HP 6890/5973 MS SVQA**
Analyst: **RTS**

Prep Batch: **XXX28527**
Prep Method: **SW3550C**
Prep Date/Time: **12/04/2012 14:45**
Spike Init Wt./Vol.: 22.2 ug/Kg Extract Vol: 1 mL
Dupe Init Wt./Vol.: Extract Vol:

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

Matrix Spike Summary

Original Sample ID: 1125899001
MS Sample ID: 1131037 MS
MSD Sample ID: 1131038 MSD

QC for Samples: 1125855001

Analysis Date: 12/05/2012 11:10
Analysis Date: 12/05/2012 11:27
Analysis Date: 12/05/2012 11:45
Matrix: Soil/Solid (dry weight)

Results by **8270D SIMS (PAH)**

		Matrix Spike (ug/Kg)			Spike Duplicate (ug/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Acenaphthene	(3.38) U	24.9	26.7	108	24.9	17.7	71	45-110	40.40 *	(< 30)
Acenaphthylene	(3.38) U	24.9	22.8	92	24.9	16.2	65	45-105	34.50 *	(< 30)
Anthracene	(3.38) U	24.9	23.6	95	24.9	20.3	82	55-105	15.00	(< 30)
Benzo(a)Anthracene	3.46J	24.9	28.2	100	24.9	25.2	88	50-110	11.30	(< 30)
Benzo[a]pyrene	2.14J	24.9	23.3	85	24.9	23.2	85	50-110	0.90	(< 30)
Benzo[b]Fluoranthene	3.20J	24.9	25.6	90	24.9	26.2	93	45-115	2.20	(< 30)
Benzo[g,h,i]perylene	2.95J	24.9	21.8	76	24.9	21.7	76	40-125	0.39	(< 30)
Benzo[k]fluoranthene	2.41J	24.9	25.1	91	24.9	24.3	88	45-125	3.00	(< 30)
Chrysene	3.44J	24.9	26.9	94	24.9	24.6	85	55-110	8.70	(< 30)
Dibenzo[a,h]anthracene	1.86J	24.9	21.6	79	24.9	21.8	80	40-125	0.99	(< 30)
Fluoranthene	4.38J	24.9	29.2	100	24.9	25.6	86	55-115	12.60	(< 30)
Fluorene	4.55J	24.9	26.0	87	24.9	18.5	56	50-110	33.50 *	(< 30)
Indeno[1,2,3-c,d] pyrene	2.40J	24.9	22.8	82	24.9	23.1	83	40-120	1.00	(< 30)
Phenanthrene	10.5	24.9	36.6	105	24.9	27.2	67	50-110	29.30	(< 30)
Pyrene	4.81J	24.9	28.9	97	24.9	24.7	80	45-125	15.50	(< 30)
1-Methylnaphthalene	416	24.9	642	914 *	24.9	299	-467 *	44-107	72.80 *	(< 30)
2-Methylnaphthalene	595	24.9	902	1240 *	24.9	402	-773 *	45-105	76.50 *	(< 30)
Naphthalene	304	24.9	467	658 *	24.9	224	-321 *	40-105	70.30 *	(< 30)
Surrogates										
2-Fluorobiphenyl			19.5	79		14.4	58	45-105	30.80	
Terphenyl-d14			30.4	122		26.7	108	30-125	12.90	

Batch Information

Analytical Batch: XMS7126
Analytical Method: 8270D SIMS (PAH)
Instrument: HP 6890/5973 MS SVQA
Analyst: RTS
Analytical Date/Time: 12/5/2012 11:27:00AM

Prep Batch: XXX28527
Prep Method: Sonication Extraction Soil 8270 PAH SIM
Prep Date/Time: 12/4/2012 2:45:00PM
Prep Initial Wt./Vol.: 22.77g
Prep Extract Vol: 1.00mL

Print Date: 12/26/2012 1:18:16PM

SGS

SGS NORTH AMERICA INC.
CHAIN OF CUSTODY RECORD

Alas
New
Nort
Wes

1125855

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

Page ___ of ___

1

CLIENT: ABR Inc.

CONTACT: Joel G. PHONE NO:

PROJECT NAME: 12-162 PROJECT/ PWSID/ PERMIT#:

REPORTS TO: Joel @ ABR E-MAIL: off. 344-6777 x208 cell 947-9161

INVOICE TO: Conoco Phillips QUOTE #: P.O. #:

2

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 MI = Multi Incremental Soils	DRO/RRO	PAHSIM	12 CRA metals							REMARKS/ LOC ID
DA	Water_1	11-16-12			1	G										
	↓															
	Water 3															

5

Relinquished By: (1)	Date	Time	Received By:
Kim Hall	11/30/12	10:15 a.m.	
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date	Time	Received For Laboratory By: 11-30-12 1015

4

DOD Project? YES NO

Cooler ID: _____

Data Deliverable Requirements: L2 + DV

Requested Turnaround Time and-or Special Instructions:

Std.

Temp Blank °C: _____

or Ambient [ ]

(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle)

INTACT BROKEN ABSENT

(See attached Sample Receipt Form)

SGS-00082 (6/12)

[ ] 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

SGS

1125855

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	
Temperature blank compliant* (i.e., 0-6°C after correction factor)? * *Note: Exemption permitted for chilled samples collected less than 8 hours ago.* Cooler ID: _____ @ _____ w/ Therm.ID: _____ 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 Road Runner 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: (N/A) → For samples **received in FBKS**, ANCH staff will verify all criteria are reviewed. SRF Initiated by: SC 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 which case, use times on COC.* Were analyses requested unambiguous?	(Yes) No N/A Yes (No) N/A Yes No N/A	-time of collection absent
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	
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)	
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** or **site-specific QC** (e.g., BMS/BMSD/BDUP) samples, were the COC & bottles flagged (e.g., stickers) accordingly? For RUSH/SHORT HT, was email sent?	(Yes) No N/A	-Sample breaks hold 11/30/12
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: SC 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):

Sample rec'd frozen and on last day of HT for DRO/RRO & PAH SIM. Per Joel, proceed w/ testing.
PRG: RRO. SRC 11/30/12
Collection Time = 1200

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

Appendix F. Two analyses of polycyclic aromatic hydrocarbon levels (PAH), percent lipid, and moisture content in muscle samples from 5 arctic cisco collected on the Niġliq Channel of the Colville River, 11 November 2012 (MDL = Minimum Detection Limit).

Analyte	Analysis 1		Analysis 2	
Fish No.	MDL	Test Result	MDL	Test Result
Anthracene (µg/kg)				
1	0.77	*	2.6	2.9
2	0.77	*	2.2	2.6
3	0.77	*	1.6	1.9
4	0.77	*	1.6	1.9
5	0.77	*	1.1	1.2
Benzo(a)anthracene (µg/kg)				
1	0.85	*	2.9	*
2	0.85	*	2.4	*
3	0.85	*	1.8	*
4	0.85	*	1.8	*
5	0.85	*	1.2	*
Benzo(a)pyrene (µg/kg)				
1	0.81	*	2.8	*
2	0.81	*	2.3	*
3	0.81	*	1.7	*
4	0.81	*	1.7	*
5	0.81	*	1.1	*
Benzo(k)fluoranthene (µg/kg)				
1	0.81	*	2.8	*
2	0.81	*	2.3	*
3	0.81	*	1.7	*
4	0.81	*	1.7	*
5	0.81	*	1.1	*
Chrysene (µg/kg)				
1	0.87	*	3	*
2	0.87	*	2.5	*
3	0.87	*	1.9	*
4	0.87	*	1.8	*
5	0.87	*	1.2	*
Fluoranthene (µg/kg)				
1	1.1	*	3.8	*
2	1.1	*	3.1	*
3	1.1	*	2.3	*
4	1.1	*	2.3	*
5	1.1	*	1.5	*
Fluorene (µg/kg)				
1	0.76	*	2.6	*
2	0.76	2	2.2	*
3	0.76	*	1.6	*
4	0.76	*	1.6	*
5	0.76	*	1.1	*

Analyte	Analysis 1		Analysis 2	
Fish No.	MDL	Test Result	MDL	Test Result
Naphthalene (µg/kg)				
1	0.76	*	2.6	*
2	0.76	5.3	2.2	*
3	0.76	2.2	1.6	1.9
4	0.76	2.4	1.6	2
5	0.76	1.4	1.1	*
Phenanthrene (µg/kg)				
1	1	*	3.6	*
2	1	2.1	2.9	*
3	1	*	2.2	*
4	1	*	2.1	*
5	1	*	1.4	*
Pyrene (µg/kg)				
1	0.88	*	3	*
2	0.88	*	2.5	*
3	0.88	*	1.9	*
4	0.88	*	1.8	*
5	0.88	*	1.2	*
Lipid (%)				
1	–	4	–	4
2	–	3.5	–	3.5
3	–	2.4	–	2.4
4	–	1.8	–	1.8
5	–	1.7	–	1.7
Percent Moisture (%)				
1	0.1	74.4	0.1	74.4
2	0.1	75.5	0.1	75.5
3	0.1	76.6	0.1	76.6
4	0.1	77.5	0.1	77.5
5	0.1	76.8	0.1	76.8

Appendix G. Fish tissue chemistry

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

February 28, 2013

Joel Gottschalk
ABR Inc.
PO Box 240268
Anchorage, AK 99524

RE: Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Dear Joel Gottschalk:
Enclosed are the analytical results for sample(s) received by the laboratory on December 22, 2012. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Lab PAH control spike duplicate had some analytes exceed the QC recovery limits. The samples that had some mass available were re-extracted and re-analyzed.

The re-analyzed sampels are also reported although with higher reporting limits due to the smaller mass available.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Tod Noltemeyer

Tod Noltemeyer

tod.noltemeyer@pacelabs.com
Project Manager

Enclosures

cc: Kim Allen, ABR Inc.

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

CERTIFICATIONS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Green Bay Certification IDs
1241 Bellevue Street, Green Bay, WI 54302
Florida/NELAP Certification #: E87948
Illinois Certification #: 200050
Kentucky Certification #: 82
Louisiana Certification #: 04168
Minnesota Certification #: 055-999-334
New York Certification #: 11888
North Dakota Certification #: R-150
South Carolina Certification #: 83006001
US Dept of Agriculture #: S-76505
Wisconsin Certification #: 405132750

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SAMPLE SUMMARY

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Lab ID	Sample ID	Matrix	Date Collected	Date Received
4072304001	**FISH #1 MUSCLE**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304002	**FISH #1 LIVER**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304003	**FISH #2 MUSCLE**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304004	**FISH #2 LIVER**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304005	**FISH #3 MUSCLE**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304006	**FISH #3 LIVER**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304007	**FISH #4 MUSCLE**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304008	**FISH #4 LIVER**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304009	**FISH #5 MUSCLE**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304010	**FISH #5 LIVER**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304011	**FISH #1 MUSCLE -RE**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304012	**FISH #2 MUSCLE -RE**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304013	**FISH #3 MUSCLE -RE**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304014	**FISH #4 MUSCLE -RE**	Tissue	10/24/12 10:00	12/22/12 13:10
4072304015	**FISH #5 MUSCLE -RE**	Tissue	10/24/12 10:00	12/22/12 13:10

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SAMPLE ANALYTE COUNT

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Lab ID	Sample ID	Method	Analysts	Analytes Reported
4072304001	**FISH #1 MUSCLE**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304002	**FISH #1 LIVER**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304003	**FISH #2 MUSCLE**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304004	**FISH #2 LIVER**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304005	**FISH #3 MUSCLE**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304006	**FISH #3 LIVER**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304007	**FISH #4 MUSCLE**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304008	**FISH #4 LIVER**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304009	**FISH #5 MUSCLE**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304010	**FISH #5 LIVER**	EPA 8270 by SIM	ARO	14
		ASTM D2974-87	JAL	1
		Pace Lipid	ABF	1
4072304011	**FISH #1 MUSCLE -RE**	EPA 8270 by SIM	ARO	14
4072304012	**FISH #2 MUSCLE -RE**	EPA 8270 by SIM	ARO	14
4072304013	**FISH #3 MUSCLE -RE**	EPA 8270 by SIM	ARO	14
4072304014	**FISH #4 MUSCLE -RE**	EPA 8270 by SIM	ARO	14
4072304015	**FISH #5 MUSCLE -RE**	EPA 8270 by SIM	ARO	14

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Method: **EPA 8270 by SIM**
Description: 8270 MSSV PAH in Tissue
Client: ABR INC.
Date: February 28, 2013

General Information:
15 samples were analyzed for EPA 8270 by SIM. All samples were received in acceptable condition with any exceptions noted below.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 3540 with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Internal Standards:
All internal standards were within QC limits with any exceptions noted below.

Surrogates:
All surrogates were within QC limits with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

QC Batch: OEXT/17278

L0: Analyte recovery in the laboratory control sample (LCS) was outside QC limits.

- LCS (Lab ID: 733038)
  - Benzo(b)fluoranthene
- LCSD (Lab ID: 733039)
  - Anthracene
  - Benzo(a)anthracene
  - Benzo(a)pyrene
  - Benzo(b)fluoranthene
  - Benzo(e)pyrene
  - Benzo(k)fluoranthene
  - Chrysene
  - Fluoranthene
  - Fluorene
  - Naphthalene
  - Phenanthrene
  - Pyrene

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Method: **EPA 8270 by SIM**
Description: 8270 MSSV PAH in Tissue
Client: ABR INC.
Date: February 28, 2013

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

QC Batch: MSSV/5333

A matrix spike/matrix spike duplicate was not performed due to insufficient sample volume.

QC Batch: MSSV/5402

A matrix spike/matrix spike duplicate was not performed due to insufficient sample volume.

Additional Comments:

Batch Comments:

Many compounds failed high in the LCSD; this caused many RPD failures between LCS and LCSD. Any sample that has additional mass will be re-extracted.

- QC Batch: MSSV / 5333

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Method: **ASTM D2974-87**
Description: Percent Moisture Reportable
Client: ABR INC.
Date: February 28, 2013

General Information:
10 samples were analyzed for ASTM D2974-87. All samples were received in acceptable condition with any exceptions noted below.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Internal Standards:
All internal standards were within QC limits with any exceptions noted below.

Surrogates:
All surrogates were within QC limits with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Duplicate Sample:
All duplicate sample results were within method acceptance criteria with any exceptions noted below.

Additional Comments:

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Method: **Pace Lipid**
Description: Lipid
Client: ABR INC.
Date: February 28, 2013

General Information:
10 samples were analyzed for Pace Lipid. All samples were received in acceptable condition with any exceptions noted below.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Internal Standards:
All internal standards were within QC limits with any exceptions noted below.

Surrogates:
All surrogates were within QC limits with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Batch Comments:

Not enough sample volume for MS, MSD. Ran LCS, LCSD.
- QC Batch: OEXT / 17283

This data package has been reviewed for quality and completeness and is approved for release.

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #1 MUSCLE **Lab ID: 4072304001** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<0.77**	ug/kg	1.7	0.77	1	01/02/13 10:39	01/08/13 13:11	120-12-7	L3
Benzo(a)anthracene	**<0.85**	ug/kg	1.7	0.85	1	01/02/13 10:39	01/08/13 13:11	56-55-3	L3
Benzo(a)pyrene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 13:11	50-32-8	L3
Benzo(b)fluoranthene	**<0.93**	ug/kg	1.7	0.93	1	01/02/13 10:39	01/08/13 13:11	205-99-2	L3
Benzo(e)pyrene	**<1.7**	ug/kg	1.7	1.7	1	01/02/13 10:39	02/07/13 09:58	192-97-2	L3
Benzo(k)fluoranthene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 13:11	207-08-9	L3
Chrysene	**<0.87**	ug/kg	1.7	0.87	1	01/02/13 10:39	01/08/13 13:11	218-01-9	L3
Fluoranthene	**<1.1**	ug/kg	1.7	1.1	1	01/02/13 10:39	01/08/13 13:11	206-44-0	L3
Fluorene	**<0.76**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 13:11	86-73-7	L3
Naphthalene	**2.9**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 13:11	91-20-3	B,L1
Phenanthrene	**<1.0**	ug/kg	1.7	1.0	1	01/02/13 10:39	01/08/13 13:11	85-01-8	L3
Pyrene	**<0.88**	ug/kg	1.7	0.88	1	01/02/13 10:39	01/08/13 13:11	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	91	%.	59-130		1	01/02/13 10:39	01/08/13 13:11	321-60-8	
Terphenyl-d14 (S)	100	%.	59-130		1	01/02/13 10:39	01/08/13 13:11	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**74.4**	%	0.10	0.10	1		12/28/12 05:50		
Lipid	Analytical Method: Pace Lipid								
Lipid	**4.0**	%			1		01/04/13 07:47		

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #1 LIVER **Lab ID: 4072304002** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<13.0**	ug/kg	28.3	13.0	1	01/02/13 10:39	01/08/13 13:35	120-12-7	L3
Benzo(a)anthracene	**<14.4**	ug/kg	28.3	14.4	1	01/02/13 10:39	01/08/13 13:35	56-55-3	L3
Benzo(a)pyrene	**<13.8**	ug/kg	28.3	13.8	1	01/02/13 10:39	01/08/13 13:35	50-32-8	L3
Benzo(b)fluoranthene	**<15.8**	ug/kg	28.3	15.8	1	01/02/13 10:39	01/08/13 13:35	205-99-2	L3
Benzo(e)pyrene	**<28.3**	ug/kg	28.3	28.3	1	01/02/13 10:39	02/07/13 10:22	192-97-2	L3
Benzo(k)fluoranthene	**<13.7**	ug/kg	28.3	13.7	1	01/02/13 10:39	01/08/13 13:35	207-08-9	L3
Chrysene	**<14.7**	ug/kg	28.3	14.7	1	01/02/13 10:39	01/08/13 13:35	218-01-9	L3
Fluoranthene	**<18.6**	ug/kg	28.3	18.6	1	01/02/13 10:39	01/08/13 13:35	206-44-0	L3
Fluorene	**<12.9**	ug/kg	28.3	12.9	1	01/02/13 10:39	01/08/13 13:35	86-73-7	L3
Naphthalene	**<12.9**	ug/kg	28.3	12.9	1	01/02/13 10:39	01/08/13 13:35	91-20-3	L3
Phenanthrene	**<17.6**	ug/kg	28.3	17.6	1	01/02/13 10:39	01/08/13 13:35	85-01-8	L3
Pyrene	**<14.9**	ug/kg	28.3	14.9	1	01/02/13 10:39	01/08/13 13:35	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	87	%.	59-130		1	01/02/13 10:39	01/08/13 13:35	321-60-8	
Terphenyl-d14 (S)	94	%.	59-130		1	01/02/13 10:39	01/08/13 13:35	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**59.1**	%	0.10	0.10	1		12/28/12 05:50		
Lipid	Analytical Method: Pace Lipid								
Lipid	**16.9**	%			1		01/04/13 07:47		

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #2 MUSCLE **Lab ID: 4072304003** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<0.77**	ug/kg	1.7	0.77	1	01/02/13 10:39	01/08/13 13:59	120-12-7	L3
Benzo(a)anthracene	**<0.85**	ug/kg	1.7	0.85	1	01/02/13 10:39	01/08/13 13:59	56-55-3	L3
Benzo(a)pyrene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 13:59	50-32-8	L3
Benzo(b)fluoranthene	**<0.93**	ug/kg	1.7	0.93	1	01/02/13 10:39	01/08/13 13:59	205-99-2	L3
Benzo(e)pyrene	**<1.7**	ug/kg	1.7	1.7	1	01/02/13 10:39	02/07/13 10:45	192-97-2	L3
Benzo(k)fluoranthene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 13:59	207-08-9	L3
Chrysene	**<0.87**	ug/kg	1.7	0.87	1	01/02/13 10:39	01/08/13 13:59	218-01-9	L3
Fluoranthene	**<1.1**	ug/kg	1.7	1.1	1	01/02/13 10:39	01/08/13 13:59	206-44-0	L3
Fluorene	**2.0**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 13:59	86-73-7	L1
Naphthalene	**5.3**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 13:59	91-20-3	B,L1
Phenanthrene	**2.1**	ug/kg	1.7	1.0	1	01/02/13 10:39	01/08/13 13:59	85-01-8	L1
Pyrene	**<0.88**	ug/kg	1.7	0.88	1	01/02/13 10:39	01/08/13 13:59	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	87	%.	59-130		1	01/02/13 10:39	01/08/13 13:59	321-60-8	
Terphenyl-d14 (S)	96	%.	59-130		1	01/02/13 10:39	01/08/13 13:59	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**75.5**	%	0.10	0.10	1		12/28/12 05:51		
Lipid	Analytical Method: Pace Lipid								
Lipid	**3.5**	%			1		01/04/13 07:47		

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #2 LIVER **Lab ID: 4072304004** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<10.5**	ug/kg	22.8	10.5	1	01/02/13 10:39	01/08/13 14:23	120-12-7	L3
Benzo(a)anthracene	**<11.6**	ug/kg	22.8	11.6	1	01/02/13 10:39	01/08/13 14:23	56-55-3	L3
Benzo(a)pyrene	**<11.1**	ug/kg	22.8	11.1	1	01/02/13 10:39	01/08/13 14:23	50-32-8	L3
Benzo(b)fluoranthene	**<12.7**	ug/kg	22.8	12.7	1	01/02/13 10:39	01/08/13 14:23	205-99-2	L3
Benzo(e)pyrene	**<22.8**	ug/kg	22.8	22.8	1	01/02/13 10:39	02/07/13 11:09	192-97-2	L3
Benzo(k)fluoranthene	**<11.1**	ug/kg	22.8	11.1	1	01/02/13 10:39	01/08/13 14:23	207-08-9	L3
Chrysene	**<11.9**	ug/kg	22.8	11.9	1	01/02/13 10:39	01/08/13 14:23	218-01-9	L3
Fluoranthene	**<15.0**	ug/kg	22.8	15.0	1	01/02/13 10:39	01/08/13 14:23	206-44-0	L3
Fluorene	**<10.4**	ug/kg	22.8	10.4	1	01/02/13 10:39	01/08/13 14:23	86-73-7	L3
Naphthalene	**16.3J**	ug/kg	22.8	10.4	1	01/02/13 10:39	01/08/13 14:23	91-20-3	L1
Phenanthrene	**<14.1**	ug/kg	22.8	14.1	1	01/02/13 10:39	01/08/13 14:23	85-01-8	L3
Pyrene	**<12.0**	ug/kg	22.8	12.0	1	01/02/13 10:39	01/08/13 14:23	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	93	%.	59-130		1	01/02/13 10:39	01/08/13 14:23	321-60-8	
Terphenyl-d14 (S)	101	%.	59-130		1	01/02/13 10:39	01/08/13 14:23	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**69.9**	%	0.10	0.10	1		12/28/12 05:51		
Lipid	Analytical Method: Pace Lipid								
Lipid	**10.0**	%			1		01/04/13 07:47		

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #3 MUSCLE **Lab ID: 4072304005** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<0.77**	ug/kg	1.7	0.77	1	01/02/13 10:39	01/08/13 14:47	120-12-7	L3
Benzo(a)anthracene	**<0.85**	ug/kg	1.7	0.85	1	01/02/13 10:39	01/08/13 14:47	56-55-3	L3
Benzo(a)pyrene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 14:47	50-32-8	L3
Benzo(b)fluoranthene	**<0.93**	ug/kg	1.7	0.93	1	01/02/13 10:39	01/08/13 14:47	205-99-2	L3
Benzo(e)pyrene	**<1.7**	ug/kg	1.7	1.7	1	01/02/13 10:39	02/07/13 11:33	192-97-2	L3
Benzo(k)fluoranthene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 14:47	207-08-9	L3
Chrysene	**<0.87**	ug/kg	1.7	0.87	1	01/02/13 10:39	01/08/13 14:47	218-01-9	L3
Fluoranthene	**<1.1**	ug/kg	1.7	1.1	1	01/02/13 10:39	01/08/13 14:47	206-44-0	L3
Fluorene	**<0.76**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 14:47	86-73-7	L3
Naphthalene	**2.2**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 14:47	91-20-3	B,L1
Phenanthrene	**<1.0**	ug/kg	1.7	1.0	1	01/02/13 10:39	01/08/13 14:47	85-01-8	L3
Pyrene	**<0.88**	ug/kg	1.7	0.88	1	01/02/13 10:39	01/08/13 14:47	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	89	%.	59-130		1	01/02/13 10:39	01/08/13 14:47	321-60-8	
Terphenyl-d14 (S)	96	%.	59-130		1	01/02/13 10:39	01/08/13 14:47	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**76.6**	%	0.10	0.10	1		12/28/12 05:51		
Lipid	Analytical Method: Pace Lipid								
Lipid	**2.4**	%			1		01/04/13 07:47		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #3 LIVER **Lab ID: 4072304006** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<9.9**	ug/kg	21.6	9.9	1	01/02/13 10:39	01/08/13 15:11	120-12-7	L3
Benzo(a)anthracene	**<11.0**	ug/kg	21.6	11.0	1	01/02/13 10:39	01/08/13 15:11	56-55-3	L3
Benzo(a)pyrene	**<10.5**	ug/kg	21.6	10.5	1	01/02/13 10:39	01/08/13 15:11	50-32-8	L3
Benzo(b)fluoranthene	**<12.0**	ug/kg	21.6	12.0	1	01/02/13 10:39	01/08/13 15:11	205-99-2	L3
Benzo(e)pyrene	**<21.6**	ug/kg	21.6	21.6	1	01/02/13 10:39	02/07/13 11:57	192-97-2	L3
Benzo(k)fluoranthene	**<10.5**	ug/kg	21.6	10.5	1	01/02/13 10:39	01/08/13 15:11	207-08-9	L3
Chrysene	**<11.2**	ug/kg	21.6	11.2	1	01/02/13 10:39	01/08/13 15:11	218-01-9	L3
Fluoranthene	**<14.2**	ug/kg	21.6	14.2	1	01/02/13 10:39	01/08/13 15:11	206-44-0	L3
Fluorene	**<9.8**	ug/kg	21.6	9.8	1	01/02/13 10:39	01/08/13 15:11	86-73-7	L3
Naphthalene	**<9.9**	ug/kg	21.6	9.9	1	01/02/13 10:39	01/08/13 15:11	91-20-3	L3
Phenanthrene	**<13.4**	ug/kg	21.6	13.4	1	01/02/13 10:39	01/08/13 15:11	85-01-8	L3
Pyrene	**<11.4**	ug/kg	21.6	11.4	1	01/02/13 10:39	01/08/13 15:11	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	93	%.	59-130		1	01/02/13 10:39	01/08/13 15:11	321-60-8	
Terphenyl-d14 (S)	103	%.	59-130		1	01/02/13 10:39	01/08/13 15:11	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**71.3**	%	0.10	0.10	1		12/28/12 05:51		
Lipid	Analytical Method: Pace Lipid								
Lipid	**8.1**	%			1		01/04/13 07:48		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #4 MUSCLE **Lab ID: 4072304007** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<0.77**	ug/kg	1.7	0.77	1	01/02/13 10:39	01/08/13 15:35	120-12-7	L3
Benzo(a)anthracene	**<0.85**	ug/kg	1.7	0.85	1	01/02/13 10:39	01/08/13 15:35	56-55-3	L3
Benzo(a)pyrene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 15:35	50-32-8	L3
Benzo(b)fluoranthene	**<0.93**	ug/kg	1.7	0.93	1	01/02/13 10:39	01/08/13 15:35	205-99-2	L3
Benzo(e)pyrene	**<1.7**	ug/kg	1.7	1.7	1	01/02/13 10:39	02/07/13 12:21	192-97-2	L3
Benzo(k)fluoranthene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 15:35	207-08-9	L3
Chrysene	**<0.87**	ug/kg	1.7	0.87	1	01/02/13 10:39	01/08/13 15:35	218-01-9	L3
Fluoranthene	**<1.1**	ug/kg	1.7	1.1	1	01/02/13 10:39	01/08/13 15:35	206-44-0	L3
Fluorene	**<0.76**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 15:35	86-73-7	L3
Naphthalene	**2.4**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 15:35	91-20-3	B,L1
Phenanthrene	**<1.0**	ug/kg	1.7	1.0	1	01/02/13 10:39	01/08/13 15:35	85-01-8	L3
Pyrene	**<0.88**	ug/kg	1.7	0.88	1	01/02/13 10:39	01/08/13 15:35	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	89	%.	59-130		1	01/02/13 10:39	01/08/13 15:35	321-60-8	
Terphenyl-d14 (S)	96	%.	59-130		1	01/02/13 10:39	01/08/13 15:35	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**77.5**	%	0.10	0.10	1		12/28/12 05:51		
Lipid	Analytical Method: Pace Lipid								
Lipid	**1.8**	%			1		01/04/13 07:48		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #4 LIVER **Lab ID: 4072304008** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<21.8**	ug/kg	47.5	21.8	1	01/02/13 10:39	01/08/13 16:06	120-12-7	L3
Benzo(a)anthracene	**<24.2**	ug/kg	47.5	24.2	1	01/02/13 10:39	01/08/13 16:06	56-55-3	L3
Benzo(a)pyrene	**<23.1**	ug/kg	47.5	23.1	1	01/02/13 10:39	01/08/13 16:06	50-32-8	L3
Benzo(b)fluoranthene	**<26.5**	ug/kg	47.5	26.5	1	01/02/13 10:39	01/08/13 16:06	205-99-2	L3
Benzo(e)pyrene	**<47.5**	ug/kg	47.5	47.5	1	01/02/13 10:39	02/07/13 12:44	192-97-2	L3
Benzo(k)fluoranthene	**<23.1**	ug/kg	47.5	23.1	1	01/02/13 10:39	01/08/13 16:06	207-08-9	L3
Chrysene	**<24.8**	ug/kg	47.5	24.8	1	01/02/13 10:39	01/08/13 16:06	218-01-9	L3
Fluoranthene	**<31.2**	ug/kg	47.5	31.2	1	01/02/13 10:39	01/08/13 16:06	206-44-0	L3
Fluorene	**<21.7**	ug/kg	47.5	21.7	1	01/02/13 10:39	01/08/13 16:06	86-73-7	L3
Naphthalene	**<21.7**	ug/kg	47.5	21.7	1	01/02/13 10:39	01/08/13 16:06	91-20-3	L3
Phenanthrene	**<29.5**	ug/kg	47.5	29.5	1	01/02/13 10:39	01/08/13 16:06	85-01-8	L3
Pyrene	**<25.1**	ug/kg	47.5	25.1	1	01/02/13 10:39	01/08/13 16:06	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	83	%.	59-130		1	01/02/13 10:39	01/08/13 16:06	321-60-8	
Terphenyl-d14 (S)	92	%.	59-130		1	01/02/13 10:39	01/08/13 16:06	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**73.5**	%	0.10	0.10	1		12/28/12 05:51		
Lipid	Analytical Method: Pace Lipid								
Lipid	**4.5**	%			1		01/04/13 07:48		

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #5 MUSCLE **Lab ID: 4072304009** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<0.77**	ug/kg	1.7	0.77	1	01/02/13 10:39	01/08/13 16:30	120-12-7	L3
Benzo(a)anthracene	**<0.85**	ug/kg	1.7	0.85	1	01/02/13 10:39	01/08/13 16:30	56-55-3	L3
Benzo(a)pyrene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 16:30	50-32-8	L3
Benzo(b)fluoranthene	**<0.93**	ug/kg	1.7	0.93	1	01/02/13 10:39	01/08/13 16:30	205-99-2	L3
Benzo(e)pyrene	**<1.7**	ug/kg	1.7	1.7	1	01/02/13 10:39	02/07/13 13:08	192-97-2	L3
Benzo(k)fluoranthene	**<0.81**	ug/kg	1.7	0.81	1	01/02/13 10:39	01/08/13 16:30	207-08-9	L3
Chrysene	**<0.87**	ug/kg	1.7	0.87	1	01/02/13 10:39	01/08/13 16:30	218-01-9	L3
Fluoranthene	**<1.1**	ug/kg	1.7	1.1	1	01/02/13 10:39	01/08/13 16:30	206-44-0	L3
Fluorene	**<0.76**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 16:30	86-73-7	L3
Naphthalene	**1.4J**	ug/kg	1.7	0.76	1	01/02/13 10:39	01/08/13 16:30	91-20-3	B,L1
Phenanthrene	**<1.0**	ug/kg	1.7	1.0	1	01/02/13 10:39	01/08/13 16:30	85-01-8	L3
Pyrene	**<0.88**	ug/kg	1.7	0.88	1	01/02/13 10:39	01/08/13 16:30	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	85	%.	59-130		1	01/02/13 10:39	01/08/13 16:30	321-60-8	
Terphenyl-d14 (S)	94	%.	59-130		1	01/02/13 10:39	01/08/13 16:30	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**76.8**	%	0.10	0.10	1		12/28/12 05:52		
Lipid	Analytical Method: Pace Lipid								
Lipid	**1.7**	%			1		01/04/13 07:49		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #5 LIVER **Lab ID: 4072304010** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**<14.2**	ug/kg	30.8	14.2	1	01/02/13 10:39	01/08/13 16:54	120-12-7	L3
Benzo(a)anthracene	**<15.7**	ug/kg	30.8	15.7	1	01/02/13 10:39	01/08/13 16:54	56-55-3	L3
Benzo(a)pyrene	**<15.0**	ug/kg	30.8	15.0	1	01/02/13 10:39	01/08/13 16:54	50-32-8	L3
Benzo(b)fluoranthene	**<17.2**	ug/kg	30.8	17.2	1	01/02/13 10:39	01/08/13 16:54	205-99-2	L3
Benzo(e)pyrene	**<30.8**	ug/kg	30.8	30.8	1	01/02/13 10:39	02/07/13 13:32	192-97-2	L3
Benzo(k)fluoranthene	**<14.9**	ug/kg	30.8	14.9	1	01/02/13 10:39	01/08/13 16:54	207-08-9	L3
Chrysene	**<16.0**	ug/kg	30.8	16.0	1	01/02/13 10:39	01/08/13 16:54	218-01-9	L3
Fluoranthene	**<20.2**	ug/kg	30.8	20.2	1	01/02/13 10:39	01/08/13 16:54	206-44-0	L3
Fluorene	**<14.1**	ug/kg	30.8	14.1	1	01/02/13 10:39	01/08/13 16:54	86-73-7	L3
Naphthalene	**<14.1**	ug/kg	30.8	14.1	1	01/02/13 10:39	01/08/13 16:54	91-20-3	L3
Phenanthrene	**<19.1**	ug/kg	30.8	19.1	1	01/02/13 10:39	01/08/13 16:54	85-01-8	L3
Pyrene	**<16.3**	ug/kg	30.8	16.3	1	01/02/13 10:39	01/08/13 16:54	129-00-0	L3
Surrogates									
2-Fluorobiphenyl (S)	89	%.	59-130		1	01/02/13 10:39	01/08/13 16:54	321-60-8	
Terphenyl-d14 (S)	96	%.	59-130		1	01/02/13 10:39	01/08/13 16:54	1718-51-0	
Percent Moisture Reportable	Analytical Method: ASTM D2974-87								
Percent Moisture	**65.1**	%	0.10	0.10	1		12/28/12 05:52		
Lipid	Analytical Method: Pace Lipid								
Lipid	**10.9**	%			1		01/04/13 07:49		

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #1 MUSCLE -RE **Lab ID: 4072304011** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**2.9J**	ug/kg	5.7	2.6	1	01/30/13 12:43	02/21/13 15:03	120-12-7	
Benzo(a)anthracene	**<2.9**	ug/kg	5.7	2.9	1	01/30/13 12:43	02/21/13 15:03	56-55-3	
Benzo(a)pyrene	**<2.8**	ug/kg	5.7	2.8	1	01/30/13 12:43	02/21/13 15:03	50-32-8	
Benzo(b)fluoranthene	**<3.2**	ug/kg	5.7	3.2	1	01/30/13 12:43	02/21/13 15:03	205-99-2	
Benzo(e)pyrene	**<5.7**	ug/kg	5.7	5.7	1	01/30/13 12:43	02/21/13 15:03	192-97-2	
Benzo(k)fluoranthene	**<2.8**	ug/kg	5.7	2.8	1	01/30/13 12:43	02/21/13 15:03	207-08-9	
Chrysene	**<3.0**	ug/kg	5.7	3.0	1	01/30/13 12:43	02/21/13 15:03	218-01-9	
Fluoranthene	**<3.8**	ug/kg	5.7	3.8	1	01/30/13 12:43	02/21/13 15:03	206-44-0	
Fluorene	**<2.6**	ug/kg	5.7	2.6	1	01/30/13 12:43	02/21/13 15:03	86-73-7	
Naphthalene	**<2.6**	ug/kg	5.7	2.6	1	01/30/13 12:43	02/21/13 15:03	91-20-3	
Phenanthrene	**<3.6**	ug/kg	5.7	3.6	1	01/30/13 12:43	02/21/13 15:03	85-01-8	
Pyrene	**<3.0**	ug/kg	5.7	3.0	1	01/30/13 12:43	02/21/13 15:03	129-00-0	
Surrogates									
2-Fluorobiphenyl (S)	74	%.	59-130		1	01/30/13 12:43	02/21/13 15:03	321-60-8	
Terphenyl-d14 (S)	77	%.	51-130		1	01/30/13 12:43	02/21/13 15:03	1718-51-0	

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #2 MUSCLE -RE **Lab ID: 4072304012** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**2.6J**	ug/kg	4.7	2.2	1	01/30/13 12:43	02/21/13 15:27	120-12-7	
Benzo(a)anthracene	**<2.4**	ug/kg	4.7	2.4	1	01/30/13 12:43	02/21/13 15:27	56-55-3	
Benzo(a)pyrene	**<2.3**	ug/kg	4.7	2.3	1	01/30/13 12:43	02/21/13 15:27	50-32-8	
Benzo(b)fluoranthene	**<2.6**	ug/kg	4.7	2.6	1	01/30/13 12:43	02/21/13 15:27	205-99-2	
Benzo(e)pyrene	**<4.7**	ug/kg	4.7	4.7	1	01/30/13 12:43	02/21/13 15:27	192-97-2	
Benzo(k)fluoranthene	**<2.3**	ug/kg	4.7	2.3	1	01/30/13 12:43	02/21/13 15:27	207-08-9	
Chrysene	**<2.5**	ug/kg	4.7	2.5	1	01/30/13 12:43	02/21/13 15:27	218-01-9	
Fluoranthene	**<3.1**	ug/kg	4.7	3.1	1	01/30/13 12:43	02/21/13 15:27	206-44-0	
Fluorene	**<2.2**	ug/kg	4.7	2.2	1	01/30/13 12:43	02/21/13 15:27	86-73-7	
Naphthalene	**4.8**	ug/kg	4.7	2.2	1	01/30/13 12:43	02/21/13 15:27	91-20-3	
Phenanthrene	**<2.9**	ug/kg	4.7	2.9	1	01/30/13 12:43	02/21/13 15:27	85-01-8	
Pyrene	**<2.5**	ug/kg	4.7	2.5	1	01/30/13 12:43	02/21/13 15:27	129-00-0	
Surrogates									
2-Fluorobiphenyl (S)	80	%.	59-130		1	01/30/13 12:43	02/21/13 15:27	321-60-8	
Terphenyl-d14 (S)	86	%.	51-130		1	01/30/13 12:43	02/21/13 15:27	1718-51-0	

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #3 MUSCLE -RE **Lab ID: 4072304013** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**1.9J**	ug/kg	3.6	1.6	1	01/30/13 12:43	02/21/13 15:51	120-12-7	
Benzo(a)anthracene	**<1.8**	ug/kg	3.6	1.8	1	01/30/13 12:43	02/21/13 15:51	56-55-3	
Benzo(a)pyrene	**<1.7**	ug/kg	3.6	1.7	1	01/30/13 12:43	02/21/13 15:51	50-32-8	
Benzo(b)fluoranthene	**<2.0**	ug/kg	3.6	2.0	1	01/30/13 12:43	02/21/13 15:51	205-99-2	
Benzo(e)pyrene	**<3.6**	ug/kg	3.6	3.6	1	01/30/13 12:43	02/21/13 15:51	192-97-2	
Benzo(k)fluoranthene	**<1.7**	ug/kg	3.6	1.7	1	01/30/13 12:43	02/21/13 15:51	207-08-9	
Chrysene	**<1.9**	ug/kg	3.6	1.9	1	01/30/13 12:43	02/21/13 15:51	218-01-9	
Fluoranthene	**<2.3**	ug/kg	3.6	2.3	1	01/30/13 12:43	02/21/13 15:51	206-44-0	
Fluorene	**<1.6**	ug/kg	3.6	1.6	1	01/30/13 12:43	02/21/13 15:51	86-73-7	
Naphthalene	**1.9J**	ug/kg	3.6	1.6	1	01/30/13 12:43	02/21/13 15:51	91-20-3	
Phenanthrene	**<2.2**	ug/kg	3.6	2.2	1	01/30/13 12:43	02/21/13 15:51	85-01-8	
Pyrene	**<1.9**	ug/kg	3.6	1.9	1	01/30/13 12:43	02/21/13 15:51	129-00-0	
Surrogates									
2-Fluorobiphenyl (S)	82	%.	59-130		1	01/30/13 12:43	02/21/13 15:51	321-60-8	
Terphenyl-d14 (S)	84	%.	51-130		1	01/30/13 12:43	02/21/13 15:51	1718-51-0	

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #4 MUSCLE -RE **Lab ID: 4072304014** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**1.9J**	ug/kg	3.4	1.6	1	01/30/13 12:43	02/21/13 16:15	120-12-7	
Benzo(a)anthracene	**<1.8**	ug/kg	3.4	1.8	1	01/30/13 12:43	02/21/13 16:15	56-55-3	
Benzo(a)pyrene	**<1.7**	ug/kg	3.4	1.7	1	01/30/13 12:43	02/21/13 16:15	50-32-8	
Benzo(b)fluoranthene	**<1.9**	ug/kg	3.4	1.9	1	01/30/13 12:43	02/21/13 16:15	205-99-2	
Benzo(e)pyrene	**<3.4**	ug/kg	3.4	3.4	1	01/30/13 12:43	02/21/13 16:15	192-97-2	
Benzo(k)fluoranthene	**<1.7**	ug/kg	3.4	1.7	1	01/30/13 12:43	02/21/13 16:15	207-08-9	
Chrysene	**<1.8**	ug/kg	3.4	1.8	1	01/30/13 12:43	02/21/13 16:15	218-01-9	
Fluoranthene	**<2.3**	ug/kg	3.4	2.3	1	01/30/13 12:43	02/21/13 16:15	206-44-0	
Fluorene	**<1.6**	ug/kg	3.4	1.6	1	01/30/13 12:43	02/21/13 16:15	86-73-7	
Naphthalene	**2.0J**	ug/kg	3.4	1.6	1	01/30/13 12:43	02/21/13 16:15	91-20-3	
Phenanthrene	**<2.1**	ug/kg	3.4	2.1	1	01/30/13 12:43	02/21/13 16:15	85-01-8	
Pyrene	**<1.8**	ug/kg	3.4	1.8	1	01/30/13 12:43	02/21/13 16:15	129-00-0	
Surrogates									
2-Fluorobiphenyl (S)	81	%.	59-130		1	01/30/13 12:43	02/21/13 16:15	321-60-8	
Terphenyl-d14 (S)	85	%.	51-130		1	01/30/13 12:43	02/21/13 16:15	1718-51-0	

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Sample: FISH #5 MUSCLE -RE **Lab ID: 4072304015** Collected: 10/24/12 10:00 Received: 12/22/12 13:10 Matrix: Tissue

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8270 MSSV PAH in Tissue	Analytical Method: EPA 8270 by SIM Preparation Method: EPA 3540								
Anthracene	**1.2J**	ug/kg	2.3	1.1	1	01/30/13 12:43	02/21/13 16:39	120-12-7	
Benzo(a)anthracene	**<1.2**	ug/kg	2.3	1.2	1	01/30/13 12:43	02/21/13 16:39	56-55-3	
Benzo(a)pyrene	**<1.1**	ug/kg	2.3	1.1	1	01/30/13 12:43	02/21/13 16:39	50-32-8	
Benzo(b)fluoranthene	**<1.3**	ug/kg	2.3	1.3	1	01/30/13 12:43	02/21/13 16:39	205-99-2	
Benzo(e)pyrene	**<2.3**	ug/kg	2.3	2.3	1	01/30/13 12:43	02/21/13 16:39	192-97-2	
Benzo(k)fluoranthene	**<1.1**	ug/kg	2.3	1.1	1	01/30/13 12:43	02/21/13 16:39	207-08-9	
Chrysene	**<1.2**	ug/kg	2.3	1.2	1	01/30/13 12:43	02/21/13 16:39	218-01-9	
Fluoranthene	**<1.5**	ug/kg	2.3	1.5	1	01/30/13 12:43	02/21/13 16:39	206-44-0	
Fluorene	**<1.1**	ug/kg	2.3	1.1	1	01/30/13 12:43	02/21/13 16:39	86-73-7	
Naphthalene	**<1.1**	ug/kg	2.3	1.1	1	01/30/13 12:43	02/21/13 16:39	91-20-3	
Phenanthrene	**<1.4**	ug/kg	2.3	1.4	1	01/30/13 12:43	02/21/13 16:39	85-01-8	
Pyrene	**<1.2**	ug/kg	2.3	1.2	1	01/30/13 12:43	02/21/13 16:39	129-00-0	
Surrogates									
2-Fluorobiphenyl (S)	79	%.	59-130		1	01/30/13 12:43	02/21/13 16:39	321-60-8	
Terphenyl-d14 (S)	80	%.	51-130		1	01/30/13 12:43	02/21/13 16:39	1718-51-0	

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

QC Batch: OEXT/17278 Analysis Method: EPA 8270 by SIM
QC Batch Method: EPA 3540 Analysis Description: 8270 Tissue PAH by SIM MSSV
Associated Lab Samples: 4072304001, 4072304002, 4072304003, 4072304004, 4072304005, 4072304006, 4072304007, 4072304008, 4072304009, 4072304010

METHOD BLANK: 733037 Matrix: Tissue
Associated Lab Samples: 4072304001, 4072304002, 4072304003, 4072304004, 4072304005, 4072304006, 4072304007, 4072304008, 4072304009, 4072304010

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Anthracene	ug/kg	<0.77	1.7	01/08/13 11:59	
Benzo(a)anthracene	ug/kg	<0.85	1.7	01/08/13 11:59	
Benzo(a)pyrene	ug/kg	<0.81	1.7	01/08/13 11:59	
Benzo(b)fluoranthene	ug/kg	<0.93	1.7	01/08/13 11:59	
Benzo(e)pyrene	ug/kg	<1.7	1.7	02/07/13 08:46	
Benzo(k)fluoranthene	ug/kg	<0.81	1.7	01/08/13 11:59	
Chrysene	ug/kg	<0.87	1.7	01/08/13 11:59	
Fluoranthene	ug/kg	<1.1	1.7	01/08/13 11:59	
Fluorene	ug/kg	<0.76	1.7	01/08/13 11:59	
Naphthalene	ug/kg	1.9	1.7	01/08/13 11:59	
Phenanthrene	ug/kg	<1.0	1.7	01/08/13 11:59	
Pyrene	ug/kg	<0.88	1.7	01/08/13 11:59	
2-Fluorobiphenyl (S)	%.	85	59-130	01/08/13 11:59	
Terphenyl-d14 (S)	%.	92	59-130	01/08/13 11:59	

LABORATORY CONTROL SAMPLE & LCSD: 733038 733039

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Anthracene	ug/kg	33.3	32.8	47.5	99	143	41-130	37	40	L0
Benzo(a)anthracene	ug/kg	33.3	39.0	54.8	117	164	50-130	34	40	L0
Benzo(a)pyrene	ug/kg	33.3	37.7	52.2	113	157	50-130	32	40	L0
Benzo(b)fluoranthene	ug/kg	33.3	43.7	58.9	131	177	50-130	30	40	L0
Benzo(e)pyrene	ug/kg	33.3	40.7	56.7	122	170	50-140	33	40	L0
Benzo(k)fluoranthene	ug/kg	33.3	34.6	49.9	104	150	50-130	36	40	L0
Chrysene	ug/kg	33.3	33.1	46.0	99	138	55-130	33	40	L0
Fluoranthene	ug/kg	33.3	36.8	51.3	110	154	51-130	33	40	L0
Fluorene	ug/kg	33.3	35.0	53.4	105	160	55-130	42	40	D6,L0
Naphthalene	ug/kg	33.3	37.1	48.0	111	144	47-130	26	40	L0
Phenanthrene	ug/kg	33.3	38.2	54.9	115	165	49-130	36	40	L0
Pyrene	ug/kg	33.3	36.0	50.3	108	151	46-130	33	40	L0
2-Fluorobiphenyl (S)	%.				86	90	59-130			
Terphenyl-d14 (S)	%.				93	98	59-130			

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

QC Batch: OEXT/17442 Analysis Method: EPA 8270 by SIM
QC Batch Method: EPA 3540 Analysis Description: 8270 Tissue PAH by SIM MSSV
Associated Lab Samples: 4072304011, 4072304012, 4072304013, 4072304014, 4072304015

METHOD BLANK: 743693 Matrix: Tissue
Associated Lab Samples: 4072304011, 4072304012, 4072304013, 4072304014, 4072304015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Anthracene	ug/kg	0.85J	1.7	02/21/13 13:52	
Benzo(a)anthracene	ug/kg	<0.85	1.7	02/21/13 13:52	
Benzo(a)pyrene	ug/kg	<0.81	1.7	02/21/13 13:52	
Benzo(b)fluoranthene	ug/kg	<0.93	1.7	02/21/13 13:52	
Benzo(e)pyrene	ug/kg	<1.7	1.7	02/21/13 13:52	
Benzo(k)fluoranthene	ug/kg	<0.81	1.7	02/21/13 13:52	
Chrysene	ug/kg	<0.87	1.7	02/21/13 13:52	
Fluoranthene	ug/kg	<1.1	1.7	02/21/13 13:52	
Fluorene	ug/kg	<0.76	1.7	02/21/13 13:52	
Naphthalene	ug/kg	<0.76	1.7	02/21/13 13:52	
Phenanthrene	ug/kg	<1.0	1.7	02/21/13 13:52	
Pyrene	ug/kg	<0.88	1.7	02/21/13 13:52	
2-Fluorobiphenyl (S)	%.	84	59-130	02/21/13 13:52	
Terphenyl-d14 (S)	%.	87	51-130	02/21/13 13:52	

LABORATORY CONTROL SAMPLE & LCSD: 743694 743695

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Anthracene	ug/kg	33.3	22.6	23.6	68	71	41-130	4	40	
Benzo(a)anthracene	ug/kg	33.3	24.9	26.0	75	78	50-130	4	40	
Benzo(a)pyrene	ug/kg	33.3	23.3	23.9	70	72	50-130	2	40	
Benzo(b)fluoranthene	ug/kg	33.3	26.8	26.9	80	81	50-130	0	40	
Benzo(e)pyrene	ug/kg	33.3	22.7	23.1	68	69	50-140	2	40	
Benzo(k)fluoranthene	ug/kg	33.3	26.9	27.6	81	83	50-130	3	40	
Chrysene	ug/kg	33.3	23.8	24.3	71	73	55-130	2	40	
Fluoranthene	ug/kg	33.3	24.5	25.4	73	76	51-130	4	40	
Fluorene	ug/kg	33.3	25.1	26.7	75	80	55-130	6	40	
Naphthalene	ug/kg	33.3	20.1	20.6	60	62	47-130	2	40	
Phenanthrene	ug/kg	33.3	24.8	25.6	74	77	49-130	3	40	
Pyrene	ug/kg	33.3	23.0	26.8	69	80	46-130	15	40	
2-Fluorobiphenyl (S)	%.				76	77	59-130			
Terphenyl-d14 (S)	%.				80	83	51-130			

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

QC Batch: OEXT/17253
Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87
Analysis Description: Dry Weight Reporting Only
Associated Lab Samples: 4072304001, 4072304002, 4072304003, 4072304004, 4072304005, 4072304006, 4072304007, 4072304008, 4072304009, 4072304010

SAMPLE DUPLICATE: 731959

Parameter	Units	4072304001 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	74.4	74.8	1	10	

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

QC Batch: OEXT/17283 Analysis Method: Pace Lipid
QC Batch Method: Pace Lipid Analysis Description: LIPID
Associated Lab Samples: 4072304001, 4072304002, 4072304003, 4072304004, 4072304005, 4072304006, 4072304007, 4072304008, 4072304009, 4072304010

METHOD BLANK: 733217 Matrix: Tissue
Associated Lab Samples: 4072304001, 4072304002, 4072304003, 4072304004, 4072304005, 4072304006, 4072304007, 4072304008, 4072304009, 4072304010

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Lipid	%	0.62		01/04/13 07:47	

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALIFIERS

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PRL - Pace Reporting Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

BATCH QUALIFIERS

Batch: OEXT/17283

[1] Not enough sample volume for MS, MSD. Ran LCS, LCSD.

Batch: MSSV/5333

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

[1] Many compounds failed high in the LCSD; this caused many RPD failures between LCS and LCSD. Any sample that has additional mass will be re-extracted.

Batch: MSSV/5402

[IP] Benzo(b)fluoranthene and benzo(k)fluoranthene were in the check standard but did not meet the resolution criteria in SW846 Method 8270C. Whereas sample results included are reported as individual isomers, the lab and the customer must recognize them as an isomeric pair.

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

ANALYTE QUALIFIERS

B Analyte was detected in the associated method blank.

D6 The relative percent difference (RPD) between the sample and sample duplicate exceeded laboratory control limits.

L0 Analyte recovery in the laboratory control sample (LCS) was outside QC limits.

L1 Analyte recovery in the laboratory control sample (LCS) was above QC limits. Results may be biased high.

L3 Analyte recovery in the laboratory control sample (LCS) exceeded QC limits. Analyte presence below reporting limits in associated samples. Results unaffected by high bias.

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: COLVILLE FALL FISHERY
Pace Project No.: 4072304

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
4072304001	**FISH #1 MUSCLE**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304002	**FISH #1 LIVER**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304003	**FISH #2 MUSCLE**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304004	**FISH #2 LIVER**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304005	**FISH #3 MUSCLE**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304006	**FISH #3 LIVER**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304007	**FISH #4 MUSCLE**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304008	**FISH #4 LIVER**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304009	**FISH #5 MUSCLE**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304010	**FISH #5 LIVER**	EPA 3540	OEXT/17278	EPA 8270 by SIM	MSSV/5333
4072304011	**FISH #1 MUSCLE -RE**	EPA 3540	OEXT/17442	EPA 8270 by SIM	MSSV/5402
4072304012	**FISH #2 MUSCLE -RE**	EPA 3540	OEXT/17442	EPA 8270 by SIM	MSSV/5402
4072304013	**FISH #3 MUSCLE -RE**	EPA 3540	OEXT/17442	EPA 8270 by SIM	MSSV/5402
4072304014	**FISH #4 MUSCLE -RE**	EPA 3540	OEXT/17442	EPA 8270 by SIM	MSSV/5402
4072304015	**FISH #5 MUSCLE -RE**	EPA 3540	OEXT/17442	EPA 8270 by SIM	MSSV/5402
4072304001	**FISH #1 MUSCLE**	ASTM D2974-87	OEXT/17253		
4072304002	**FISH #1 LIVER**	ASTM D2974-87	OEXT/17253		
4072304003	**FISH #2 MUSCLE**	ASTM D2974-87	OEXT/17253		
4072304004	**FISH #2 LIVER**	ASTM D2974-87	OEXT/17253		
4072304005	**FISH #3 MUSCLE**	ASTM D2974-87	OEXT/17253		
4072304006	**FISH #3 LIVER**	ASTM D2974-87	OEXT/17253		
4072304007	**FISH #4 MUSCLE**	ASTM D2974-87	OEXT/17253		
4072304008	**FISH #4 LIVER**	ASTM D2974-87	OEXT/17253		
4072304009	**FISH #5 MUSCLE**	ASTM D2974-87	OEXT/17253		
4072304010	**FISH #5 LIVER**	ASTM D2974-87	OEXT/17253		
4072304001	**FISH #1 MUSCLE**	Pace Lipid	OEXT/17283		
4072304002	**FISH #1 LIVER**	Pace Lipid	OEXT/17283		
4072304003	**FISH #2 MUSCLE**	Pace Lipid	OEXT/17283		
4072304004	**FISH #2 LIVER**	Pace Lipid	OEXT/17283		
4072304005	**FISH #3 MUSCLE**	Pace Lipid	OEXT/17283		
4072304006	**FISH #3 LIVER**	Pace Lipid	OEXT/17283		
4072304007	**FISH #4 MUSCLE**	Pace Lipid	OEXT/17283		
4072304008	**FISH #4 LIVER**	Pace Lipid	OEXT/17283		
4072304009	**FISH #5 MUSCLE**	Pace Lipid	OEXT/17283		
4072304010	**FISH #5 LIVER**	Pace Lipid	OEXT/17283		