FALL 2011 SUBSISTENCE FISHERY MONITORING ON THE COLVILLE RIVER

PREPARED FOR

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FINAL REPORT

Prepared for

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INTRODUCTION

In 2011, ABR worked with key fishery stakeholders in Nuiqsut, Alaska, to monitor the Colville River subsistence fishery, which is conducted each fall after freeze-up in the Niġliq Channel of the Colville River. The 2011 monitoring program was 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 focuses on arctic cisco (*Coregonus autumnalis*; *Qaaktaq*, in Iñupiaq), which are a staple in the diet of Nuiqsut residents. 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 issues associated with the fishery.

Prior to implementing a new monitoring program in 2007, CPAI hosted several community meetings seeking (1) to reaffirm support for the monitoring program among the primary stakeholders (i.e., the Nuiqsut fishers, the Kuukpik Subsistence Oversight Panel, Inc. [KSOPI], the North Slope Borough [NSB] Department of Wildlife Management, and CPAI), and (2) to gain consensus on how the monitoring program should be implemented and managed. This process was successful, 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 2011 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 has long been predicted that 2011 would be a year with an above-average harvest of arctic cisco (Larry Moulton 2008, personal communication).

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). Until recently, a commercial arctic cisco fishery operated by the Helmericks family also was active on the Main Channel of the Colville River. 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 29 June 2011 at the KSOPI office in Nuiqsut. The purpose of this meeting was to (1) summarize the 2010 fishing season and report results comparing 2010 harvest information to historical records, (2) continue to work with active fishers to get their perspective on the upcoming 2011 fall fishery, and (3) collect comments from the panel highlighting their concerns about the fishery to relay to CPAI. John Seigle of ABR presented 2010 harvest data to the panel and there was as open discussion covering a broad array of topics. Meeting attendees were: Lydia Sovalik, Dwayne Hopson, Sr., Sam Kunaknana, Frank Oyagak, Jr, Dora Leavitt, Robert Lampe, Edward Nukapigak, and Jonah Nukapigak; ABR scientist, John Seigle; and KSOPI representative, Eunice Brower.

Notes on the community meetings held in June 2011 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

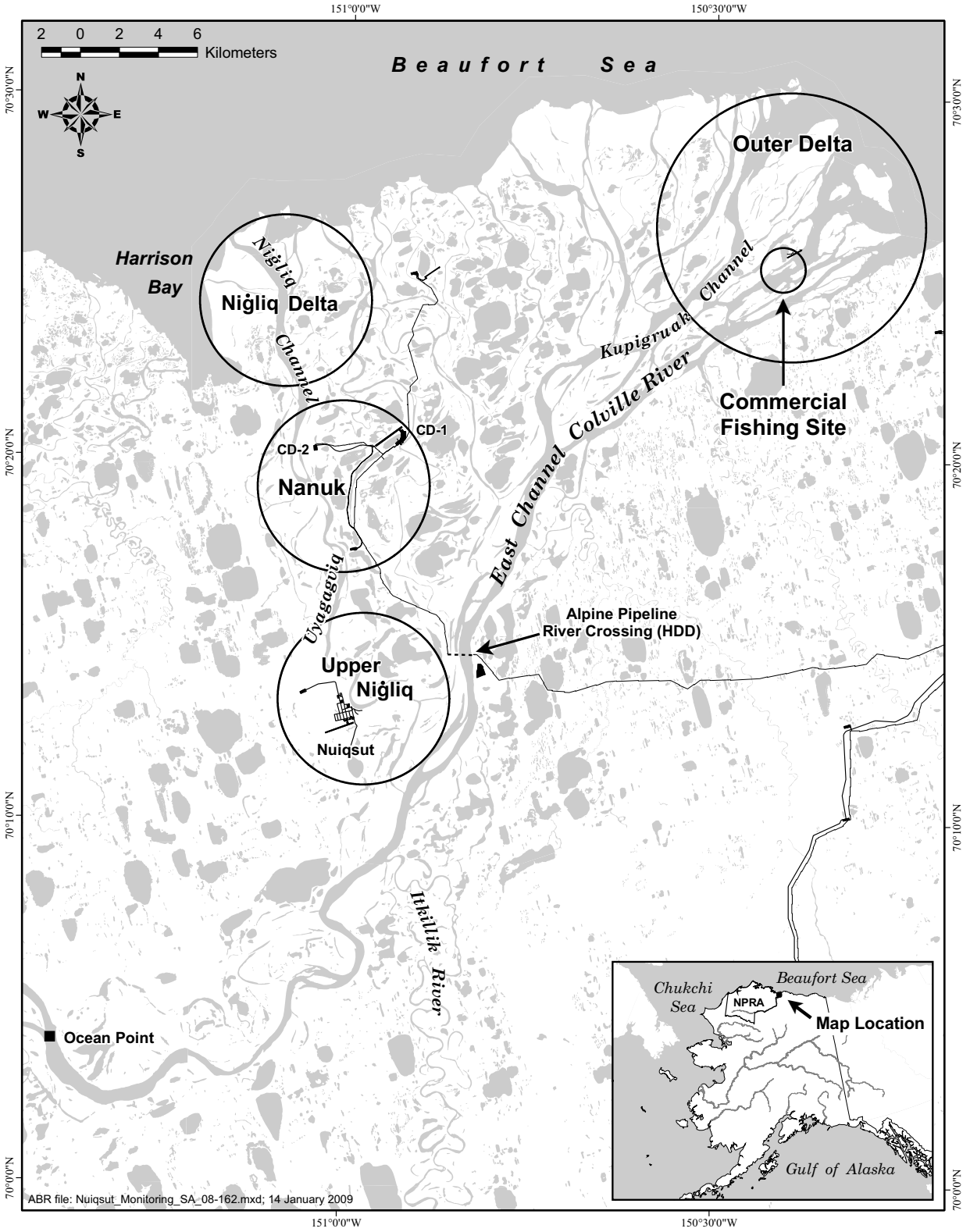

Figure 1. Historically used subsistence fishing areas in the Niġliq Channel and the commercial/subsistence fishing area in the Main Channel used for harvesting arctic cisco in the Colville River delta (after Moulton and Seavey 2004).

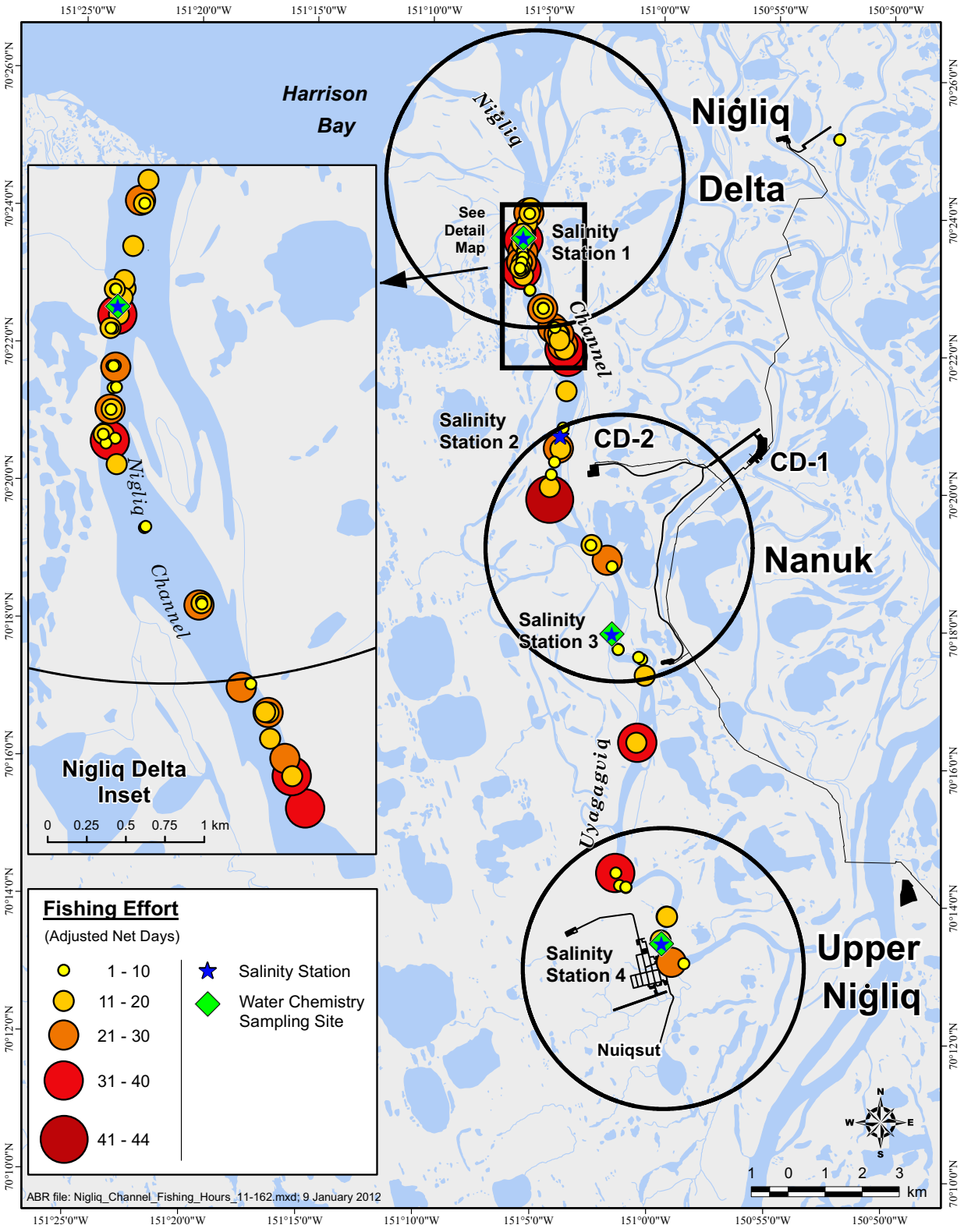

Figure 2. Salinity stations (4), water chemistry sampling sites (3) and net sites in each of the 3 main subsistence fishing areas in the Nigliq Channel of the Colville River, 2011. The amount of effort for each net set (adjusted net days) is depicted by both color and the size of the net symbol.

traditionally used area, the Uyagagviq area (Figure 2), was minimally fished in 2011. For the second consecutive year, fishing effort also was observed in the Main Channel of the Colville River following years of no fall harvest effort in that area of the Colville delta.

The harvest monitoring team always included 2 scientists from ABR. The remaining team members were local residents of Nuiqsut: Jerry Pausanna, Richard Tukle, and Isiah Nukapigak. 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 inches). CPUE was calculated only 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 2011, ABR created and distributed a "North Slope Fisheries Logbook" to interested fishers (Appendix B). These books were distributed to fishers to assist them in tracking their personal harvests year-round. Several fishers chose to share their daily harvest information throughout the fall fishing season, bolstering ABR's observational efforts.

LENGTH, WEIGHT, AND AGE OF CATCH

After fish were removed from each net they were enumerated and a sub-sample was measured for fork length (to the nearest mm). The harvest from each specific net was enumerated separately.

The standard routine for sub-sampling from each net's catch was to lay out all fish of each species side-by-side on the ice in no particular order. Depending on the number of fish in the harvest and the amount of time available for the interview, monitors measured every second, third, or fourth fish from a 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 fee to fishers who were willing to donate a sub-sample of fish (~10/day at $10/fish). The monitoring team only accepted donated fish from nets of known mesh size and were 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.

The break-and-burn technique was used to prepare otoliths for ageing (n = 178) (Chilton and Beamish 1982). Otoliths were broken in half along the transverse axis using a sharp scalpel or by pressing the otolith between a fingernail and forefinger. The broken edge of each otolith was held over an open flame for several seconds until it acquired an amber color. The otolith half was then placed broken-edge up in putty and the surface was brushed with mineral oil to emphasize the growth rings under magnification. The sample was examined under reflected light on a dissecting scope with 10–40× magnification. Alternating bands of dark and light 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.

SALINITY MEASUREMENTS AND WATER QUALITY

Water salinity was measured every other day (weather permitting) at 4 salinity sampling stations that corresponded to areas of intense fishing (Figure 2). 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. On 2 dates, 30 October and 15 November, ABR collected water samples for 3 analyses conducted by Arctic Fox Environmental, Inc., in Prudhoe Bay, Alaska. Samples were collected at the salinity stations in the Niġliq Delta fishing area near Woods' Camp, in the Nanuk fishing area and in the Upper Niġliq fishing area closest to Nuiqsut. Water samples were collected at a depth of 3 meters using a van Dorn 4.2 l, β acrylic horizontal water column sampler. Water sample aliquiots were poured directly from the sampler into pre-rinsed glass and polypropylene bottles provided by Arctic Fox and were held under refrigeration until shipment to Pruhdoe Bay. Analyses included total metals (mercury, arsenic, barium, cadmium, chromium, lead, selenium and silver, method EPA747OA, EPA 6020), total nitrogen (NO3 + NO2) (EPA 353.2), diesel-range organics and heavy oil (EPA1664) and algal fragment enumeration (algal fragments/100 ml of H_2O). Algal fragment enumeration was completed by an ABR algal taxonomist by examining Whatman GF/C 1.2 µm pore size filters at 200× magnification (Leica CME microscope) through which 100 ml of a homogenized water sample had been filtered. All algal fragments on the filter were enumerated.

RESULTS

FISHERY EFFORT AND HARVEST

In 2011, the arctic cisco subsistence harvest began on 13 October shortly after freeze up on the Colville River delta, according to interviews conducted on the ice (Table 1). The onset of fishing was delayed by warm temperatures and resulting unstable ice conditions, forcing overland travel to reach several favored fishing locations in the Niġliq Delta fishing area (Figure 1) early in the season. ABR harvest monitors recorded 334 unique harvest events in 2011. Thirty-one households deployed 70 nets during the fall fishery in 2011 (Table 2, Figure 3), 5 fewer nets than were deployed in 2010 but well above the average and median numbers deployed since 1986 (mean = 56, median = 56). The total number of nets set in 2011 was the second highest number deployed since 2004. Seventy-eight sets of 63 unique nets were set in the Niġliq Channel in 2011 (Table 2). An additional 11 net sets were located in the Main Channel, where fishing began on 29 October and ceased on 30 November.

At least 10 nets were deployed in the Niġliq Channel on 13 October and numbers rose steadily during the first 2 weeks of the fishing season (Table 2, Figure 4). Niġliq Channel nets increased from 14 to 30 from 13–23 October, peaking at 41 nets on 31 October. The number of active nets leveled off at ~40 between 31 October and 5 November. Peak net activity on the Niġliq Channel in 2011 occurred approximately 1 week earlier than in 2010. Fishing effort began to decline sharply around 6 November. At the time of ABR's departure from Nuiqsut on 21 November 2011, only 3 nets were actively fishing the Niġliq Channel (compared to ~30 active nets on 21 November 2010). After standardizing for net length, a total of 1,232 adjusted net-days of fishing effort were calculated for 2011 in the Niġliq and Main channels, 1,136 in the Niġliq Channel and 96 in the Main Channel (Table 2). This represents a 47% decrease in fishing effort compared to 2010. In the Niġliq Channel, fishing effort was highest in the Niġliq Delta area at 64% of total, followed by the Nanuk area at 25% of total and the Upper Niġliq at 11% of total (Figure 5).

Table 1. Estimated onset of the fall subsistence fishery in the Niġliq Channel of the Colville River, Alaska, 1985–2011.

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
Average	7 Oct

The most frequently deployed mesh size of nets in the Nuiqsut fall fishery has traditionally been 7.6 cm and this continued in 2011. Thirty-six of 63 nets deployed in 2011 in the Niġliq Channel were 7.6-cm mesh nets (Table 2). In the Niġliq Channel, 14,671 arctic cisco were documented during harvest monitoring in 7.6-cm mesh nets, the highest in 25 years of monitoring (Table 3, Figure 6) and nearly 200% higher than the long-term Niġliq Channel average of 4,995 arctic cisco documented between 1986 and 2010 in 7.6-cm mesh nets. The total documented harvest in 7.6-cm mesh nets increased in all 3 major fishing areas of the Niġlig Channel compared to 2010 (Table 3).

Table 2. Total adjusted fishing effort recorded for the 2011 fall fishery, Niġliq 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
4	Niġliq	A	114A1	24.4	11/2/11	11/14/11	7.6	12	16.0
4	Niġliq	B	114B1	24.4	11/2/11	11/21/11	7.6	19	25.3
4	Main	C	114C1	24.4	11/3/11	11/4/11	8.9	1	1.3
4	Niġliq	C	114C2	24.4	11/4/11	11/10/11	8.9	6	8.0
4	Main	D	114D1	18.3	11/3/11	11/5/11	7.6	2	2.0
4	Niġliq	D	114D2	18.3	11/5/11	11/10/11	7.6	5	5.0
6	Niġliq	A	116A1	24.4	10/27/11	11/7/11	7.0	11	14.7
7	Nanuq	A	117A1	24.4	10/15/11	10/23/11	7.6	8	10.7
7	Niġliq	B	117B1	18.3	10/23/11	11/13/11	7.6	21	21.0
7	Niġliq	C	117C1	24.4	10/30/11	11/4/11	7.0	5	6.7
7	Niġliq	D	117D1	30.5	11/4/11	11/13/11	7.0	9	15.0
24	Nanuq	A	1124A1	18.3	10/13/11	10/18/11	7.6	5	5.0
24	Niġliq	A	1124A2	18.3	10/18/11	11/5/11	7.6	18	18.0
24	Nanuq	B	1124B1	18.3	10/13/11	10/18/11	7.6	5	5.0
24	Niġliq	B	1124B2	18.3	10/18/11	11/5/11	7.6	18	18.0
24	Nanuq	C	1124C1	24.4	10/13/11	10/23/11	7.6	10	13.3
24	Main	C	1124C2	24.4	11/24/11	11/30/11	7.6	6	8.0
24	Nanuq	D	1124D1	18.3	10/13/11	10/23/11	7.6	10	10.0
25	Niġliq	A	1125A1	30.5	10/27/11	11/13/11	7.6	17	28.3
25	Niġliq	B	1125B1	18.3	10/28/11	11/13/11	8.9	16	16.0
25	Niġliq	C	1125C1	18.3	11/7/11	11/13/11	7.6	6	6.0
27	Upper Niġliq	A	1127A1	15.2	10/15/11	10/18/11	7.6	3	2.5
27	Upper Niġliq	A	1127A2	15.2	10/24/11	10/31/11	7.6	7	5.8
27	Upper Niġliq	B	1127B1	12.2	10/31/11	11/20/11	7.6	20	13.3
28	Nanuq	A	1128A1	24.4	10/15/11	10/30/11	7.0	15	20.0
28	Niġliq	A	1128A2	24.4	11/2/11	11/16/11	7.0	14	18.7
30	Nanuq	A	1130A1	30.5	10/18/11	11/13/11	7.0	26	43.3
31	Nanuq	A	1131A1	24.4	11/4/11	11/13/11	7.0	9	12.0
31	Nanuq	B	1131B1	18.3	11/11/11	11/13/11	7.0	2	2.0
32	Nanuq	A	1132A1	24.4	10/20/11	10/31/11	7.0	11	14.7
32	Nanuq	A	1132A2	24.4	10/31/11	11/5/11	7.0	5	6.7
32	Nanuq	B	1132B1	24.4	10/31/11	11/5/11	7.6	5	6.7
33	Upper Niġliq	A	1133A1	30.5	10/16/11	11/9/11	7.0	24	40.0
33	Upper Niġliq	B	1133B1	30.5	10/16/11	10/18/11	5.1	2	3.3
51	Niġliq	A	1151A1	18.3	10/22/11	11/7/11	7.6	16	16.0
51	Niġliq	B	1151B1	30.5	10/22/11	10/27/11	6.4	5	8.3
51	Niġliq	C	1151C1	12.2	10/27/11	11/7/11	8.9	11	7.3
56	Niġliq	A	1156A1	24.4	10/20/11	11/2/11	7.6	13	17.3
56	Niġliq	B	1156B1	24.4	10/15/11	11/2/11	7.6	18	24.0
63	Niġliq	A	1163A1	30.5	10/27/11	11/20/11	7.6	24	40.0
63	Niġliq	B	1163B1	24.4	10/27/11	11/3/11	7.0	7	9.3
65	Nanuq	A	1165A1	18.3	10/22/11	10/29/11	7.6	7	7.0
65	Niġliq	A	1165A2	18.3	10/30/11	10/31/11	7.6	1	1.0
65	Niġliq	A	1165A3	18.3	11/5/11	11/20/11	7.6	15	15.0
65	Nanuq	B	1165B1	24.4	10/21/11	11/7/11	8.9	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	C	1165C1	24.4	10/27/11	10/31/11	7.6	4	5.3
66	Upper Niġliq	A	1166A1	24.4	10/28/11	11/10/11	8.9	13	17.3
66	Upper Niġliq	B	1166B1	24.4	10/29/11	11/10/11	8.9	12	16.0
69	Niġliq	A	1169A1	24.4	10/14/11	11/7/11	8.9	24	32.0
69	Niġliq	B	1169B1	24.4	10/14/11	10/29/11	7.6	15	20.0
70	Niġliq	A	1170A1	24.4	10/13/11	10/17/11	7.6	4	5.3
70	Niġliq	B	1170B1	30.5	10/13/11	10/17/11	7.6	4	6.7
70	Niġliq	C	1170C1	30.5	10/14/11	10/17/11	7.6	3	5.0
72	Nanuq	A	1172A1	24.4	10/15/11	11/13/11	7.6	29	38.7
72	Main	B	1172B1	24.4	11/20/11	11/30/11	7.6	10	13.3
72	Main	C	1172C1	24.4	11/20/11	11/30/11	7.6	10	13.3
77	Upper Niġliq	A	1177A1	12.2	10/24/11	11/25/11	6.4	32	21.3
78	Niġliq	A	1178A1	18.3	10/19/11	11/7/11	7.6	19	19.0
78	Niġliq	B	1178B1	24.4	10/19/11	11/7/11	8.9	19	25.3
79	Nanuq	A	1179A1	24.4	10/24/11	11/6/11	7.6	13	17.3
82	Niġliq	A	1182A1	24.4	10/13/11	10/19/11	7.6	6	8.0
82	Main	A	1182A2	24.4	10/31/11	11/9/11	7.6	9	12.0
82	Niġliq	B	1182B1	18.3	10/13/11	10/19/11	8.9	6	6.0
82	Main	B	1182B2	18.3	10/31/11	11/9/11	8.9	9	9.0
82	Niġliq	C	1182C1	24.4	10/13/11	10/19/11	7.6	6	8.0
82	Main	C	1182C2	24.4	10/31/11	11/9/11	7.6	9	12.0
82	Main	D	1182D1	24.4	10/31/11	11/9/11	7.6	9	12.0
84	Upper Niġliq	A	1184A1	24.4	10/22/11	10/27/11	7.6	5	6.7
84	Niġliq	A	1184A2	24.4	10/27/11	11/16/11	7.6	20	26.7
84	Niġliq	A	1184A3	24.4	11/16/11	11/20/11	7.6	4	5.3
86	Main	A	1186A1	30.5	10/29/11	11/2/11	7.6	4	6.7
86	Main	B	1186B1	30.5	10/29/11	11/2/11	6.4	4	6.7
87	Nanuq	A	1187A1	24.4	10/24/11	10/27/11	7.6	3	4.0
87	Niġliq	A	1187A2	24.4	10/27/11	11/21/11	7.6	25	33.3
87	Nanuq	B	1187B1	18.3	10/23/11	10/27/11	7.6	4	4.0
87	Niġliq	B	1187B2	18.3	10/27/11	11/14/11	7.6	18	18.0
88	Nanuq	A	1188A1	24.4	10/14/11	10/18/11	8.3	4	5.3
88	Niġliq	A	1188A2	24.4	10/22/11	11/10/11	8.3	19	25.3
88	Nanuq	B	1188B1	24.4	10/14/11	10/18/11	7.6	4	5.3
88	Niġliq	B	1188B2	24.4	10/22/11	10/25/11	7.6	3	4.0
88	Niġliq	C	1188C1	18.3	10/23/11	11/10/11	7.6	18	18.0
89	Niġliq	A	1189A1	24.4	10/15/11	11/11/11	7.0	27	36.0
89	Niġliq	B	1189B1	24.4	10/31/11	11/7/11	7.6	7	9.3
93	Niġliq	A	1193A1	24.4	10/20/11	10/22/11	6.4	2	2.7
93	Nanuq	B	1193B1	24.4	10/23/11	11/13/11	8.9	21	28.0
94	Niġliq	A	1194A1	30.5	10/13/11	10/20/11	6.4	7	11.7
94	Niġliq	B	1194B1	18.3	10/14/11	10/20/11	8.3	6	6.0
95	Niġliq	A	1195A1	18.3	10/18/11	11/6/11	7.6	19	19.0
95	Niġliq	B	1195B1	18.3	10/20/11	11/6/11	7.6	17	17.0
Total									1,232.3

Figure 3. The number of gill nets deployed annually in the Colville River, Alaska, fall subsistence fishery, 1986–2011.

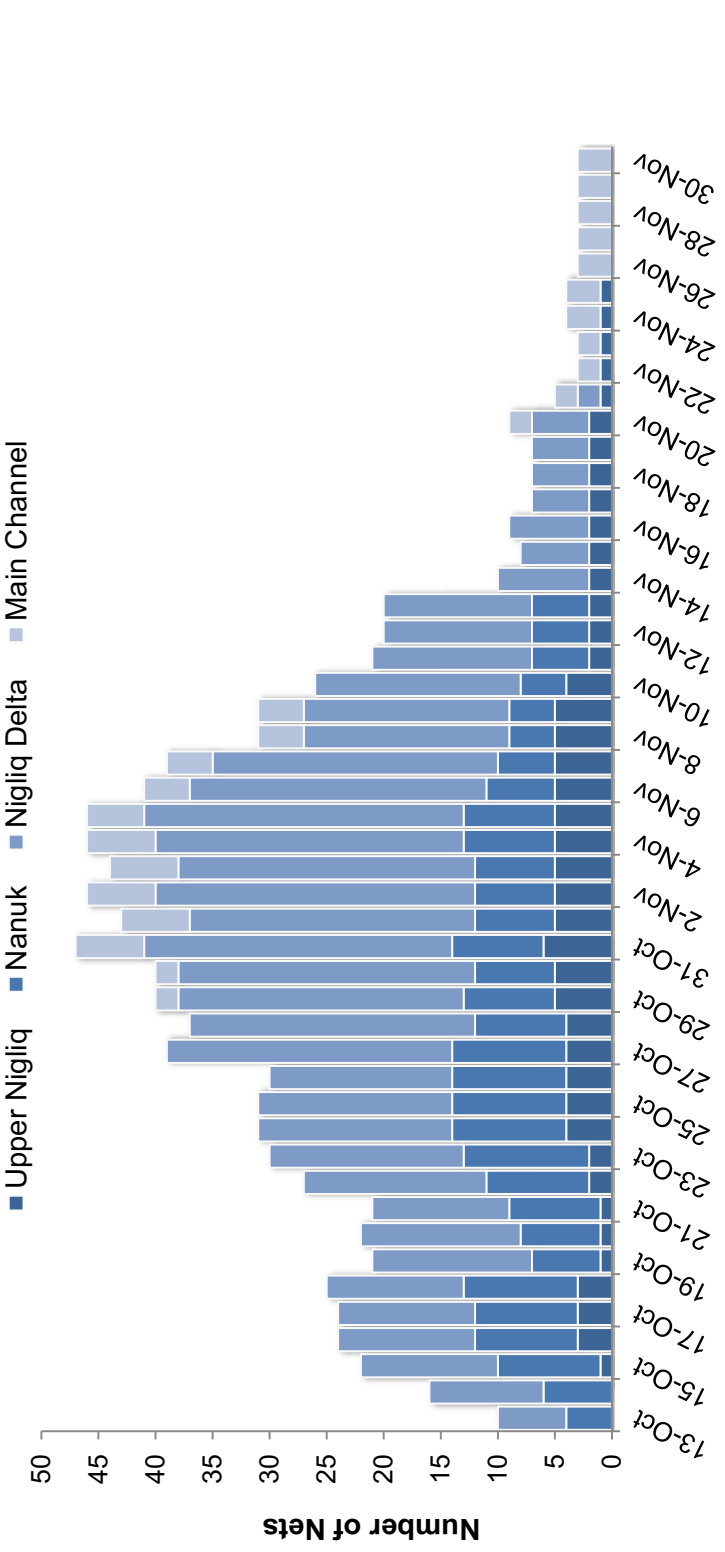

Figure 4. Number of nets fishing each day in each of three Nigliq Channel fishing areas and in the Main Channel, Colville River, 2011.

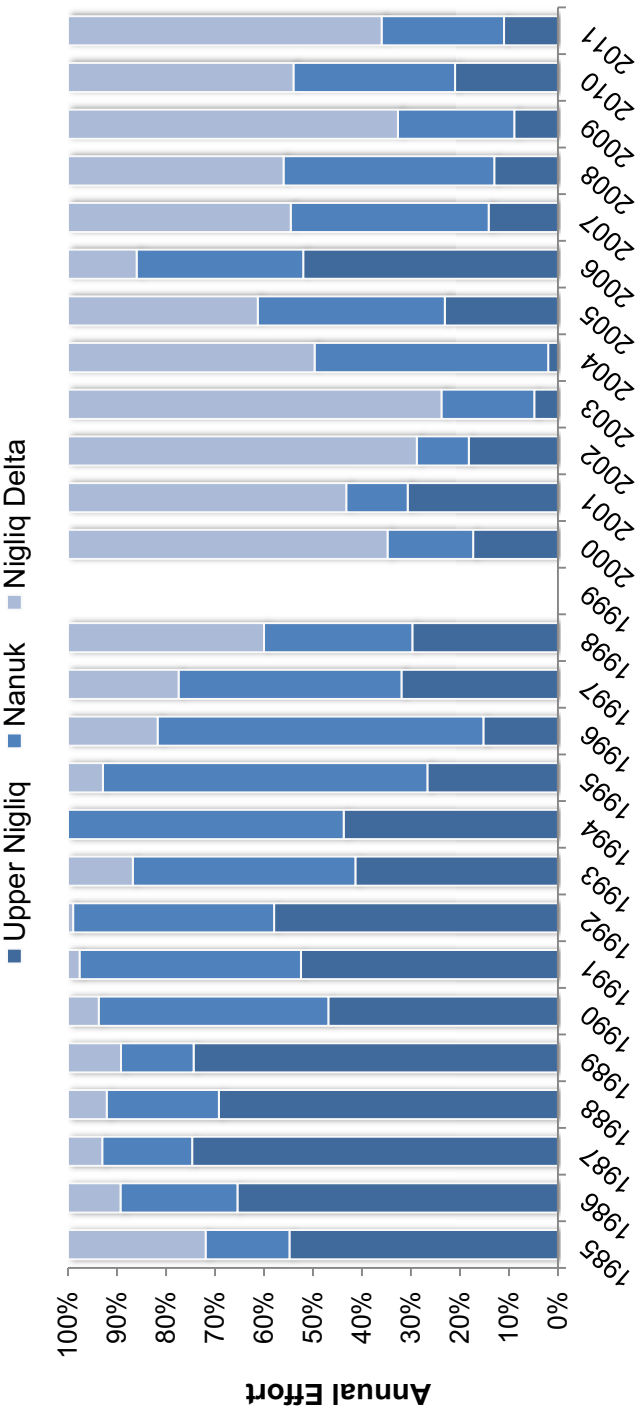

Figure 5. The percentage of annual fishing effort in each of three Niġliq Channel, Colville River fishing areas, 1985–2011. All nets are included, and the Uyagagviq area is combined with the Nanuk area.

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, 1986–2011. 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[b]	–	–	–	–	–	–	–	–	–	–	–	–
2000	8	8.0	1.0	217	62.0	3.5	1,826	190.4	9.6	2,051	260.4	7.9
2001	92	62.0	1.5	36	22.7	1.6	611	208.8	2.9	739	293.4	2.5
2002	103	115.7	0.9	137	36.7	3.7	2,925	460.9	6.3	3,165	613.2	5.2
2003	62	11.7	5.3	1,495	104.0	14.4	6,187	455.7	13.6	7,744	571.3	13.6
2004	338	22.0	15.4	8,102	270.9	29.9	5,021	199.7	25.1	13,461	492.6	27.3
2005	1,387	90.0	15.4	3,222	169.5	19.0	4,512	177.0	25.5	9,121	436.5	20.9
2006[a]	1,281	105.0	12.0	2,930	83.3	35.0	6,913	81.3	85.0	11,124	269.7	41.0
2007[a]	498	63.0	7.9	935	109.2	8.6	4,422	200.2	22.1	5,855	372.5	15.7
2008[a]	156	44.0	3.5	1,665	203.3	8.2	2,662	198.3	13.4	4,483	445.6	10.1
2009[a]	0	0.0	0.0	1,027	88.3	11.6	4,258	196.3	21.7	5,285	284.6	18.6
2010[a]	91	34.7	2.6	270	98.0	2.8	1,866	193.0	9.7	2,227	326.0	6.8
2011[a]	212	27.3	7.8	1,064	56.3	18.9	13,395	320.7	41.8	14,671	404.3	36.3
Total[c]	20,525	2087.6	9.8	42,355	2932.8	14.4	71,681	3434.0	20.9	134,561	8,454.8	15.9

[a] Upper Nigliq catch and effort values include fish and net data from the Uyagagviq area (Area 630).
[b] No data were collected in 1999.
[c] Denotes average CPUE from 1986–2011.

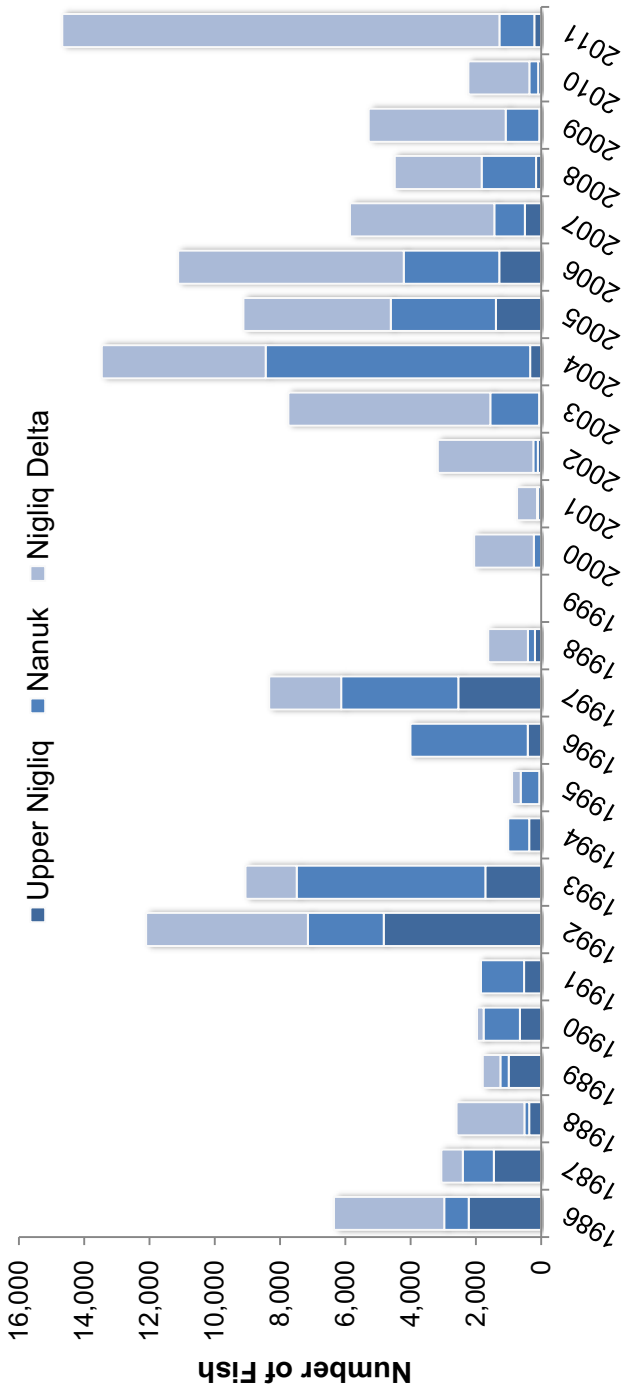

Figure 6. The observed number of arctic cisco harvested in 7.6 cm mesh gill nets in each of three Nigliq Channel fishing areas, 1986-2011. Data from 2005-2011 are not directly comparable to older data because the fishery was not monitored for the entire season.

An additional harvest of 1,533 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 2011 CPUE in 7.6-cm mesh nets for arctic cisco in Niġliq Channel was highest in the Niġliq Delta area (41.8 fish/adjusted net-day) followed by the Nanuk area (18.9 fish/adjusted net-day), and the Upper Niġliq area (7.8 fish/adjusted net-day) (Table 3). The total CPUE in 7.6-cm mesh nets for arctic cisco in the Niġliq Channel (36.3 fish/adjusted net-day) was the highest since 2006 and well above the 1986–2010 average of 15.4 fish/adjusted net-day (Table 3, Figure 7). CPUE in 7.6-cm net in the Main Channel was 43.0 fish/adjusted net-day (Table 4). In 2011, the daily average CPUE in 7.6-cm mesh nets in the Nigliq Channel exhibited 2 extreme peaks on 14 and 24 October with CPUE values of 126.9 and 129.7, respectively. The overall peak harvest period for arctic cisco was between 14 and 26 October, with an average CPUE of 87.7 fish/adjusted net-day (Figure 8).

A total of 22,941 arctic cisco were documented by the monitoring team in all mesh sizes combined for the Niġliq Channel (Table 4). The net-length adjusted CPUE for each individual mesh size from observed harvests in the Niġliq Channel reveals that harvest results varied widely from 12.1 fish/day in 8.9-cm mesh nets to 156.9 fish/day in 6.4-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 ~39,502 arctic cisco from the Niġliq Channel and ~3,774 from the Main Channel of the Colville River for an estimated harvest of ~43,276 arctic cisco in 2011 (Table 4).

In addition to arctic cisco, 6 other species of fish were documented in the Colville River fall fishery harvest in 2011 (Table 5). A total of 28,211 fish (all species and mesh sizes) were counted during interviews, with arctic cisco (94.8%) and least cisco (4.0%) comprising the bulk of the recorded harvest (Table 5). The proportion of least cisco in the observed harvest was the lowest since 1986 (3.8%) and the proportion of arctic cisco was the highest since 1986 (95.9%). Rainbow smelt (*Osmerus mordax*), saffron cod (*Eleginus gracilis*), Bering cisco (*Coregonus laurettae*), broad whitefish (*C. nasus*), and humpback whitefish (*C. pidschian*) were observed but comprised a negligible proportion of the harvest. The CPUE in the Niġliq Channel for least cisco in 2011 was slightly lower (1.7 fish/day) than it was in 2010 (1.9 fish/day) (Table 6). CPUE increased in a downstream direction with the highest CPUE (1.9 fish/adjusted net-day) occurring in the Niġliq Delta fishing area, an inverse of the 2010 results where the highest catch rates occurred in the Upper Niġliq fishing area (4.0 fish/day). The 2011 CPUE for least cisco in the Niġliq Channel was half of the long term average 1986–2010 (3.4 fish/day). No least cisco were reported from Main Channel interviews though were very likely present as by-catch in nets that were fishing.

LENGTH, WEIGHT, AND AGE OF CATCH

A sub-sample of fish were measured daily at net sites to determine the length distribution present in the fishery. ABR measured fork lengths of 1,914 arctic cisco in 2011 compared to 1,547 arctic cisco in 2010 and 2,277 in 2009. Fish ranged in length from 208 to 393 mm (Figure 9). The middle 50% of fish ranged between 296 and 322 mm as compared to a middle 50% of 280 to 331 mm in 2010 and 308 to 333 mm in 2009. The median fork length was 310 mm (compared to a median of 296 mm in 2010) and the length distribution of arctic cisco appears normally distributed about the median. The length distribution of arctic cisco captured was similar to years past among mesh sizes, though 5.1-cm mesh size nets captured a larger class of fish than in recent years, indicating larger fish were present in the fishery as a whole (Figure 10). The proportional harvest of least cisco was one of the lowest on record and ABR measured fork lengths of only 83 least cisco in 2011 (Figure 9). The length distribution for least cisco in 2011 also was normally distributed and ranged from 250 mm to 366 mm with a median of 316 mm, as compared to range of lengths in 2010 from 204 mm to 403 mm and a median fork length of 322 mm. The middle 50% of the measured harvest was between 300 and

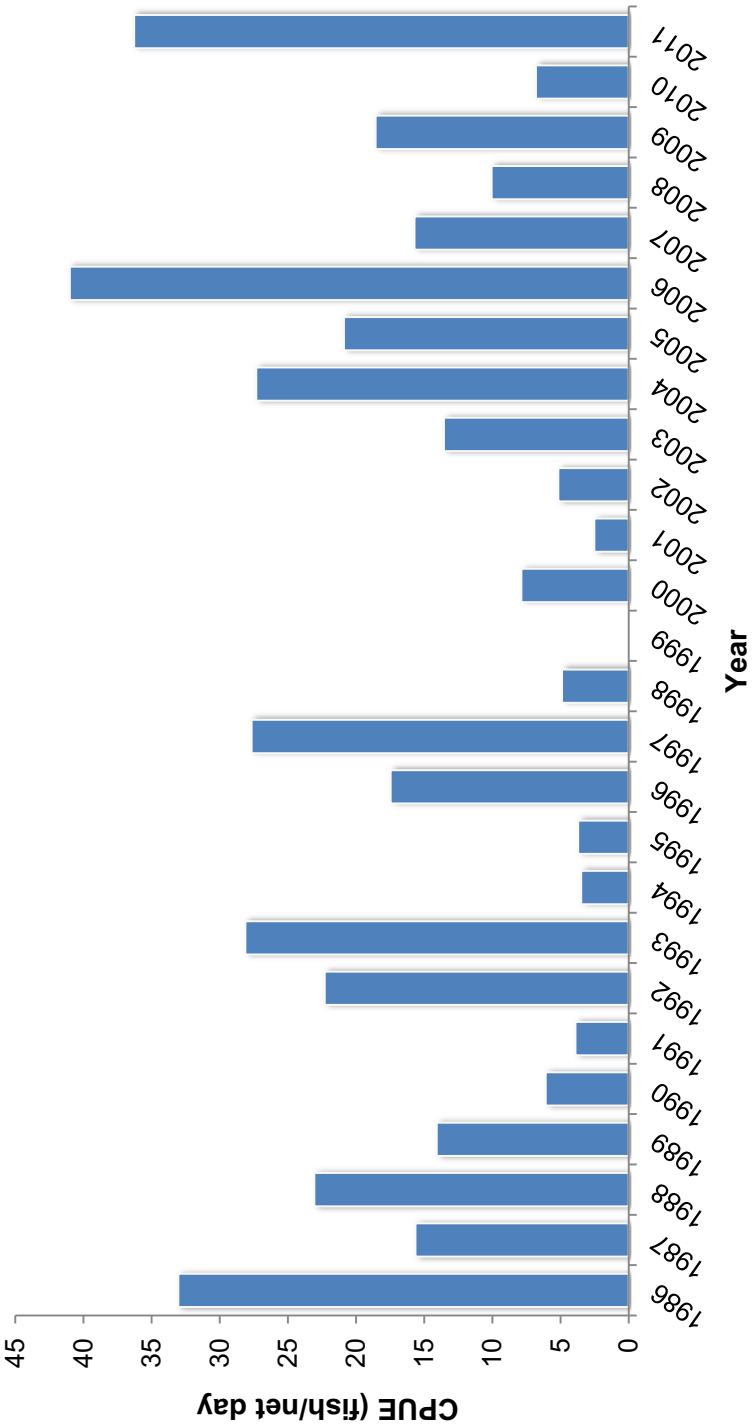

Figure 7. Catch per unit effort (CPUE) of arctic cisco in 7.6-cm gillnets, Nigliq Channel, Colville River, Alaska, 1986–2011. Effort is standardized to an18 m net length.

Table 4. Observed harvest of arctic cisco (number of fish), effort (net days), and catch per unit effort (CPUE; fish/net day) by mesh size. standardized to 18-m length, for each fishing area in the Niġliq Channel and Main Channel, Colville River, Alaska, 1986–2011. Estimate of total harvest is calculated based on calculated effort and estimated CPUE for each river section.

	Upper Niġliq			Nanuk			Niġliq Delta			Total Niġliq Channel			Main Channel			Total							
Mesh Size (cm)	Observed Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Niġliq Actual Adjusted Net Days	Estimated Niġliq Channel Harvest	Actual Adjusted Net Days by net mesh	Estimated Main Channel Harvest	Estimated Harvest
5.1	222	8.3	26.6	--	--	--	--	--	--	222	8.3	26.6	--	--	--	222	8.3	26.6	3.3	87.9	--	--	
6.4	1,207	7.3	164.6	--	--	--	1,931	12.7	152.4	3,138	20.0	156.9	--	--	--	3,138	20.0	156.9	44.0	6,903.6	6.7	--	
7.0	436	26.3	16.6	696	24.0	29.0	2,402	83.0	28.9	3,534	133.3	26.5	--	--	--	3,534	133.3	26.5	239.0	6,334.7	--	--	
7.6	212	27.3	7.8	1,064	56.3	18.9	13,395	320.7	41.8	14,671	404.3	36.3	1533.0	35.7	43.0	16,204	440	36.8	634.3	23,015.2	79.3	3,408.42	
8.3	--	--	--	--	--	--	407	15.0	27.1	407	15.0	27.1	--	--	--	407	15.0	27.1	36.7	995.8	--	--	
8.9	--	--	--	154	16.0	9.6	815	64.0	12.7	969	80.0	12.1	71.0	2.0	35.5	1,040	82	12.7	178.7	2,164.5	10.3	365.65	
																				39,501.7		3,774.07	43,275.78

[a] No harvest information was collected for 6.4cm mesh nets in the main channel and thus an estimate of harvest was not calculated.

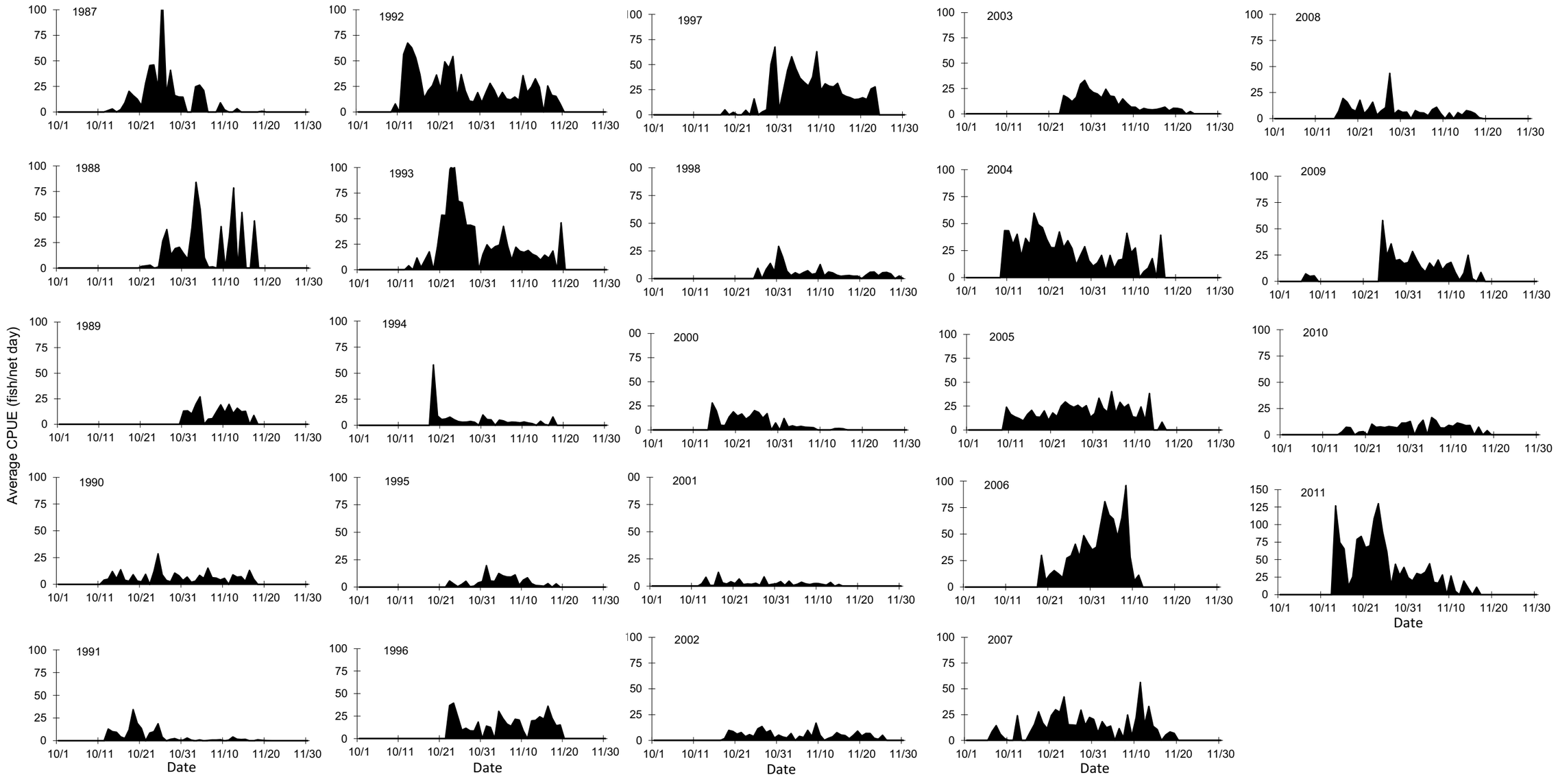

Figure 8. Average daily catch per unit effort (catch per net day) of arctic cisco in 7.6-cm gillnets, Niğliq Channel, 1987–2011. Effort is standardized to 18 m net length, as described in text.

Table 5. Species composition of the observed subsistence harvest from the Colville River fall fishery, expressed as a percent of the sampled catch, 1985–2011. Table includes all fish caught 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	0.03	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	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	1	3.8	0	1	0.03	0	0	0.04	0.09	0	(b)	7,576
1992	89.2	0.1	6	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	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	0.2	6	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	0.03	0.85	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	0.4	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	0.1	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	0.00	4.0	0.1	0.55	0	0.4	0	0	0	0.09	0	0	(b)	28,211

(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, 1986–2011. 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	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[a]	–	–	–	–	–	–	–	–	–	–	–	–
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	1,085	188.7	6.0	2,583	361.2	7.0
2008	78	44.0	1.8	529	188.0	2.8	460	233.2	2.0	1,067	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
Totals	7,357	2,077	3.5	11,074	2,866	3.9	9,883	3,398	2.9	28,314	8,341	3.4

[a] No data were collected in 1999.

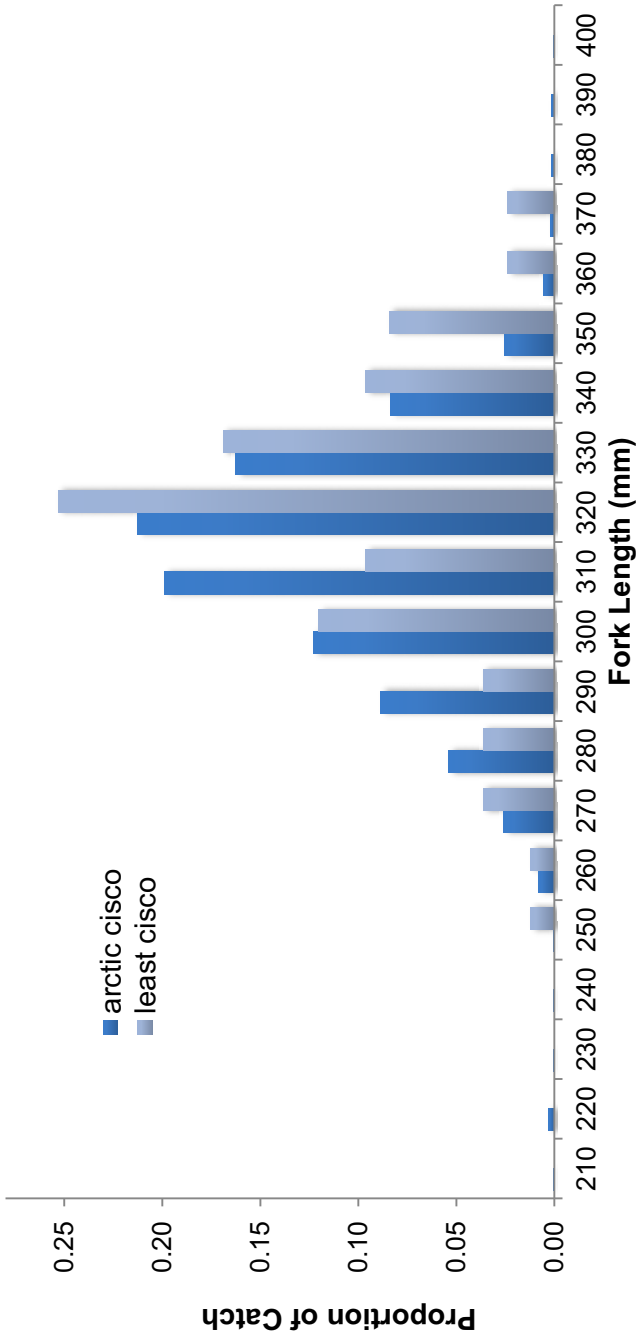

Figure 9. Length frequency (10mm increments) of arctic cisco and least cisco captured in all mesh sizes in the fall subsistence fishery, Nigliq Channel, Colville River, 2011.

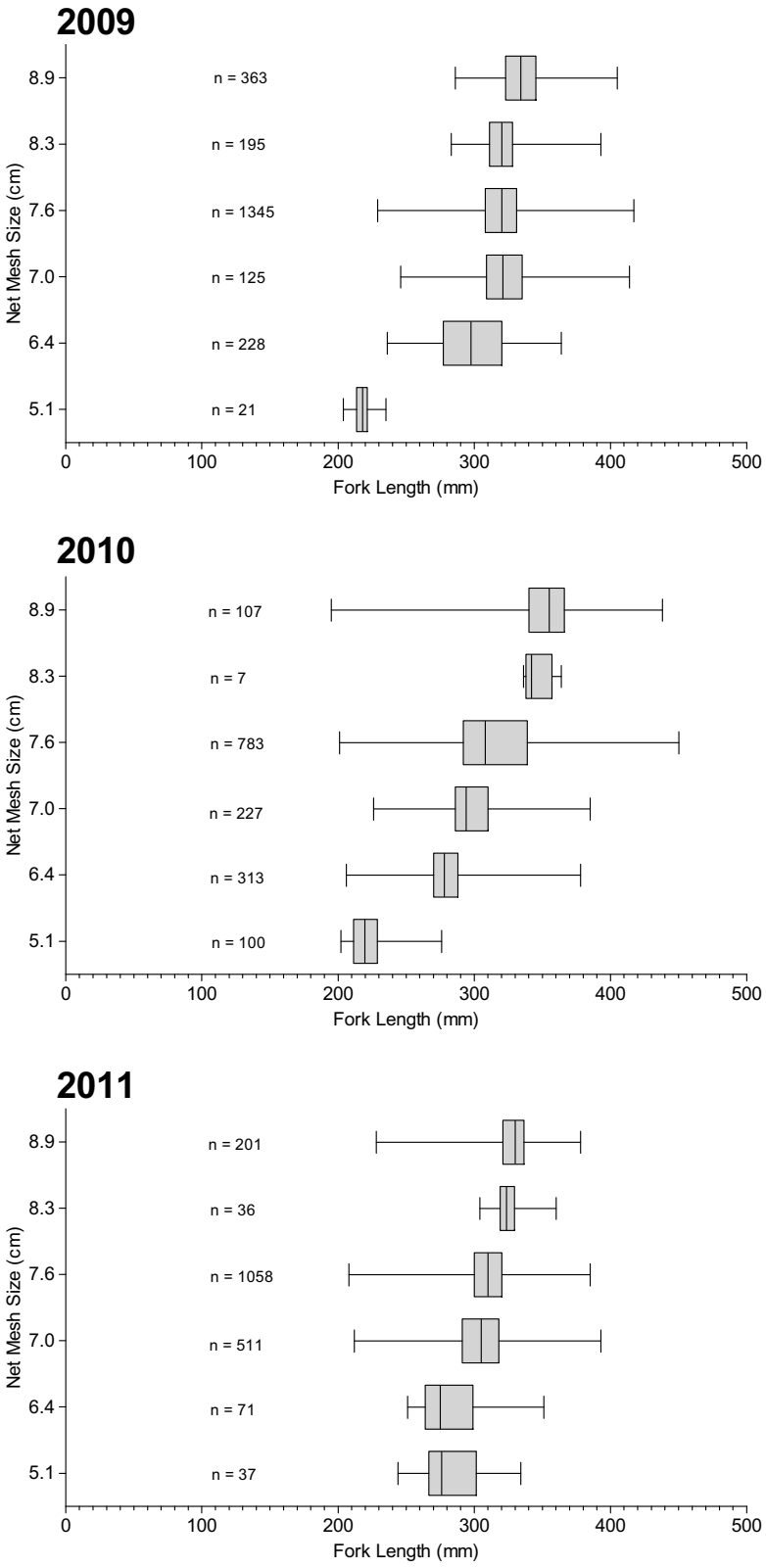

Figure 10. Cumulative length frequency of arctic cisco in the fall subsistence fishery by gillnet mesh size, Niġliq Channel and Main Channel, Colville River (2009–2011).

330 mm in 2011, as compared to 304–343 mm in 2010.

As in previous years, a small stipend was presented to fishers who donated fish otoliths to the project and allowed for weight and length measurements to be taken on the fish from which these otoliths were removed. The samples were used in aging fish and in calculating length (mm) and weight (g) relationships (n = 178). This relationship can be used as an indicator of fish health or condition of the fish. Length and weight were strongly correlated (r^2 = 0.7815, n = 178) in arctic cisco in 2011 (Figure 11) but the correlation was slightly weaker than it was in 2009 (r^2 = 0.9281) and 2010 (r^2 = 0.8977) (Figure 12). By applying length-weight regression formulas by mesh from this sub-sample of arctic cisco to known lengths in field-measured fish, we were able to calculate an average weight of arctic cisco by mesh size. The estimated average weight was multiplied by estimated harvest totals by mesh for a total 13,941 kg for the Niġliq Channel in 2011.

Analysis of otoliths revealed that arctic cisco in the 2011 harvest ranged in age from 5 to 8 years (all mesh sizes combined, n = 178) (Figure 13). Age composition was 64% age 6, 16% ages 5 and 7, and 4% age 8. 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 = 138), age composition was approximately 65% age 6, 15% ages 5 and 7, and 5% age 8 (Figure 13, Appendix C). Harvest of age 6 fish in 2011 made up a higher proportion of the overall observed harvest than age 5 fish, (which represent the same year class) did in 2010 (Seigle et. al 2011). 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 2011, the largest fish tended to be age 6 and age 7 with the length distribution age 8 fish tending smaller than ages 6 and 7 fish. (Figure 14).

Using the age composition of the catch (as percentage of catch) and the overall CPUE of 36.3 fish/net-day in the Nigliq Channel (Table 3), age-specific CPUE was estimated for the 2011 arctic cisco harvest. For 7.6-cm mesh nets, the CPUE increased dramatically from age 5 (5.5 fish/adjusted net-day) to age 6 (23.4 fish). CPUE dropped off in age 7 (5.5 fish) and age 8 (1.9 fish) arctic cisco (Figure 15, Appendix D). These fish represent the 2003–2006 year classes. Based on these estimates, there was little or no representation in the fishery by the 2002 year class. The 2005 year class appears to have been dominant in the 2011 fall arctic cisco fishery (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). As no representation is estimated for the 2002 year class, the cumulative total CPUE for this year class appears to have topped out at near 10 fish/adjusted net-day cumulatively by age class. The 2003 year class (8-year-old fish) has likely returned to spawn in the McKenzie River drainage and topped out at ~12 fish/adjusted net-day in 7.6-cm mesh nets. The 2004 year class (7-year-old fish) accounted for an additional 5 fish/adjusted net-day in 2011, bringing the total CPUE to 22 fish/net-day. The 2005 year class (age 6) has so far contributed 27 fish per net-day to the fishery, making this the most successful year class since the 1998 year class. The 2006 year class (age 5) contributed 5 fish/net-day to the cumulative CPUE in 2011, but the 2007 year class (age 4) failed to make an appearance in the 2011 fishery (Figure 15).

SALINITY AND WATER QUALITY

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 began salinity sampling on 18 October 2011. A steady increase in salinity over the sampling season at the 3-m depth occurred at all sampling locations, but was most pronounced at stations 3 and 4, farther upstream near Nuiqsut (Figure 2, Figure 17). The 3-m salinity levels at downstream stations (1 and 2) peaked in the second week of November, while salinities increased at stations 3 and 4 into week 3 of November. As would be expected, the highest salinities were found closest to the delta and lowest

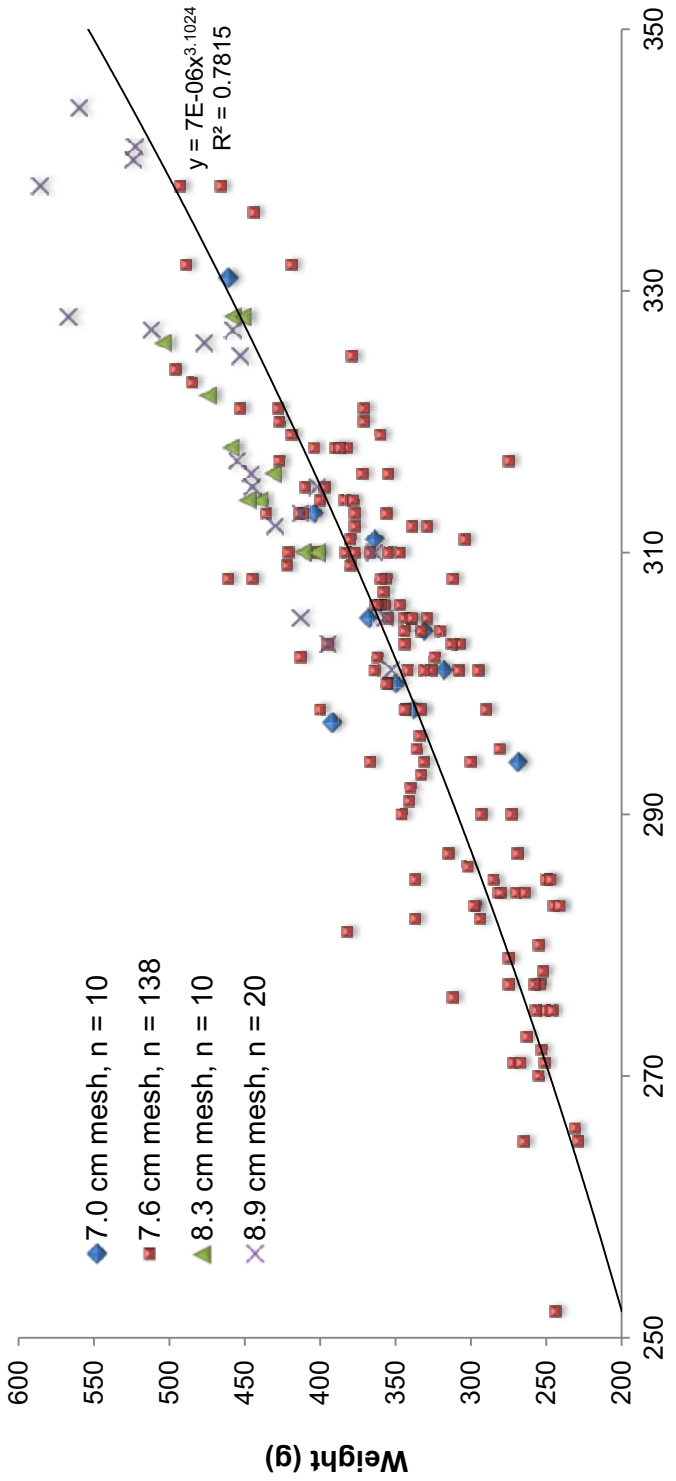

Figure 11. Length-weight relationships of arctic cisco captured in the Nigliq Channel, Colville River, 2011. Includes fish captured in all mesh sizes and all nets (n = 178).

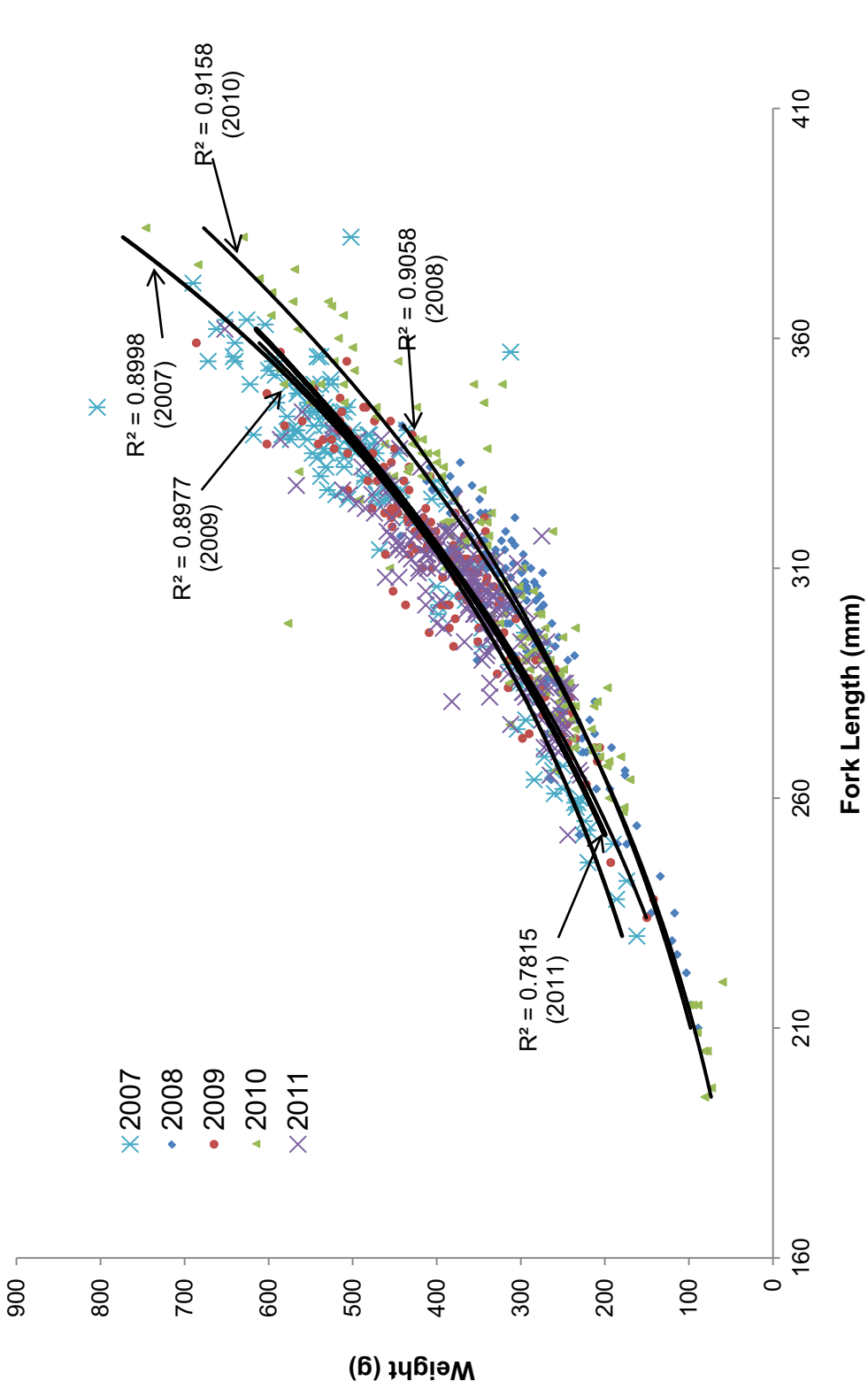

Figure 12. Length weight relationships of arctic cisco captured in all mesh sizes compared over 5 years (2007-2011) in the Nigliq Channel, Colville River, Alaska. All regression lines are power transformed.

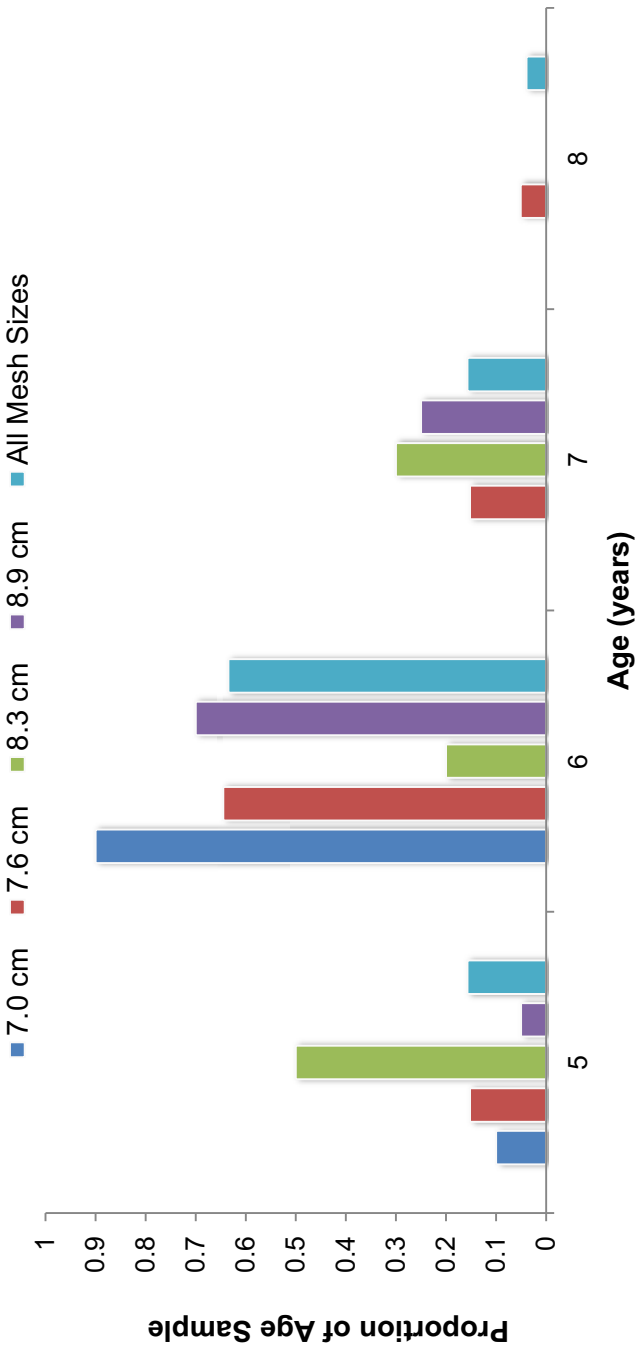

Figure 13. Age composition of arctic cisco harvested in 7.0-cm mesh nets (n=10), 7.6-cm mesh nets (n=138), 8.3-cm mesh nets (n=10), 8.9-cm mesh nets (n=10) , and all mesh sizes combined (n=178).

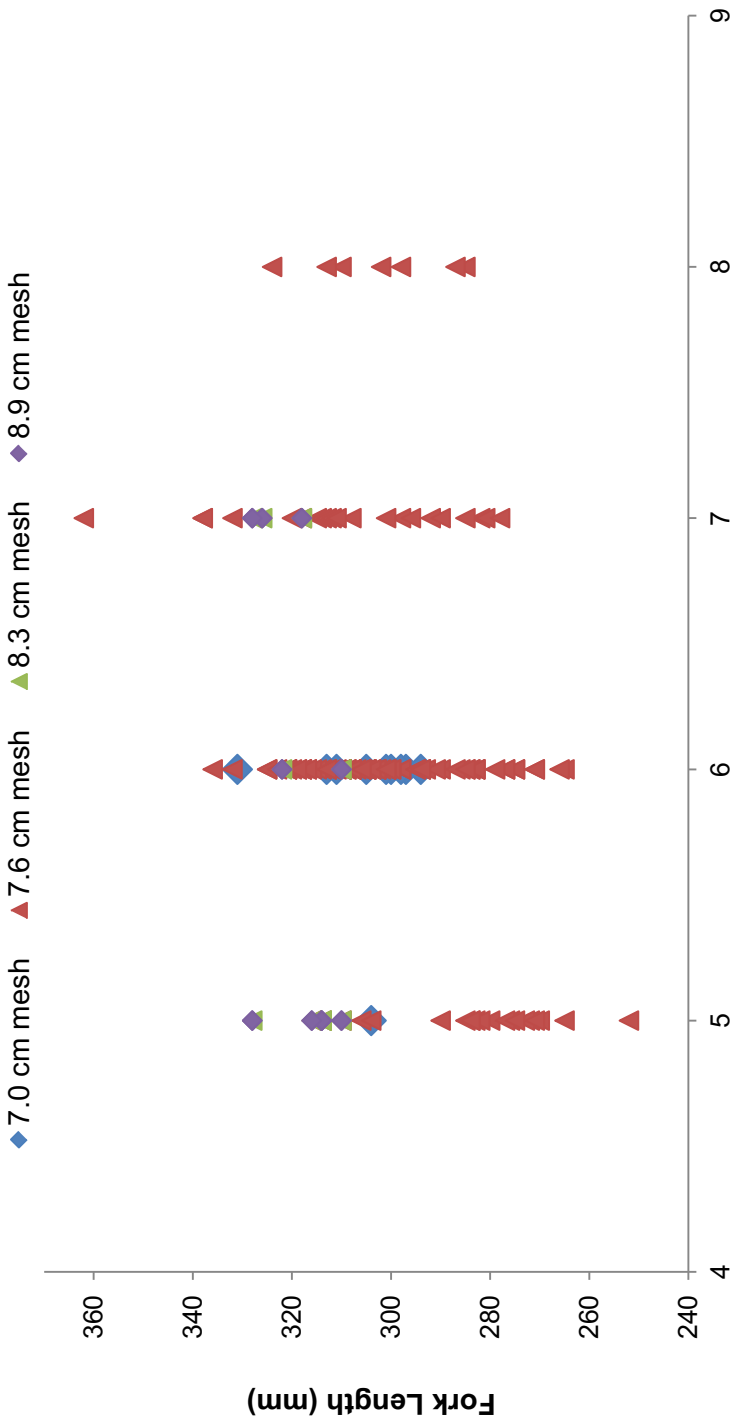

Figure 14. Age-specific length distribution of arctic cisco harvested in the fall subsistence fishery, Nigliq Channel, Colville River, Alaska, 2011.

salinities were found upstream, indicative of the "salt wedge" that moves up and down the channel with changing flow conditions. Salinity reached 15 ppt at the farthest upstream station in the Upper Niġliq area around 3 November; 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). Salinity frequently reaches 15 ppt at the 3-m depth by early November at the 3 downstream sampling stations, but in 2011 the salinity at the 3-m depth was within the favorable range for over-wintering arctic cisco at the onset of sampling in mid-October (Figure 18).

ABR biologists collected water chemistry samples at stations 1, 3, and 4 on 30 October and 15 November for analysis of total metals, total nitrogen, diesel range and heavy oil range organics, and enumeration of algal fragments (Figure 2, Appendices E and F). Total nitrogen readings were the highest at the farthest upstream station (station 4) in the Upper Niġliq area on both occasions. Dissolved forms of nitrogen (nitrate and nitrite) in running waters are normally associated with anthropogenic sources like fertilizers, sewage and wastewater effluent or animal wastes, although natural microbial processes can contribute to nitrogen levels in water (Loseto et al. 2004, USEPA 2012). In the Niġliq Channel in 2011 both forms of nitrogen were found at levels below Environmental Protection Agency (EPA) standards for drinking water (<10 mg/l nitrate and <1 mg/l nitrite). Trace detections of barium occurred at all 3 stations on the 2 sampling dates, with the highest values occurring at the Niġliq Delta location (station 1) on 15 November and at the Nanuk location (station 3) on 30 October. The detection of dissolved barium may be attributed to the local geology of the Colville River drainage which has barium-rich lithology throughout (Crecelius et al. 1991, Rember and Trefry 2004). The levels of barium detected on both sampling occasions in the Niġliq Channel in 2011 were below acceptable EPA standards (<2 mg/l) for drinking water (USEPA 2012). Mercury was detected at the Upper Nigliq location on both sampling dates and at the Nanuk location on 30 October. Mercury is commonly elevated in the high arctic due to the atmospheric transport and distillation from Eurasian anthropogenic sources which is deposited as precipitate (Douglas and Sturm 2004). Other potential sources of mercury are runoff from landfills or the natural weathering of mercury-bearing inorganic substrates. All results in the Niġliq Channel in 2011 were below the maximum contaminant goal for drinking water (<0.002 mg/l) outlined by the EPA (USEPA 2012). Diesel range and heavy oil range organics were below detectable limits at all locations on both sampling dates. The number of algal fragments found in filtered water samples was negligible.

Sediment samples were collected from the stream bed at stations 1 and 4 on 17 November 2012 for analysis of total metals, diesel range and heavy oil range organics. All analytes aside from arsenic were below Alaska Department of Environmental Conservation levels for arctic zone direct contact (ADEC 2012). Arsenic levels were slightly above the direct contact level although the ADEC states that elevated levels of this mineral are not uncommon in many soils around the state of Alaska (ADEC 2009). The sample chromatographs of diesel and residual range organics displayed several spikes but not in ranges attributable to petroleum (Stephen Crupi, SGS North America, Inc., pers. comm.). Full laboratory reports and a summary of water and sediment chemistry results are presented in Appendices E, F and G.

DISCUSSION

In 2011, the fall fishery for arctic cisco began on 13 October, a week later than the average historic start date (Table 1). The late start of the fishery was due to unusually warm weather in fall 2011 that persisted into mid-October and contributed to unstable ice conditions well into the third week of October. Fishers were forced to travel over-land to downstream fishing locations early in the season, rather than risking thin ice conditions on the Niġliq Channel. Despite the late start, ABR recorded 334 individual harvest events in 2011 (a decrease from 423 in 2010) and observed 70 different nets with 89 distinct sets over 37 days by 31 families. This was an above-average effort in terms of net sets (Figure 3). After 21 November, fishing effort was indirectly monitored until 30 November via personal communication with several resident fishers. The amount of observed fishing effort decreased by over 1,000 adjusted net days in 2011 compared to 2010 and

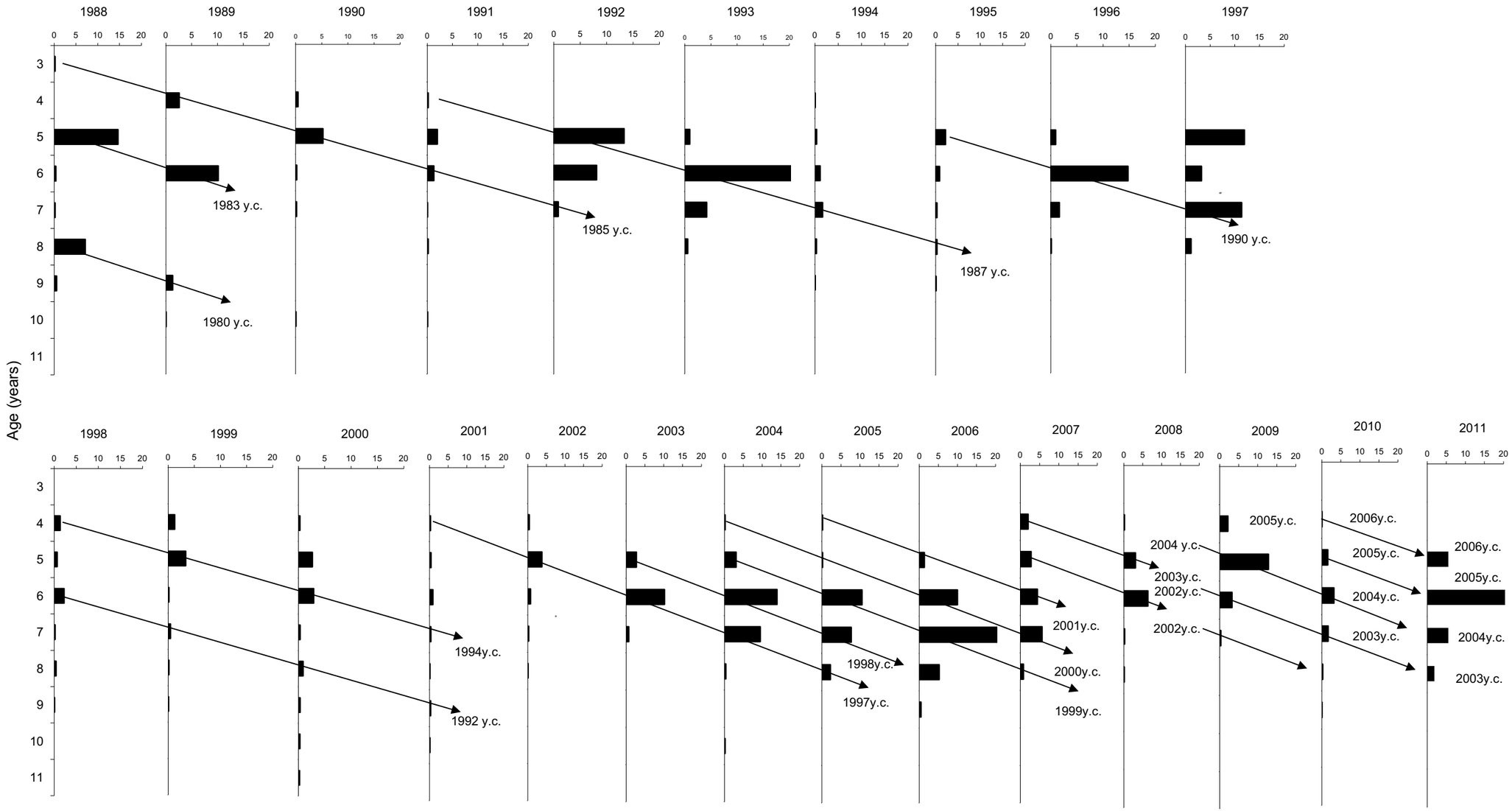

Figure 15. Catch per unit effort (CPUE) of arctic cisco by age class in the fall subsistence fishery, Niġliq Channel, 1988–2011. Arrows demonstrate the progression of select year classes through the fishery. Only fish harvested in 7.6 cm mesh gillnets are included and counts are standardized to 18 m net length, as described in text.

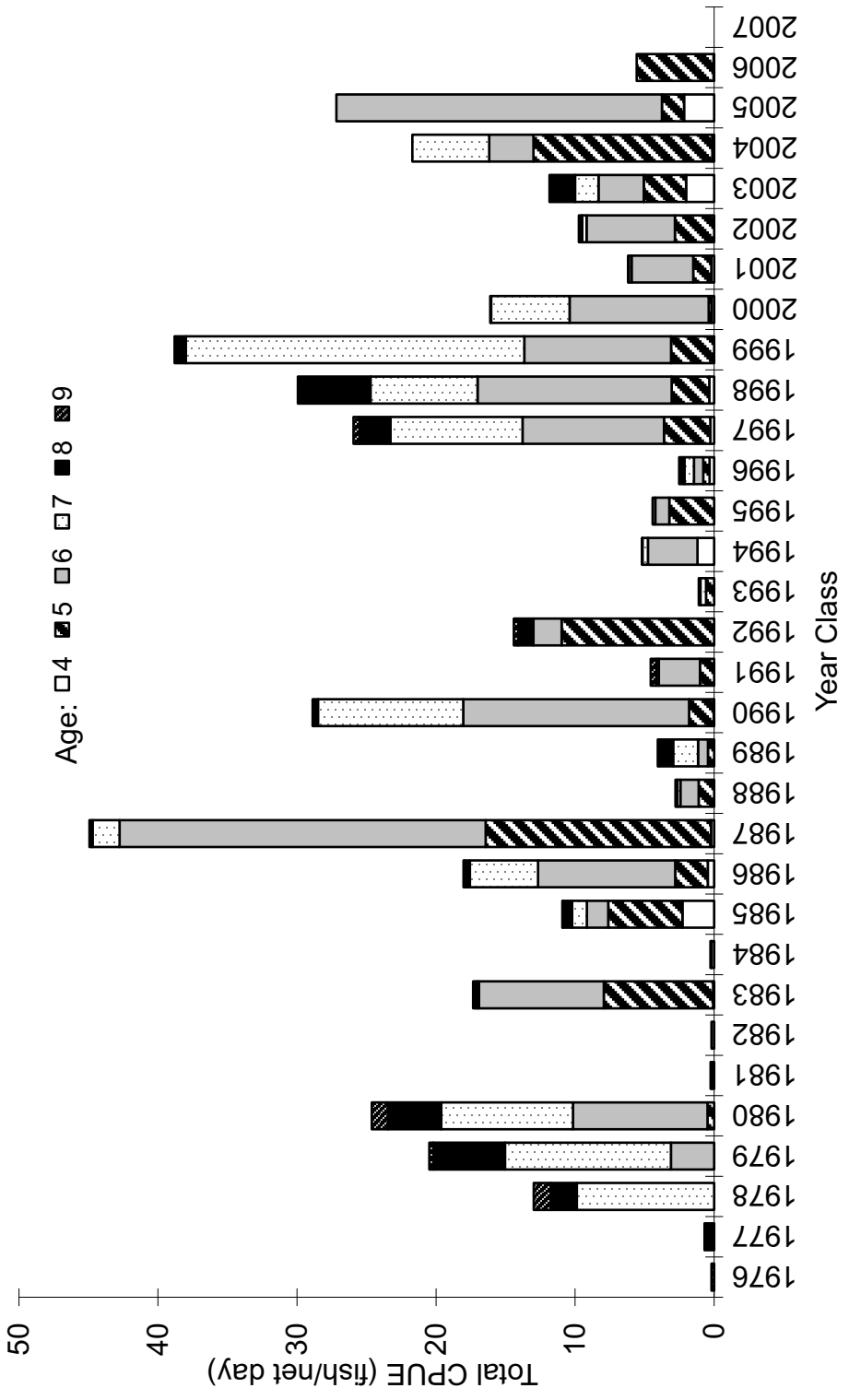

Figure 16. Cumulative catch per unit effort (catch per net day) of arctic cisco by year class (year of hatch) in the fall subsistence fishery, Niġliq Channel, Colville River, Alaska, 1976–2007.

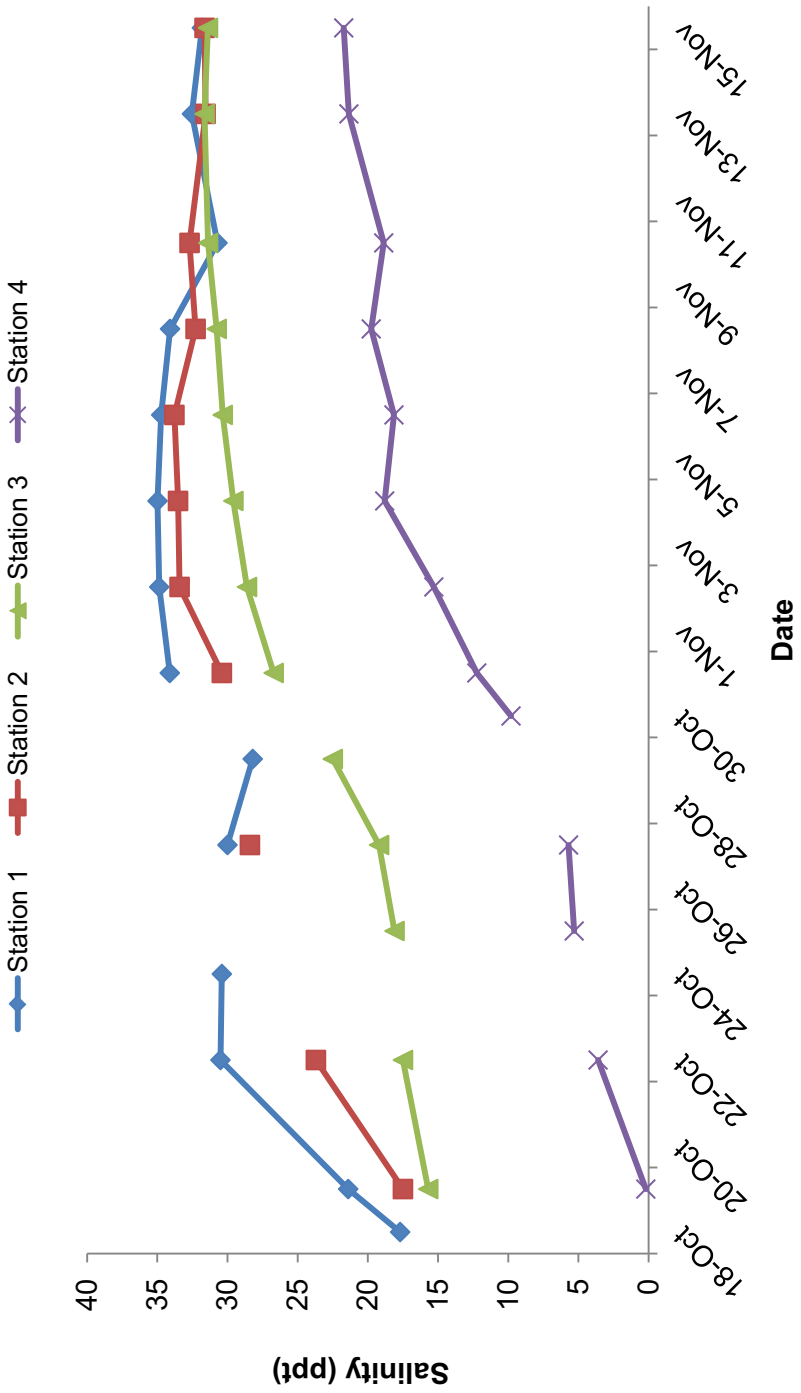

Figure 17. Water salinity (parts per thousand) at 3.0-m depth in each of 4 Niğliq Channel, Colville River fishing areas, 2011.

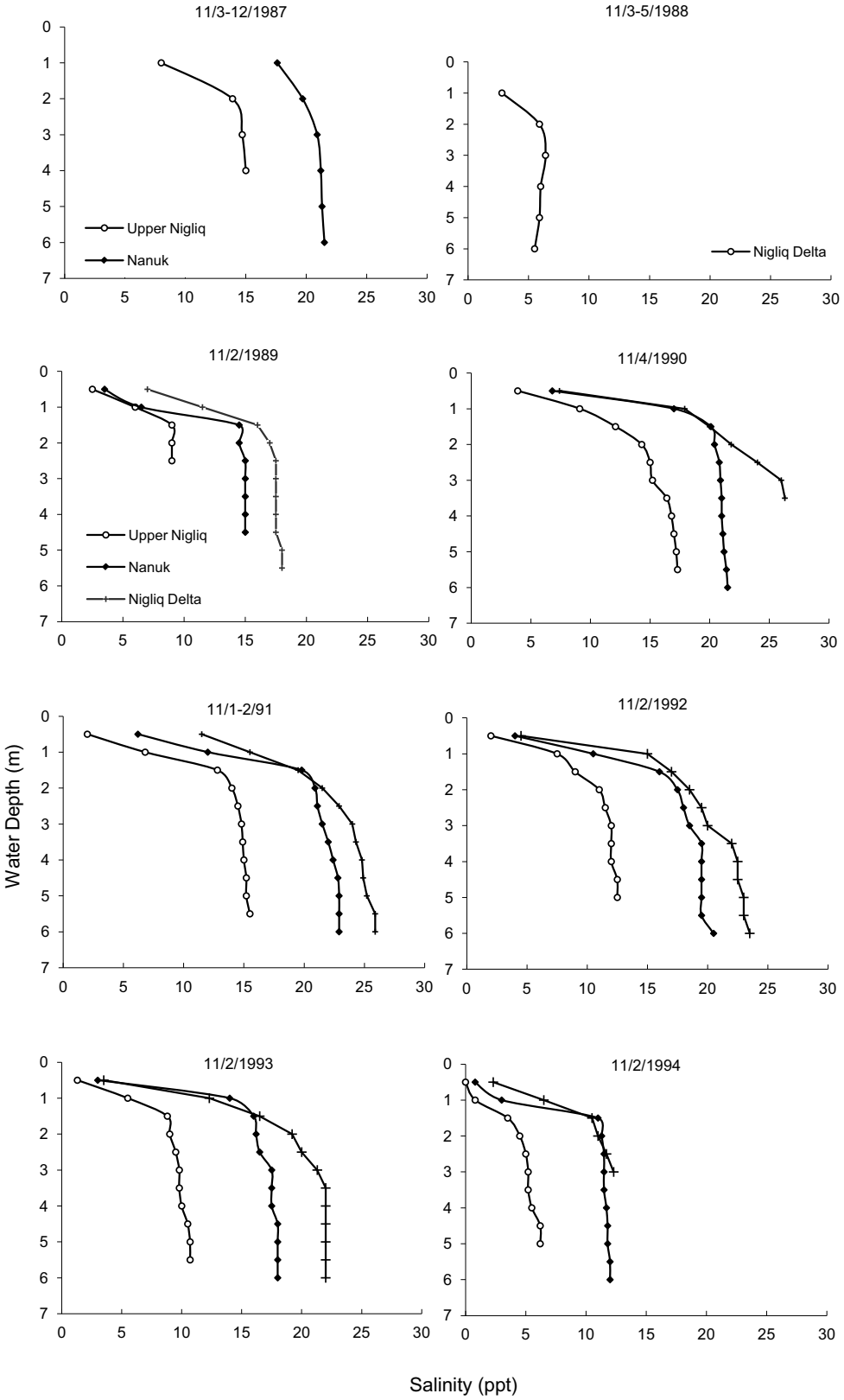

Figure 18a. Water salinity depth profiles in Niġliq Channel fishing areas, early November 1987–1994.

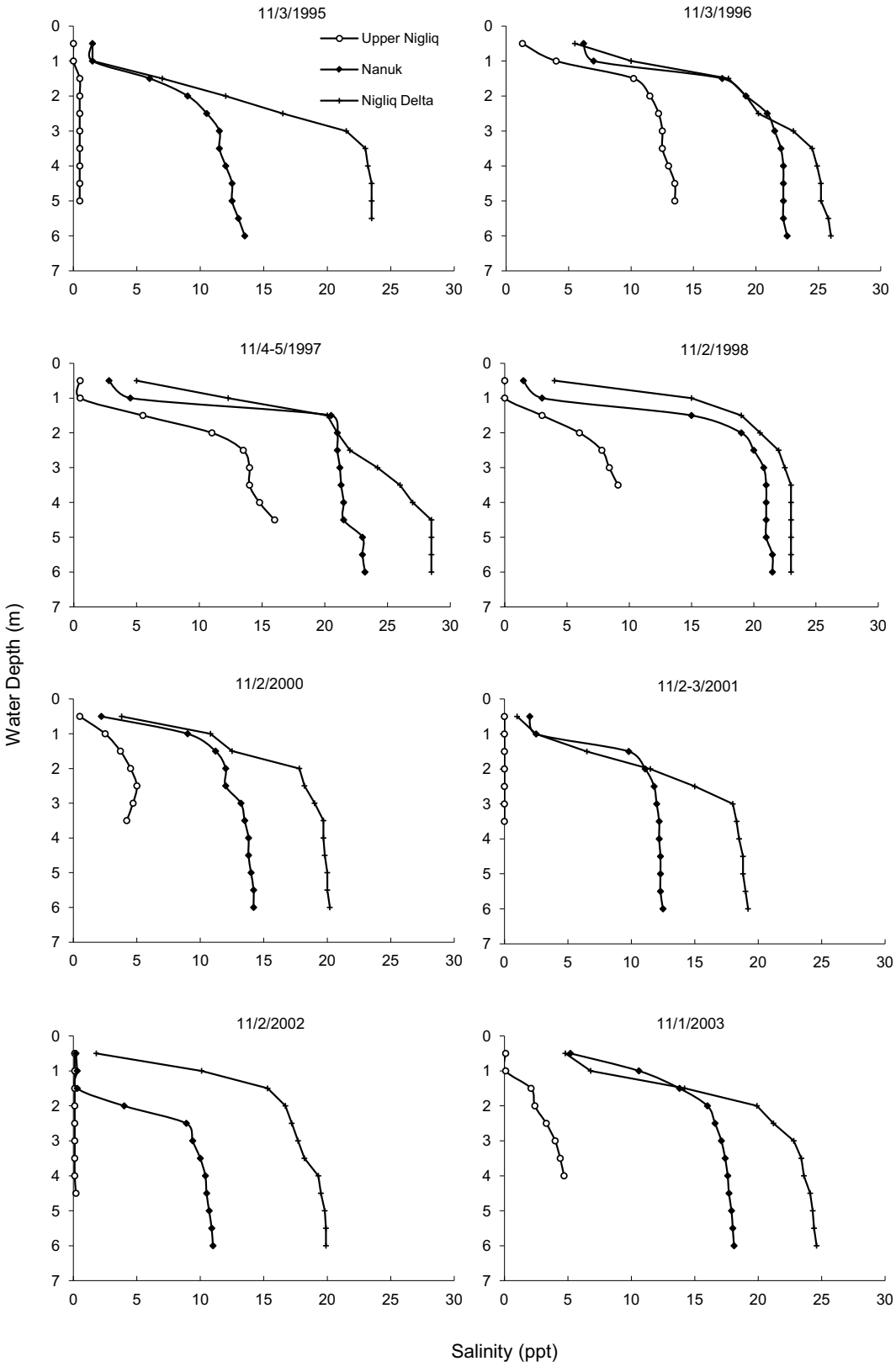

Figure 18b. Water salinity depth profiles in Niġliq Channel fishing areas, early November 1995–2003.

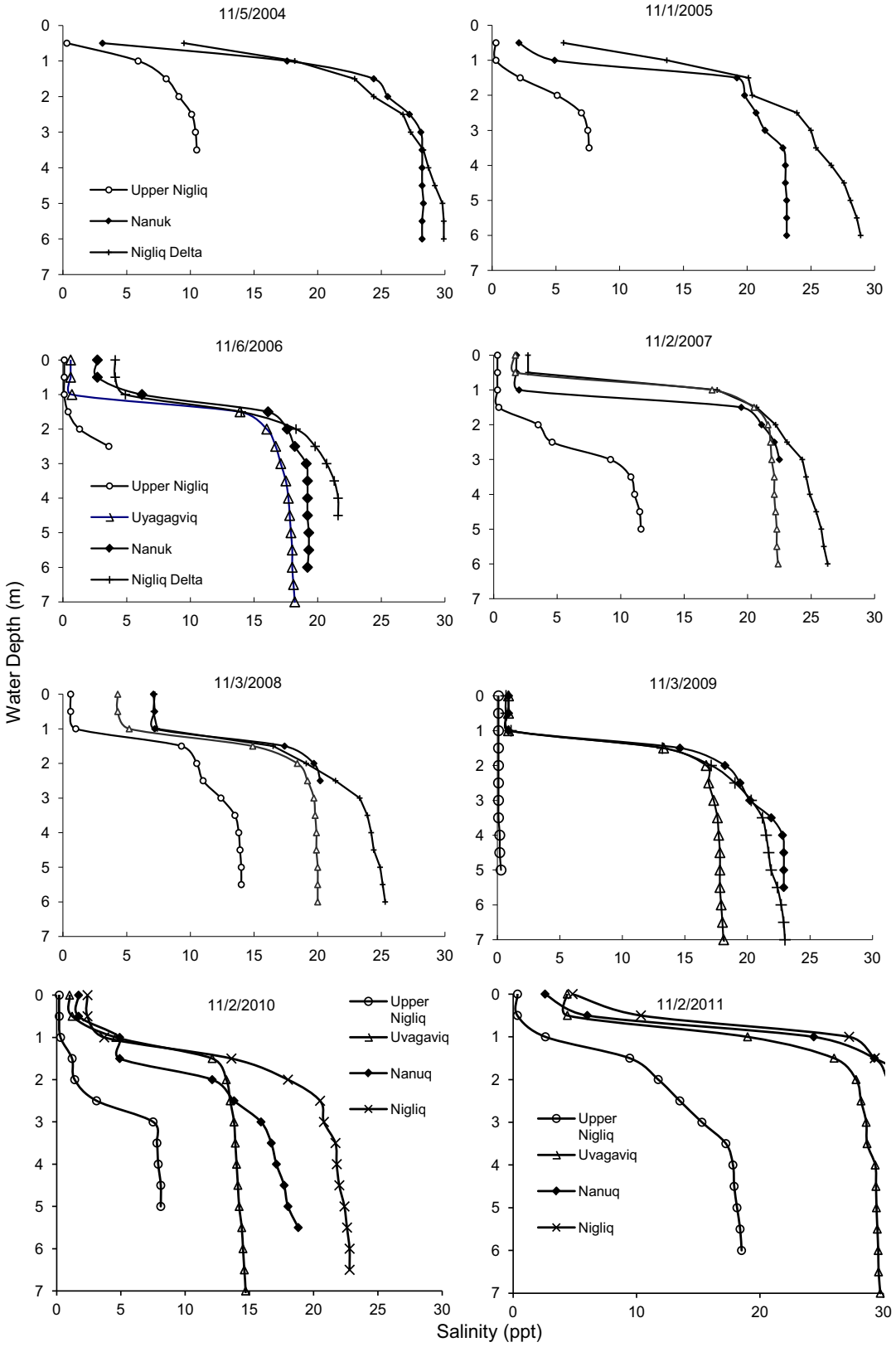

Figure 18c. Water salinity depth profiles in Niġliq Channel fishing areas, early November 2004–2011.

yet the total observed harvest for all species was the highest in 25 years (Tables 2 and 5).

The number of active nets increased to 45 nets by the end of October and this level of fishing effort continued through the first week of November (Figure 4). However, the peak fishing timeframe was substantially decreased in length from 2010 when ~50 nets were active for nearly 3 weeks and intense fishing continued throughout November. The peak fall fishing season was reduced to approximately 5 weeks in 2011, due largely to successful fishing in the early and middle part of the fishing season (Figure 8). In 2011, the number of nets active on a given day began to decrease substantially starting 8 November, barely 3 weeks into the fishery and only 3 nets remained in the Niġliq Channel on 21 November, when the field crew departed Nuiqsut. This was a marked difference from 2010 when 30 nets were still active at the end of November.

As in prior years since 2000, 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. (Figures 2 and 5). The increasing fishing effort in downstream fishing areas over the past 12 years results from the perception amongst fishers that fishing returns relative to effort are superior in the delta compared to locations farther upstream. The CPUE results in 2011 for the Niġliq Delta fishing area support this perception (Table 3).

In the Niġliq Delta area, the CPUE of 41.8 arctic cisco per adjusted net day in 7.6-cm nets was one of the highest on record and was a substantial increase from the 9.7 fish per adjusted net day recorded in 2010 and more than double the historic average of 20.9 fish (Table 3). Hence, the bias in relative fishing effort by residents of Nuiqsut toward the delta is justified and makes the ~30 mile roundtrip trek to the delta worthwhile. However, fishers also found success in other parts of the channel in 2011. The CPUE for 7.6-cm nets in the Nanuk area improved dramatically from 2.8 fish in 2010 to 18.9 fish in 2011, the highest CPUE since 2006. The CPUE of 7.8 fish in the Upper Niġliq area was the highest since 2007. The overall CPUE of 36.3 arctic cisco per adjusted net day in the Niġliq Channel fishery was the second highest in 25 years (Table 3).

Limited fishing effort also occurred on the Main Channel of the river (8% of total adjusted net days) (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. Still, fishers who initially set or moved nets to the Main Channel from the Niġliq Channel expressed pleasure with the prospect of fishing an under-utilized area of the delta during a bumper harvest season. Those who fished the Main Channel were successful, with a higher CPUE than those in the Niġliq Channel (43 versus 36.3 fish/adjusted net day in 7.6-cm nets) (Table 4).

Why was CPUE of arctic cisco in the Colville River so much higher in 2011 than it was in 2010? Once air and water temperatures dropped and stable ice developed, fishing was successful (Figure 8). One likely factor was that salinity levels in the Niġliq Delta and Nanuk fishing areas were optimal for overwintering arctic cisco from the onset of sampling (15–25 ppt, Figure 17). By the first week of November, optimal salinity levels had reached far upstream to Nuiqsut. Movement of this "salt wedge" upstream in the Niġliq Channel usually is associated with offshore west winds (Moulton and Field 1988, Moulton 1994) which were prevalent in 2011 in the early and middle part of the sampling season. Peak observed daily CPUEs of over 125 fish per adjusted net day on 14 and 24 October were the highest in monitoring history for 7.6-cm nets and corresponded with ideal salinity conditions for the upstream migration of arctic cisco in the Niġliq Delta and Nanuk fishing areas (Figures 7 and 17).

Just as this salt wedge is a predictor for arctic cisco movement in the Niġliq Channel, it is also likely responsible for the very low harvest rates for least cisco in 2011. Least cisco is traditionally the second-most harvested species during the fall fishery and that was true again in 2011. However, the observed proportion of least cisco as a function of the total harvest decreased significantly from 2010 (Table 5). Least cisco generally reside in waters with salinity <15 ppt (Moulton and Field 1988). Salinity exceeded this level for the entire season in traditional fishing areas of the Niġliq Channel, likely forcing the majority of least cisco to seek less saline waters up-river.

Recruitment of young arctic cisco into the fishery probably also contributed to the high harvest rates in 2011. 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 would begin to increase in 2011. As such, we 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, given that this is the age at which these fish tend to show up in the fishery. However, the age distribution of fish in 2011 shows that the fishery was dominated by arctic cisco in the 2004–2006 year classes (Figure 15).

The absence of 4-year-old arctic cisco in the Colville fisheries raises questions about their recruitment success or whereabouts. A number of factors may contribute to the absence of a particular age class in the fishery. Chance sampling error or mis-ageing seem unlikely as ABR had three different biologists age fish. (Figure 13). A more likely explanation could be site selective overwintering behavior of various age classes, possibly being present but located in another, unfished part of the Colville River delta or other large North Slope rivers. Still another possibility is that the year class is present but that fish are too small to be consistently harvested in 7.6-cm mesh nets. It will be interesting to see if the 2007 year class emerges in the fishery as 5-year-olds in 2012.

Another interesting characteristic of overwintering Colville River arctic cisco in 2011 was the wide range of sizes within age classes, including younger fish (Figures 10 and 14). The size distributions of ages 5–8 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 2005 year class, which dominated in the 2011 harvest, apparently experienced high survival and recruited in large numbers to the fishery, although they were not necessarily large in size across the board (Figures 12 and 15). Nonetheless, fishers expressed satisfaction with the size of arctic cisco in 2011 (relative to 2010) and this is probably due to the dominance in the fishery of the 2005 year class which had one more year of growth in 2011.

2011 was predicted to be the first year of an upward trend in the harvest of arctic cisco based on above average numbers of young-of-the-year arctic cisco captured during summer fyke net surveys near Prudhoe Bay (Moulton et al. 2006, Larry Moulton, MJM, personal communication 2010). We are optimistic that Colville River harvests will remain relatively high in the near future. This optimism is based on the assumption that arctic cisco year classes from 2008–2010, which are already in the western Beaufort Sea, will maintain high recruitment into the fishery. 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 4-year-olds in the 2011 harvest is unexplained. 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 June 2011, ABR met with the community to discuss issues related to the 2010 fishery as well as the forecast for 2011 (Appendix A). The *Qaaktaq* Panel will again meet in the spring of 2012 to discuss the fishery results from the 2011 season and to hear their concerns for the fishery moving forward. A positive addition to this year's fishery was the distribution of personal log books to interested fishers for the sole purpose of allowing them to monitor their own seasonal harvest patterns. ABR continued to receive important feedback from the *Qaaktaq* Panel and enthusiastic on-ice participation from fishers throughout the 2011 fishery.

Despite a later-than-usual start to the season fishers expressed uniform pleasure with the 2011 arctic cisco harvest. Higher-than-average catch rates in the Niġliq Channel allowed fishers to achieve their harvest goals quickly, making for a short fishing season for most fishers. Fishers expressed that they had harvested enough arctic

cisco for their household, gifting, or trade purposes relatively early in the season and the arctic cisco harvest in 2011 was one of the best on record.

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Appendix A. Qaaktaq panel meeting notes discussing the 2011 and 2012 fall fishery on the Colville River.

The *Qaaktaq* Panel, composed of expert fishers involved in the Colville River subsistence harvest near Nuiqsut, met on June 29, 2011 at the KSOPI office in Nuiqsut. The purpose of this meeting was to (1) summarize the 2010 fishing season and report results comparing 2010 harvest information to historical records, (2) continue to work with active fishers to get their perspective on the upcoming 2011 fall fishery, and (3) collect comments from the panel highlighting their concerns about the fishery to relay to CPAI. John Seigle of ABR presented 2010 harvest data to the panel during which there was as open discussion covering a broad array of topics.

Attendees of this meeting were: the *Qaaktaq* Panel of Nuiqsut residents and fishers, Lydia Sovalik, Dwayne Hopson, Sr., Sam Kunaknana, Frank Oyagak, Jr, Dora Leavitt, Robert Lampe, Edward Nukapigak, and Jonah Nukapigak; ABR scientist, John Seigle; and KSOPI representative, Eunice Brower.

There was general agreement that 2010 had not been a particularly good *Qaaktaq* fishing season following a slightly above average 2009 harvest season. No panel member expressed serious concerns about the overall harvest numbers for *qaaktaq;* however, it was agreed that the effort necessary to reach individual harvest goals had increased in a more competitive fishery. There was a brief discussion of increased harvest effort (number of nets) in the delta. John Seigle reminded the panel that 2010 had long been predicted to be a low harvest year and that 2009 had been a pleasant surprise in terms of better than expected harvests. The consensus among *panel* members was that we had indeed expected lower harvests and 2011 will be interesting as it has been predicted to be a year of increasing harvest levels.

John Seigle also expressed that CPAI has heard the panel's concerns regarding a need for more water, sediment, and fish tissue sampling for contaminant monitoring in the Niġliq channel. ABR is developing plans in conjunction with CPAI to increase this monitoring effort in 2011. Additionally, the panel had previously expressed interest in seeing ABR use their own nets to help in surveying the fishery and this topic was discussed. The panel agreed with John's thoughts on donating fish to the community if ABR and CPAI decided that using ABR nets was a useful effort towards augmenting monitoring. Fish tagging was also discussed and panel members did not express any uneasiness over the potential use of floy tags, particularly if a bounty system for tag returns was implemented.

One topic of discussion that focused the attention of the panel for much of the meeting was the recent news over the acquisition of nearby oil/gas leases by the Spanish company, Repsol. According to the panel, representatives from Repsol conducted an "unannounced" meeting in Nuiqsut and outlined their intent to begin drilling/exploration work and ice pad/road development just offshore from Woods Camp in the Beaufort Sea on the west side of the Colville delta, with development extending to the east beyond the delta and inland several miles. The representatives provided maps and plans for their work which included a winter ice road and/or pipeline that, according to panel members, could potentially negatively affect fish movement in the delta region. This new information along with knowledge of development plans for leases in the eastern NPRA has panel members concerned over fish stocks.

The panel expressed that they would like to see more monitoring and research focusing on the Niġliq channel fishery as well as the Fish Creek area.

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 streamline communication between ABR, KSOPI and the *Qaaktaq* Panel. This was a very well attended and enthusiastically received meeting and the panel expressed excitement over meeting again in the fall of 2012.

Appendix B. 2011 North Slope Fisheries logbook distributed to Nuiqsut fishers, fall 2011.

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.

….Continued on next page

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.

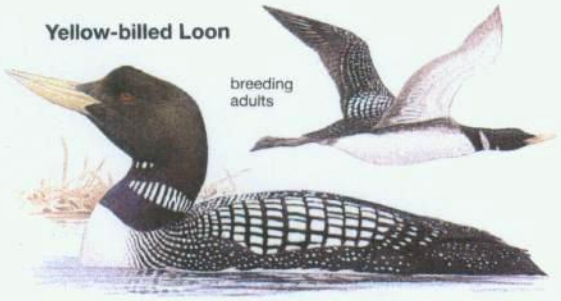
If you need assistance in removing entangled loons from your net please contact staff at the NSB Dept. of Wildlife Management **(907) 852-0350**.

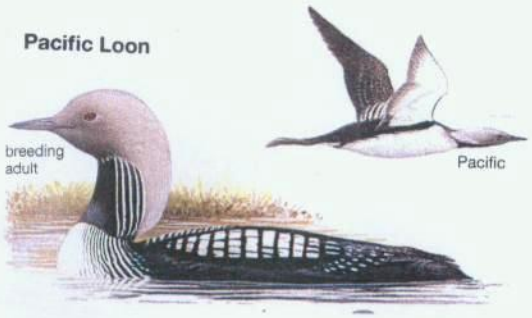
Information you provide on Loon bycatch will help us estimate how many loons are accidentally caught in nets on the North Slope. **All Information you provide us is strictly confidential.**

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:

Name of Net Checker: _____

Camp or Cabin Name: _____

Specific Net Location: _____

Net Number	Date Net Checked	Net Length	Mesh Size	Fish Species	Number Caught

General Comments:

Net Number	Date Net Checked	Net Length	Mesh Size	Fish Species	Number Caught

General Comments:

Appendix C. Age frequencies (expressed as percentages) of arctic cisco caught in 7.6-cm mesh nets, Colville Delta, Alaska, 1976-2011[a]. 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
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
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
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
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
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
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
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
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
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
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

[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. Catch per unit effort (CPUE) by age class for arctic cisco caught in 7.6-cm mesh nets, Colville Delta, Alaska, 1986–2011a. Data were collected and analyzed by MJM Research in 1986–2005, by LGL in 2006, and by ABR in 2007–2010.

Age Class (y)	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
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.2	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
5	0.0	0.1	0.0	2.6	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	0.3	0.3	0.4	0.0	0.2	0.2	0.0	2.0	0.1	2.2	1.6	5.5
6	0.0	0.0	14.6	0.0	5.2	2.0	13.3	0.9	0.4	2.2	0.9	11.9	0.6	3.4	2.6	0.4	3.8	2.7	3.1	0.2	1.3	2.8	3.0	12.8	3.2	23.4
7	13.6	0.2	0.4	10.1	0.2	1.3	8.1	22.4	1.1	0.9	14.8	3.2	2.2	0.1	2.9	0.9	0.8	10.2	14.0	10.5	10.0	4.4	6.4	3.2	1.7	5.5
8	16.8	9.2	0.2	0.0	0.2	0.1	0.9	4.2	1.6	0.3	1.6	11.4	0.2	0.4	0.3	0.4	0.2	0.7	9.5	7.7	24.3	5.6	0.2	0.3	0.2	1.8
9	2.6	5.0	7.1	0.0	0.0	0.2	0.0	0.6	0.3	0.3	0.1	1.1	0.4	0.1	0.9	0.1	0.0	0.0	0.4	2.2	5.2	0.8	0.1	0.0	0.0	0.0
10	0.0	1.2	0.5	1.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.3	0.3	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N =	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

[a] 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 1989 and 2003 harvest seasons were estimated.

Appendix E. Lab results for algal cells, heavy metals, petroleum range organics in water samples taken from 3 water sampling stations, Niġliq Channel, Colville River, October and November 2011.

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

Analytical Services Order and Chain of Custody Form

63361

1011-7911

Client Name and Address: ABR, INC. PO BOX 80410 FAIRBANKS, AK 99708	Account Number:
Contact Person: JOHN SEIGLE (907-223-2536 cell)	P.O. or Contract Number: 11-162
Phone Number: 907-344-6777 Fax Number:	Authorization Number:
E-mail: jseigle@abrinc.com	Sampled By: JOHN SEIGLE
Project Name: COLVILLE FALL FISHERY	PWS Number:
Data Deliverables: Level I ☐ Level II ☐ Level III ☐ EDD/Format:	Send Results to ADEC: ☐ YES ☐ No
Requested Turnaround Time and Special Instructions:	

Client Sample ID	Date Sampled	Time Sampled	Matrix	AF Sample ID	Number of Containers	NITRATE/NITRITE (NO preserve)	DRO/RRO (TPH)	~~METALS~~ Not Needed MS (Manganese, IRON)	Total RCRA Metals MS added on 12-6-11				Preservative / Remarks
11-162_COLVILLE_Up_4	10/30/11	0800	W	AF42105	3	✓	✓	✓	X				
11-162_COLVILLE_NAN_3	10/29/11	15:21	W	AF42106	3	✓	✓	✓	X				
11-162_COLVILLE_NIGLIQ_1	10/29/11	17:30	W	AF42107	3	✓	✓	✓	X				

Relinquished By (1): JOHN SEIGLE	Date: 10/30	Time: 10:33am	Received By: Alyson McHugh
Relinquished By (2): Alyson McHugh	Date: 10/30/11	Time: 11:00	Received By: Thomas Napageak Jr.
Relinquished By (3):	Date: 10/30/11	Time: 1500	Received for lab by: R. Gothic

TO BE COMPLETED BY LABORATORY

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

Chain of Custody Seal ☐ INTACT ☐ BROKEN ☐ ABSENT

Shipping Bill Number: _____

ERA AGENT

Page _____ of _____

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

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

Report Date: 12/9/2011
Date Arrived: 10/30/2011
Date Sampled: see below
Time Sampled: see below
Collected By: JS

Attn: John Seigle
Phone: (907) 344-6777 ext 206
Fax: (907) 770-1443
Email: jseigle@abrinc.com

Arctic Fox Lab# AF42105-42107
Client Sample ID: see below
Location/Project: Colville Fall Fishery
COC#: 63361
Sample Matrix: water

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

ABR Sample ID: 11-162 Colville up 4
Analysis Requested: TPH, Total RCRA Metals
Nitrate, Nitrite
Date Sampled: 10/30/11
Time Sampled: 0800
Arctic Fox ID: AF42105
Test America ID: PUK0026-01

ABR Sample ID: 11-162 Colville Nan 3
Analysis Requested: TPH, Total RCRA Metals
Nitrate, Nitrite
Date Sampled: 10/29/11
Time Sampled: 1521
Arctic Fox ID: AF42106
Test America ID: PUK0026-02

ABR Sample ID: 11-162 Colville Niglid 1
Analysis Requested: TPH, Total RCRA Metals
Nitrate, Nitrite
Date Sampled: 10/29/11
Time Sampled: 1130
Arctic Fox ID: AF42107
Test America ID: PUK0026-03

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

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

PORTLAND, OR 9405 S.W. NIMBUS AVENUE
BEAVERTON, OR 97008-7132
ph: (503) 906.9200 fax: (503) 906.9210

Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1011-7911/Colville Fall Fishery	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:12

Analytical Case Narrative

TestAmerica - Portland, OR

PUK0026

This is an amended report with AK102/103 DRO/RRO and RCRA 8 metals reported.

TestAmerica Portland

Vanessa Frahs, Project Manager

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

PORTLAND, OR 9405 S.W. NIMBUS AVENUE
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Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1011-7911/Colville Fall Fishery	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:12

Diesel Range Organics (C10-C25) and Residual Range Organics (C25-C36) per AK102/103

TestAmerica Portland

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
PUK0026-01 (AF42105 04-11-162 Colville-Up-4)			**Water**				**Sampled: 10/30/11 08:00**			
Diesel Range Organics	AK102/103	ND	-----	0.238	mg/l	1x	11K0153	11/04/11 07:11	11/07/11 21:43	**Q12**
Residual Range/Heavy Oil Organics	"	ND	-----	0.476	"	"	"	"	"	
Surrogate(s): 1-Chlorooctadecane				*94.8%*		*50 - 150 %*	"		"	
Triacontane				*99.1%*		*50 - 150 %*	"		"	
PUK0026-02 (AF42106 03-11-162 Colville-NAN-3)			**Water**				**Sampled: 10/29/11 15:21**			
Diesel Range Organics	AK102/103	ND	-----	0.248	mg/l	1x	11K0153	11/04/11 07:11	11/07/11 22:02	**Q13**
Residual Range/Heavy Oil Organics	"	ND	-----	0.495	"	"	"	"	"	
Surrogate(s): 1-Chlorooctadecane				*100%*		*50 - 150 %*	"		"	
Triacontane				*104%*		*50 - 150 %*	"		"	
PUK0026-03 (AF42107 03-11-162 Colville-NIGLIQ-1)			**Water**				**Sampled: 10/29/11 17:30**			
Diesel Range Organics	AK102/103	ND	-----	0.243	mg/l	1x	11K0153	11/04/11 07:11	11/07/11 22:20	**Q12**
Residual Range/Heavy Oil Organics	"	ND	-----	0.485	"	"	"	"	"	
Surrogate(s): 1-Chlorooctadecane				*93.4%*		*50 - 150 %*	"		"	
Triacontane				*96.3%*		*50 - 150 %*	"		"	

TestAmerica Portland

Vanessa Frahs, Project Manager

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THE LEADER IN ENVIRONMENTAL TESTING

PORTLAND, OR 9405 S.W. NIMBUS AVENUE
BEAVERTON, OR 97008-7132
ph: (503) 906.9200 fax: (503) 906.9210

Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1011-7911/Colville Fall Fishery	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:12

Total Metals per EPA 6000/7000 Series Methods

TestAmerica Portland

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
PUK0026-01 (AF42105 04-11-162 Colville-Up-4)			**Water**			**Sampled: 10/30/11 08:00**				
Arsenic	EPA 6020	ND	-----	0.00100	mg/l	1x	11K0072	11/02/11 11:17	11/02/11 19:20	
Barium	"	**0.118**	-----	0.00100	"	"	"	"	"	
Cadmium	"	ND	-----	0.00100	"	"	"	"	"	
Chromium	"	ND	-----	0.00200	"	"	"	"	"	
Lead	"	ND	-----	0.0200	"	20x	"	"	12/08/11 00:47	**RL1**
Selenium	"	ND	-----	0.00100	"	1x	"	"	11/02/11 19:20	
Silver	"	ND	-----	0.00100	"	"	"	"	"	
PUK0026-02 (AF42106 03-11-162 Colville-NAN-3)			**Water**			**Sampled: 10/29/11 15:21**				
Arsenic	EPA 6020	ND	-----	0.00100	mg/l	1x	11K0072	11/02/11 11:17	11/02/11 19:24	
Barium	"	**0.0902**	-----	0.0200	"	20x	"	"	12/08/11 00:51	
Cadmium	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
Chromium	"	ND	-----	0.00200	"	1x	"	"	11/02/11 19:24	
Lead	"	ND	-----	0.0200	"	20x	"	"	12/08/11 00:51	**RL1**
Selenium	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
Silver	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
PUK0026-03 (AF42107 03-11-162 Colville-NIGLIQ-1)			**Water**			**Sampled: 10/29/11 17:30**				
Arsenic	EPA 6020	ND	-----	0.00100	mg/l	1x	11K0072	11/02/11 11:17	11/02/11 19:28	
Barium	"	**0.0792**	-----	0.0200	"	20x	"	"	12/08/11 00:56	
Cadmium	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
Chromium	"	ND	-----	0.00200	"	1x	"	"	11/02/11 19:28	
Lead	"	ND	-----	0.0200	"	20x	"	"	12/08/11 00:56	**RL1**
Selenium	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
Silver	"	ND	-----	0.0200	"	"	"	"	"	**RL1**

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Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1011-7911/Colville Fall Fishery	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:12

Total Mercury per EPA Method 7470A

TestAmerica Portland

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
PUK0026-01 (AF42105 04-11-162 Colville-Up-4)			**Water**			**Sampled: 10/30/11 08:00**				
Mercury	EPA 7470A	**0.000353**	-----	0.000200	mg/l	1x	11L0179	12/07/11 13:01	12/08/11 11:16	**H1**
PUK0026-02 (AF42106 03-11-162 Colville-NAN-3)			**Water**			**Sampled: 10/29/11 15:21**				
Mercury	EPA 7470A	**0.00170**	-----	0.000200	mg/l	1x	11L0179	12/07/11 13:01	12/08/11 11:19	**H1**
PUK0026-03 (AF42107 03-11-162 Colville-NIGLIQ-1)			**Water**			**Sampled: 10/29/11 17:30**				
Mercury	EPA 7470A	ND	-----	0.000200	mg/l	1x	11L0179	12/07/11 13:01	12/08/11 11:22	**H1**

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Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1011-7911/Colville Fall Fishery	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:12

Conventional Chemistry Parameters per APHA/EPA Methods

TestAmerica Portland

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
PUK0026-01 (AF42105 04-11-162 Colville-Up-4)			**Water**				**Sampled: 10/30/11 08:00**			
Nitrate/Nitrite-Nitrogen	EPA 353.2	**0.0812**	-----	0.0300	mg/l	1x	11K0103	11/03/11 07:18	11/03/11 11:46	
PUK0026-02 (AF42106 03-11-162 Colville-NAN-3)			**Water**				**Sampled: 10/29/11 15:21**			
Nitrate/Nitrite-Nitrogen	EPA 353.2	**0.0399**	-----	0.0300	mg/l	1x	11K0103	11/03/11 07:18	11/03/11 11:46	
PUK0026-03 (AF42107 03-11-162 Colville-NIGLIQ-1)			**Water**				**Sampled: 10/29/11 17:30**			
Nitrate/Nitrite-Nitrogen	EPA 353.2	ND	-----	0.0300	mg/l	1x	11K0103	11/03/11 07:18	11/03/11 11:46	

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Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1011-7911/Colville Fall Fishery	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:12

Notes and Definitions

Report Specific Notes:

H1	-	Sample analysis performed past the method-specified holding time per client's approval.
Q12	-	Detected hydrocarbons in the diesel range do not have a distinct diesel pattern and may be due to heavily weathered diesel or possibly biogenic interference.
Q13	-	Detected hydrocarbons do not have pattern and range consistent with typical petroleum products and may be due to biogenic interference.
RL1	-	Reporting limit raised due to sample matrix effects.

Laboratory Reporting Conventions:

DET	-	Analyte DETECTED at or above the Reporting Limit. Qualitative Analyses only.
ND	-	Analyte NOT DETECTED at or above the reporting limit (MDL or MRL, as appropriate).
NR/NA	-	Not Reported / Not Available
dry	-	Sample results reported on a Dry Weight Basis. Results and Reporting Limits have been corrected for Percent Dry Weight.
wet	-	Sample results and reporting limits reported on a Wet Weight Basis (as received). Results with neither 'wet' nor 'dry' are reported on a Wet Weight Basis.
RPD	-	RELATIVE PERCENT DIFFERENCE (RPDs calculated using Results, not Percent Recoveries).
MRL	-	METHOD REPORTING LIMIT. Reporting Level at, or above, the lowest level standard of the Calibration Table.
MDL*	-	METHOD DETECTION LIMIT. Reporting Level at, or above, the statistically derived limit based on 40CFR, Part 136, Appendix B. *MDLs are listed on the report only if the data has been evaluated below the MRL. Results between the MDL and MRL are reported as Estimated Results.
Dil	-	Dilutions are calculated based on deviations from the standard dilution performed for an analysis, and may not represent the dilution found on the analytical raw data.
Reporting Limits	-	Reporting limits (MDLs and MRLs) are adjusted based on variations in sample preparation amounts, analytical dilutions and percent solids, where applicable.
Electronic Signature	-	Electronic Signature added in accordance with TestAmerica's *Electronic Reporting and Electronic Signatures Policy.* Application of electronic signature indicates that the report has been reviewed and approved for release by the laboratory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

TestAmerica Portland

Vanessa Frahs, Project Manager

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

Analytical Services Order and Chain of Custody Form

63437

1111-7961

Client Name and Address: ABR, Inc Environmental Research and Services PO Box 24068 Anchorage, AK 99524

Contact Person: John Seigle

Phone Number: 907-344-6777 Fax Number: 907-770-1443

E-mail: jseigle@abrinc.com

Project Name:

Data Deliverables: Level I ☐ Level II ☐ Level III ☐ EDD/Format:

Requested Turnaround Time and Special Instructions:

Account Number:

P.O. or Contract Number: 11-162

Authorization Number:

Sampled By: JMG, JRR

PWS Number:

Send Results to ADEC: ☐ YES ☒ No

Client Sample ID	Date Sampled	Time Sampled	Matrix	AF Sample ID	Number of Containers	HCL — 1 L GLASS BOTTLE — TPH	HNO3 — ~~500 ml poly bottle~~ Not Needed MH — Total metals	NONE — 125 ml bottle — NO3-NO2	Total RCRA Metals — added on ~~11-6-11~~ 12-6-11 MH				Preservative / Remarks
HYDRO 1-4	15 Nov 11	1400-1545	L	AF42297	3	X	X	X	X				
HYDRO 3-4	15 Nov 11	↓	L	AF42298	3	X	X	X	X				
HYDRO 4-4	15 Nov 11	↓	L	AF42299	3	X	X	X	X				

Relinquished By	Date	Time	Received By
Relinquished By (1): [signature]	16/Nov 11	1600	Received By: [signature]
Relinquished By (2):	Date:	Time:	Received By:
Relinquished By (3):	Date:	Time:	Received for lab by:

TO BE COMPLETED BY LABORATORY

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

80462153

Chain of Custody Seal ☐ INTACT ☐ BROKEN ☐ ABSENT

Shipping Bill Number: ____________

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

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

Report Date: 12/9/2011
Date Arrived: 11/16/2011
Date Sampled: 11/15/2011
Time Sampled: 2:00-3:45 PM
Collected By: JMG/JRR

Attn: John Seigle
Phone: (907) 344-6777 ext 206
Fax: (907) 770-1443
Email: jseigle@abrinc.com

Arctic Fox Lab# AF42297-42299
Client Sample ID: see below
Location/Project:
COC#: 63437
Sample Matrix: Liquid

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

ABR Sample ID: Hydro 1-4
Analysis Requested: TPH, Total RCRA Metals
Nitrate, Nitrite
Arctic Fox ID: AF42297
Test America ID:PUK0814-01

ABR Sample ID: Hydro 3-4
Analysis Requested: TPH, Total RCRA Metals
Nitrate, Nitrite
Arctic Fox ID: AF42298
Test America ID:PUK0814-02

ABR Sample ID: Hydro 4-4
Analysis Requested: TPH, Total RCRA Metals
Nitrate, Nitrite
Arctic Fox ID: AF42299
Test America ID:PUK0814-03

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

PORTLAND, OR 9405 S.W. NIMBUS AVENUE
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Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1111-7961/ABR	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:16

Analytical Case Narrative

TestAmerica - Portland, OR

PUK0814

This is an amended report with NWTPH Dx and RCRA 8 metals reported.

TestAmerica Portland

Vanessa Frahs, Project Manager

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PORTLAND, OR 9405 S.W. NIMBUS AVENUE
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Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1111-7961/ABR	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:16

Diesel and Heavy Range Hydrocarbons per NWTPH-Dx Method

TestAmerica Portland

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
PUK0814-01 (AF42997 Hydro 1-4)			**Water**				**Sampled: 11/15/11 15:45**			
Diesel Range Organics	NWTPH-Dx	ND	-----	0.0943	mg/l	1x	11K0735	11/22/11 04:52	11/23/11 12:43	
Residual Range/Heavy Oil Organics	"	ND	-----	0.472	"	"	"	"	"	
Surrogate(s): 1-Chlorooctadecane				*99.8%*		*50 - 150 %*	"			"
PUK0814-02 (AF42998 Hydro 3-4)			**Water**				**Sampled: 11/15/11 15:45**			
Diesel Range Organics	NWTPH-Dx	ND	-----	0.100	mg/l	1x	11K0735	11/22/11 04:52	11/23/11 13:00	
Residual Range/Heavy Oil Organics	"	ND	-----	0.500	"	"	"	"	"	
Surrogate(s): 1-Chlorooctadecane				*102%*		*50 - 150 %*	"			"
PUK0814-03 (AF42999 Hydro 4-4)			**Water**				**Sampled: 11/15/11 15:45**			
Diesel Range Organics	NWTPH-Dx	ND	-----	0.0943	mg/l	1x	11K0735	11/22/11 04:52	11/23/11 13:18	
Residual Range/Heavy Oil Organics	"	ND	-----	0.472	"	"	"	"	"	
Surrogate(s): 1-Chlorooctadecane				*95.6%*		*50 - 150 %*	"			"

TestAmerica Portland

Vanessa Frahs, Project Manager

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Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1111-7961/ABR	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:16

Total Metals per EPA 6000/7000 Series Methods

TestAmerica Portland

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
PUK0814-01 (AF42997 Hydro 1-4)			**Water**				**Sampled: 11/15/11 15:45**			
Arsenic	EPA 6020	ND	-----	0.0500	mg/l	50x	11K0740	11/22/11 08:16	11/23/11 13:11	**RL1**
Barium	"	**0.0905**	-----	0.0500	"	"	"	"	"	
Cadmium	"	ND	-----	0.0500	"	"	"	"	"	**RL1**
Chromium	"	ND	-----	0.100	"	"	"	"	"	**RL1**
Lead	"	ND	-----	0.0500	"	"	"	"	"	**RL1**
Selenium	"	ND	-----	0.0500	"	"	"	"	"	**RL1**
Silver	"	ND	-----	0.0500	"	"	"	"	"	**RL1**
PUK0814-02 (AF42998 Hydro 3-4)			**Water**				**Sampled: 11/15/11 15:45**			
Arsenic	EPA 6020	ND	-----	0.0200	mg/l	20x	11K0740	11/22/11 08:16	11/23/11 13:15	**RL1**
Barium	"	**0.148**	-----	0.0200	"	"	"	"	"	
Cadmium	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
Chromium	"	ND	-----	0.0400	"	"	"	"	"	**RL1**
Lead	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
Selenium	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
Silver	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
PUK0814-03 (AF42999 Hydro 4-4)			**Water**				**Sampled: 11/15/11 15:45**			
Arsenic	EPA 6020	ND	-----	0.0100	mg/l	10x	11K0740	11/22/11 08:16	11/23/11 13:19	**RL1**
Barium	"	**0.108**	-----	0.0100	"	"	"	"	"	
Cadmium	"	ND	-----	0.0100	"	"	"	"	"	**RL1**
Chromium	"	ND	-----	0.0200	"	"	"	"	"	**RL1**
Lead	"	ND	-----	0.0100	"	"	"	"	"	**RL1**
Selenium	"	ND	-----	0.0100	"	"	"	"	"	**RL1**
Silver	"	ND	-----	0.0100	"	"	"	"	"	**RL1**

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BEAVERTON, OR 97008-7132
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Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1111-7961/ABR	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:16

Total Mercury per EPA Method 7470A

TestAmerica Portland

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
PUK0814-01 (AF42997 Hydro 1-4)			**Water**				**Sampled: 11/15/11 15:45**			
Mercury	EPA 7470A	**0.000670**	-----	0.000200	mg/l	1x	11L0140	12/06/11 12:40	12/06/11 14:19	
PUK0814-02 (AF42998 Hydro 3-4)			**Water**				**Sampled: 11/15/11 15:45**			
Mercury	EPA 7470A	ND	-----	0.000200	mg/l	1x	11L0140	12/06/11 12:40	12/06/11 14:21	
PUK0814-03 (AF42999 Hydro 4-4)			**Water**				**Sampled: 11/15/11 15:45**			
Mercury	EPA 7470A	ND	-----	0.000200	mg/l	1x	11L0140	12/06/11 12:40	12/06/11 14:24	

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Arctic Fox Environmental, Inc.	Project Name:	**Main**	
Pouch 340043	Project Number:	1111-7961/ABR	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:16

Conventional Chemistry Parameters per APHA/EPA Methods

TestAmerica Portland

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
PUK0814-01 (AF42997 Hydro 1-4)			**Water**				**Sampled: 11/15/11 15:45**			
Nitrate/Nitrite-Nitrogen	EPA 353.2	**0.0779**	-----	0.0300	mg/l	1x	11K0663	11/21/11 10:00	11/21/11 14:57	
PUK0814-02 (AF42998 Hydro 3-4)			**Water**				**Sampled: 11/15/11 15:45**			
Nitrate/Nitrite-Nitrogen	EPA 353.2	**0.118**	-----	0.0300	mg/l	1x	11K0886	11/29/11 07:19	11/29/11 12:18	
PUK0814-03 (AF42999 Hydro 4-4)			**Water**				**Sampled: 11/15/11 15:45**			
Nitrate/Nitrite-Nitrogen	EPA 353.2	**0.139**	-----	0.0300	mg/l	1x	11K0886	11/29/11 07:19	11/29/11 12:18	

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Pouch 340043	Project Number:	1111-7961/ABR	Report Created:
Prudhoe Bay, AK 99734	Project Manager:	Ralph Allphin	12/09/11 11:16

Notes and Definitions

Report Specific Notes:

M7	-	The MS and/or MSD were above the acceptance limits. See Blank Spike (LCS).
R4	-	Due to the low levels of analyte in the sample, the duplicate RPD calculation does not provide useful information.
RL1	-	Reporting limit raised due to sample matrix effects.

Laboratory Reporting Conventions:

DET	-	Analyte DETECTED at or above the Reporting Limit. Qualitative Analyses only.
ND	-	Analyte NOT DETECTED at or above the reporting limit (MDL or MRL, as appropriate).
NR/NA	-	Not Reported / Not Available
dry	-	Sample results reported on a Dry Weight Basis. Results and Reporting Limits have been corrected for Percent Dry Weight.
wet	-	Sample results and reporting limits reported on a Wet Weight Basis (as received). Results with neither 'wet' nor 'dry' are reported on a Wet Weight Basis.
RPD	-	RELATIVE PERCENT DIFFERENCE (RPDs calculated using Results, not Percent Recoveries).
MRL	-	METHOD REPORTING LIMIT. Reporting Level at, or above, the lowest level standard of the Calibration Table.
MDL*	-	METHOD DETECTION LIMIT. Reporting Level at, or above, the statistically derived limit based on 40CFR, Part 136, Appendix B. *MDLs are listed on the report only if the data has been evaluated below the MRL. Results between the MDL and MRL are reported as Estimated Results.
Dil	-	Dilutions are calculated based on deviations from the standard dilution performed for an analysis, and may not represent the dilution found on the analytical raw data.
Reporting Limits	-	Reporting limits (MDLs and MRLs) are adjusted based on variations in sample preparation amounts, analytical dilutions and percent solids, where applicable.
Electronic Signature	-	Electronic Signature added in accordance with TestAmerica's *Electronic Reporting and Electronic Signatures Policy.* Application of electronic signature indicates that the report has been reviewed and approved for release by the laboratory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

TestAmerica Portland

Vanessa Frahs, Project Manager

Laboratory Analysis Report

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

Work Order:	1121223
	11-162
Client:	ABR, Inc.
Report Date:	May 01, 2012

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 AK100001 for NELAP (RCRA methods: 1020A, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035B, 6010B, 6020, 7470A, 7471B, 8021B, 8081B, 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, the National Environmental Laboratory Accreditation Program and 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
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 Ref.#	1121223001		
Client Name	ABR, Inc.	**Printed Date/Time**	05/01/2012 14:57
Project Name/#	11-162	**Collected Date/Time**	11/17/2011 12:00
Client Sample ID	11-162-Water 1	**Received Date/Time**	04/17/2012 9:30
Matrix	Soil/Solid (dry weight)	**Technical Director**	**Stephen C. Ede**

Sample Remarks:

AK103 - Unknown hydrocarbon with several peaks is present.
AK102/103 - Sample received and analyzed beyond the holding time per client request.
7471B - Mercury - Sample received and analyzed beyond the holding time per client request.
7471B - Mercury- MS/MSD recoveries for mercury were outside of acceptance criteria (biased high). Post digestion spike was successful.

Parameter	Results	LOQ	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Metals Department									
Mercury	ND	56.5	ug/Kg	SW7471B	A		04/19/12	04/19/12	CDE
Metals by ICP/MS									
Arsenic	6.35	1.32	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Barium	279	0.396	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Cadmium	ND	0.264	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Chromium	12.4	0.528	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Lead	6.72	0.264	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Selenium	ND	0.660	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Silver	ND	0.132	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Semivolatile Organic Fuels Department									
Diesel Range Organics	ND	36.2	mg/Kg	AK102	A		04/19/12	04/19/12	EAB
Residual Range Organics	54.6	36.2	mg/Kg	AK103	A		04/19/12	04/19/12	EAB
Surrogates									
5a Androstane <surr>	101		%	AK102	A	50-150	04/19/12	04/19/12	EAB
n-Triacontane-d62 <surr>	98.2		%	AK103	A	50-150	04/19/12	04/19/12	EAB
Solids									
Total Solids	70.1		%	SM21 2540G	A			04/19/12	THV

SGS Ref.#	1121223002		
Client Name	ABR, Inc.	**Printed Date/Time**	05/01/2012 14:57
Project Name/#	11-162	**Collected Date/Time**	11/17/2011 12:00
Client Sample ID	11-162-Water 4	**Received Date/Time**	04/17/2012 9:30
Matrix	Soil/Solid (dry weight)	**Technical Director**	**Stephen C. Ede**

Sample Remarks:

AK103 - Unknown hydrocarbon with several peaks is present.
AK102/103 - Sample received and analyzed beyond the holding time per client request.
7471B - Mercury - Sample received and analyzed beyond the holding time per client request.

Parameter	Results	LOQ	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Metals Department									
Mercury	78.2	63.5	ug/Kg	SW7471B	A		04/19/12	04/19/12	CDE
Metals by ICP/MS									
Arsenic	6.88	1.59	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Barium	433	0.476	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Cadmium	ND	0.317	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Chromium	23.2	0.635	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Lead	13.4	0.317	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Selenium	0.894	0.794	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Silver	ND	0.159	mg/Kg	SW6020	A		04/23/12	04/24/12	ACF
Semivolatile Organic Fuels Department									
Diesel Range Organics	ND	36.6	mg/Kg	AK102	A		04/19/12	04/19/12	EAB
Residual Range Organics	141	36.6	mg/Kg	AK103	A		04/19/12	04/19/12	EAB
Surrogates									
5a Androstane <surr>	86.1		%	AK102	A	50-150	04/19/12	04/19/12	EAB
n-Triacontane-d62 <surr>	74.7		%	AK103	A	50-150	04/19/12	04/19/12	EAB
Solids									
Total Solids	60.7		%	SM21 2540G	A			04/19/12	THV

SGS North America Inc.
CHAIN OF CUSTODY RECORD

Local
- Alaska
- New Jerse
- North Car
- West Virg

1121223

(1)

CLIENT: ABR, INC.

CONTACT: Joel Gottschalk PHONE NO: 907-947-9161

PROJECT NAME: 11-162 PROJECT/ PWSID/ PERMIT# :

REPORTS TO: EMAIL: JGottschalk@abrinc.com

INVOICE TO: QUOTE #:

P.O. #:

SGS Reference #:

page _____ of _____

(2)

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX/ MATRIX CODE	# CONTAINERS	SAMPLE TYPE C= COMP G= GRAB MI= Multi Incremental Samples	Preservatives Used	Analysis Required (3) Diesel Range ORG. R.O.	Metals EPA 6020							REMARKS/ LOC ID
1A	11-162 - WATER 1	11/17/11	12:00		1			X	X							
2A	11-162 - WATER 4	11/17/11	12:00		1			X	X							

(5)

Collected/Relinquished By:(1)	Date	Time	Received By:
J Gottschalk	4/17/12	9:30	
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date 4/17/12	Time 0930	Received For Laboratory By:

(4)

DOD Project? YES NO

Cooler ID _____

Data Deliverable Requirements:

Requested Turnaround Time and-or Special Instructions:
Mercury, Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, Silver.
* Ran past hold time

Temperature Blank °C: _____ or Ambient [ ]
(See attached Sample Receipt Form)

Chain of Custody Seal: (Circle)
INTACT BROKEN ABSENT
(See attached Sample Receipt Form)

SGS

1121223

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) Ambient 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?* $480.00 FAT 4/17/12	Note airbill/tracking # See Attached or N/A Yes No (N/A)	
→ For samples received with payment, note amount (~~$365~~) and cash / check / CC (circle one). → For samples received in FBKS, ANCH staff will verify all criteria are reviewed.		N/A 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	Proceed w/analysis per client
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	(1)A bottom cracked proceed per client
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	Limited volume, Priority to Metals Analysis.
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: JH PM = N/A
Was **PEER REVIEW** of ***sample numbering/labeling completed?***	Yes No N/A	Peer Reviewed by: N/A

Additional notes (if applicable):

STEVE CRUPI QUOTED PRICING OF: DRO/RRO = 85.00
RCRA-M = 155.00

TOTAL 240.00 PER SAMPLE. TOTAL OF $480.00
FAT 4/17/12

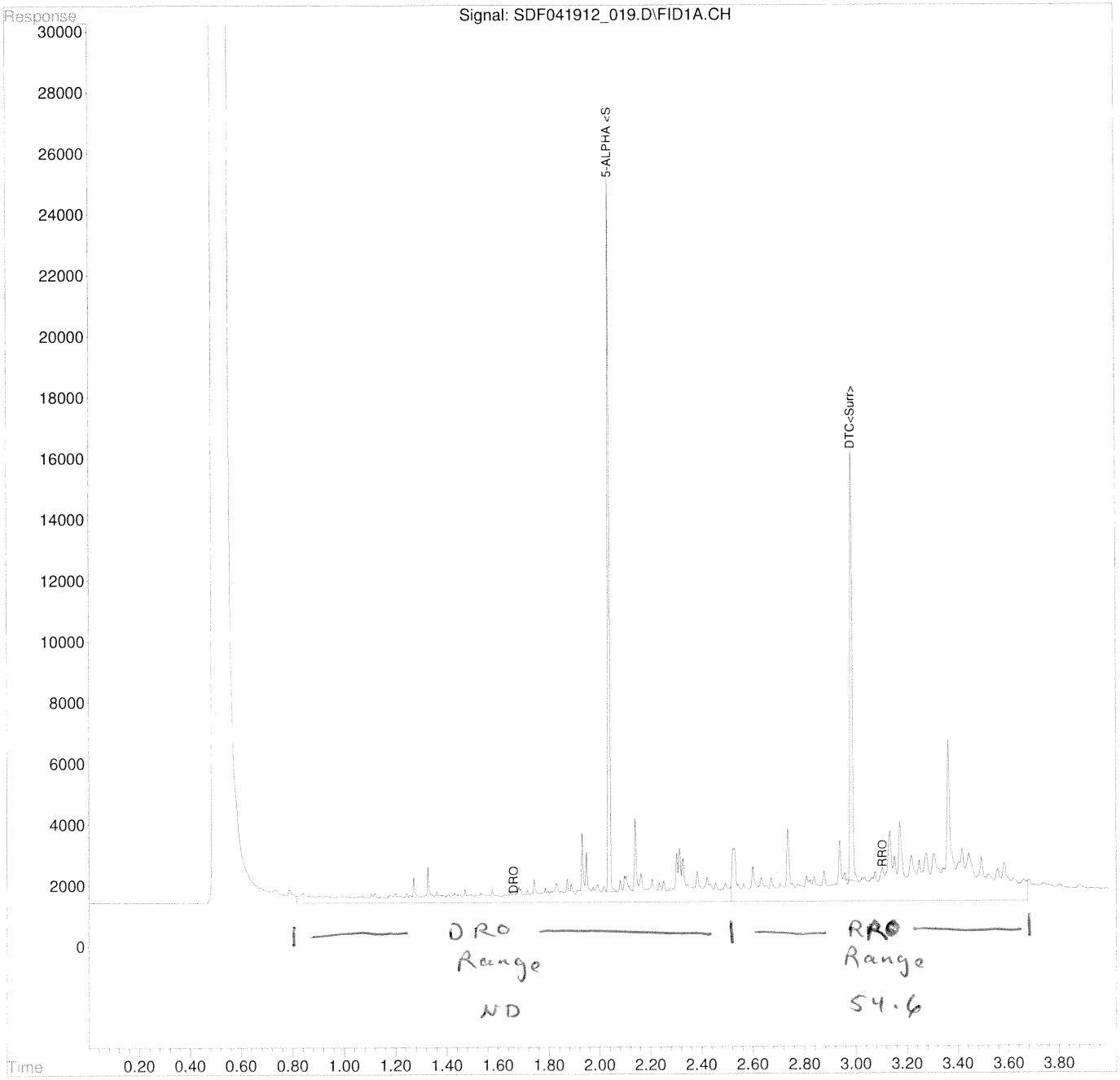
Note to Client: *Any "no" circled above indicates non-compliance with standard procedures and may impact data quality.*

Quantitation Report (Not Reviewed)

Data Path : Z:\04\SD\DATA\SDF041912\
Data File : SDF041912_019.D
Signal(s) : FID1A.CH
Acq On : 19 Apr 2012 20:35 pm
Operator : EAB
Sample : 1121223001 Water 1
Misc :
ALS Vial : 14 Sample Multiplier: 1

Integration File: autoint1.e
Quant Time: Apr 20 09:08:43 2012
Quant Method : Z:\04\SD\METHOD\SDF_040912D.M
Quant Title : DRO/RRO by Method AK 102/103
QLast Update : Mon Apr 09 20:59:45 2012
Response via : Initial Calibration
Integrator: ChemStation 6890 Scale Mode: Small noise peaks clipped

Volume Inj. :
Signal Phase :
Signal Info :



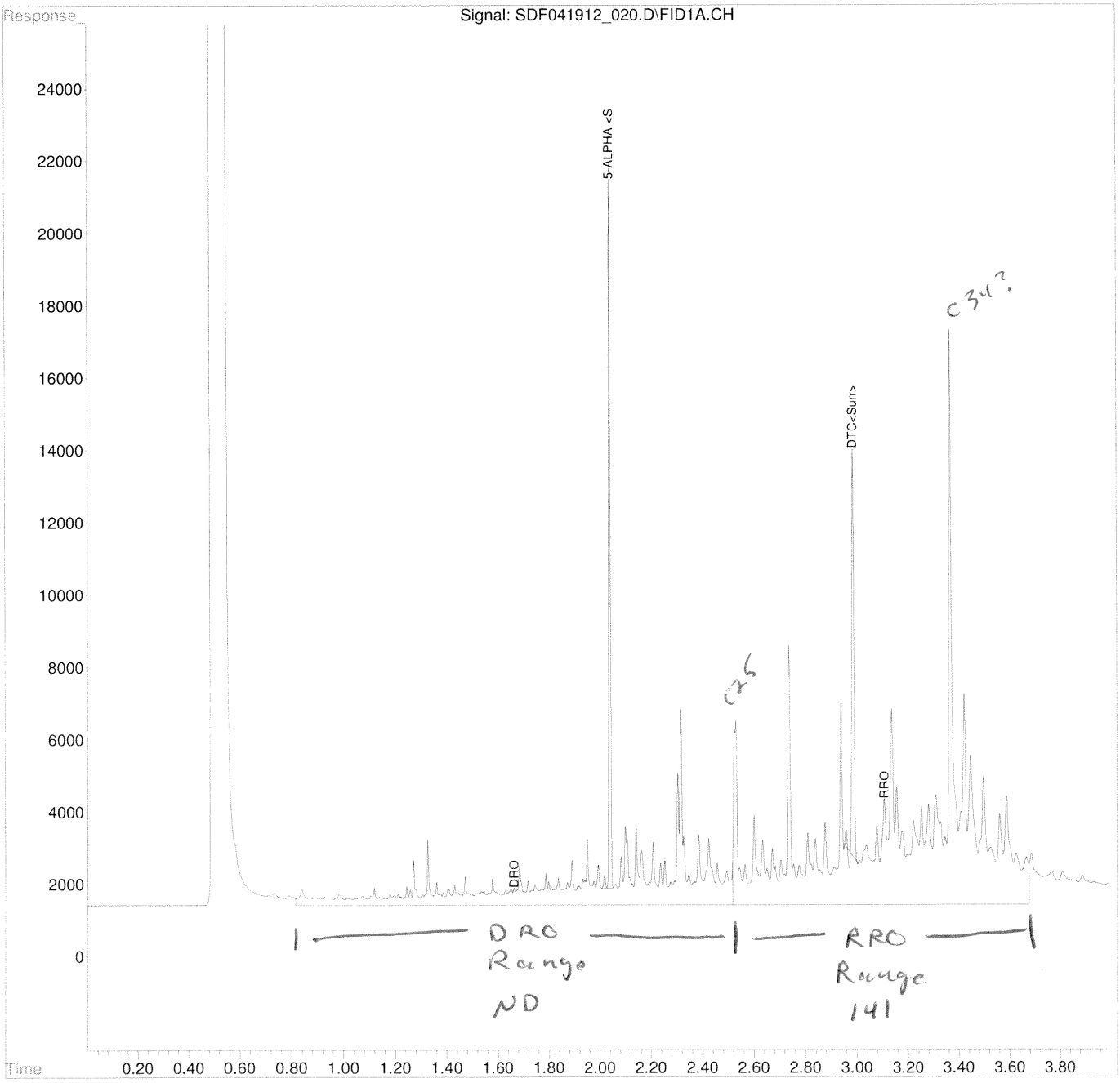
Quantitation Report (Not Reviewed)

Data Path : Z:\04\SD\DATA\SDF041912\
Data File : SDF041912_020.D
Signal(s) : FID1A.CH
Acq On : 19 Apr 2012 20:44 pm
Operator : EAB
Sample : 1121223002
Misc :
ALS Vial : 15 Sample Multiplier: 1

Water 4

Integration File: autoint1.e
Quant Time: Apr 20 09:09:03 2012
Quant Method : Z:\04\SD\METHOD\SDF_040912D.M
Quant Title : DRO/RRO by Method AK 102/103
QLast Update : Mon Apr 09 20:59:45 2012
Response via : Initial Calibration
Integrator: ChemStation 6890 Scale Mode: Small noise peaks clipped

Volume Inj. :
Signal Phase :
Signal Info :



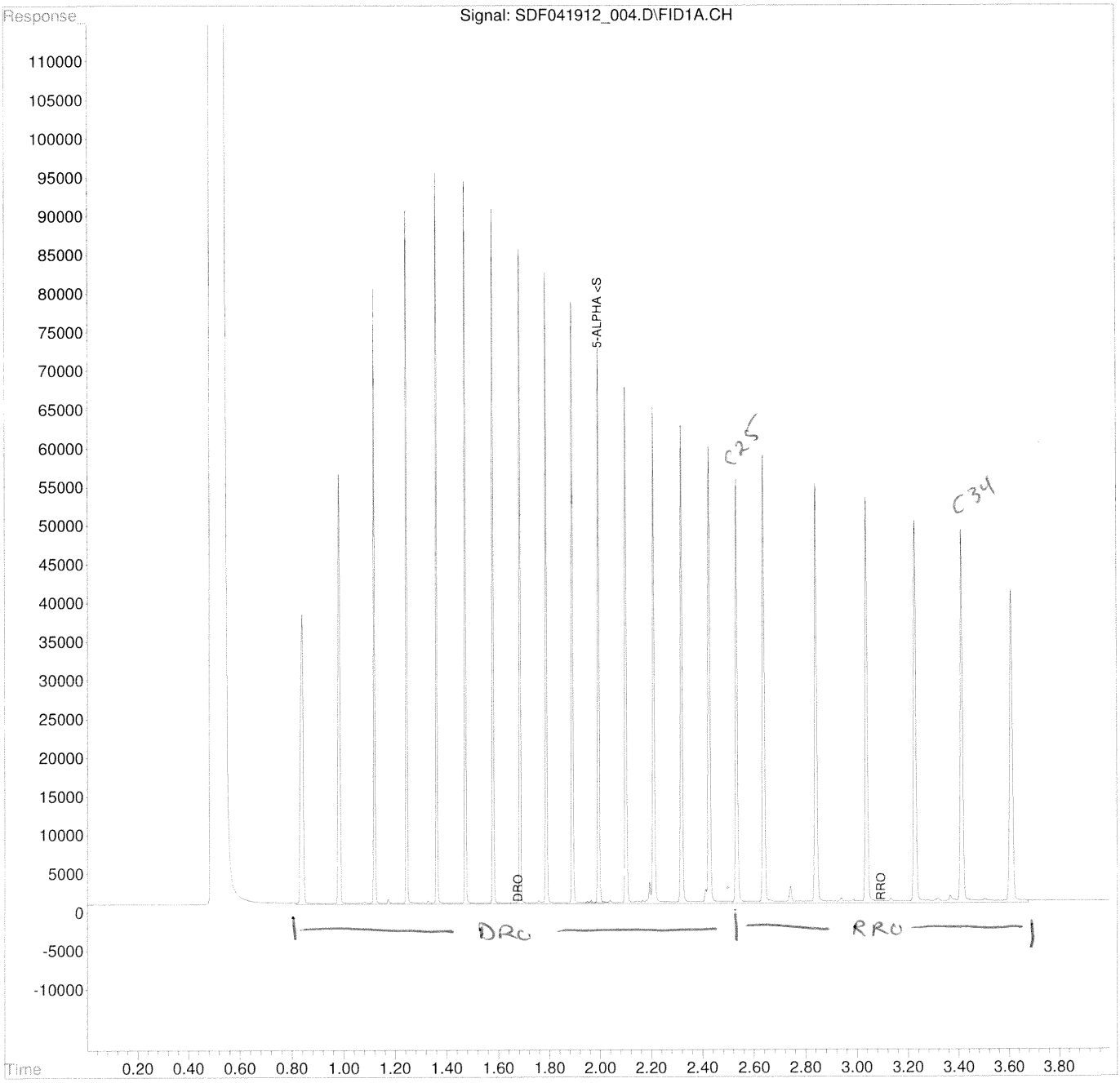
Quantitation Report (QT Reviewed)

Data Path : Z:\04\SD\DATA\SDF041912\
Data File : SDF041912_004.D
Signal(s) : FID1A.CH
Acq On : 19 Apr 2012 18:16 pm
Operator : EAB
Sample : NAS
Misc :
ALS Vial : 2 Sample Multiplier: 1

Normal Alkane Standard

Integration File: autoint1.e
Quant Time: Apr 20 09:00:32 2012
Quant Method : Z:\04\SD\METHOD\SDF_040912D.M
Quant Title : DRO/RRO by Method AK 102/103
QLast Update : Mon Apr 09 20:59:45 2012
Response via : Initial Calibration
Integrator: ChemStation 6890 Scale Mode: Small noise peaks clipped

Volume Inj. :
Signal Phase :
Signal Info :



Appendix E. (Continued). Results from algal analysis from 6 water samples taken from 3 stations on the Niġliq Channel of the Colville River during the fall subsistence fishery season, 2011.

Lab	Taxonomist	Sample ID	Sample Date	Processing Date	Frament Count	Description
ABR	JMG	11-162-1-1	30-Oct-11	30-Nov-11	13	*filamentous;chain plantktonic diatoms*
ABR	JMG	11-162-1-3	30-Oct-11	30-Nov-11	12	*filamentous*
ABR	JMG	11-162-1-4	30-Oct-11	30-Nov-11	17	*filamentous*; *stalked filamentous*; *amorphous* (globular colonies)
ABR	JMG	11-162-2-1	15-Nov-11	5-Dec-11	8	*filamentous; stalked filamentous*
ABR	JMG	11-162-2-3	15-Nov-11	5-Dec-11	6	*filamentous; amorphous* (globular colonies); *diatom* solitary, large, naviculoid
ABR	JMG	11-162-2-3	15-Nov-11	5-Dec-11	11	*filamentous*

Appendix F. A summary of water chemistry results from 3 sampling location on 2 dates during the subsistence harvest of arctic cisco in the Niġliq Channel, Colville River. ND = below detectable limits

	10/30/2011			11/15/2011		
	Water Chemistry Station 1	Water Chemistry Station 3	Water Chemistry Station 4	Water Chemistry Station 1	Water Chemistry Station 3	Water Chemistry Station 4
Arsenic (mg/l)	ND	ND	ND	ND	ND	ND
Barium (mg/l)	0.0792	0.0902	0.118	0.0905	0.148	0.108
Cadmium (mg/l)	ND	ND	ND	ND	ND	ND
Chromium (mg/l)	ND	ND	ND	ND	ND	ND
Lead (mg/l)	ND	ND	ND	ND	ND	ND
Selenium (mg/l)	ND	ND	ND	ND	ND	ND
Silver (mg/l)	ND	ND	ND	ND	ND	ND
Mercury (mg/l)	ND	0.0017	0.000353	ND	ND	0.00067
Diesel Range Organic (mg/l)	ND	ND	ND	ND	ND	ND
Residual/Heavy Oil Organics (mg/l)	ND	ND	ND	ND	ND	ND
Nitrate/Nitrite as Total Nitrogen	ND	0.0399	0.0812	0.0779	0.118	0.139
Algal Fragments/100ml H_20	12	13	17	8	6	11

Appendix G. A summary of benthic river bed chemistry results from 2 sampling location collected on 17 Nov during the subsistence harvest of arctic cisco in the Niġliq Channel, Colville River. ND = below detectable limits.

	11/17/2011		
	Water Chemistry Station 1	Water Chemistry Station 4	ADEC Soil Quality Standards - Arctic Zone Direct Contact[a] (mg/Kg)
Arsenic (mg/Kg)	6.35	6.88	6.1
Barium (mg/Kg)	279	433	27400
Cadmium (mg/Kg)	ND	ND	110
Chromium (mg/Kg)	12.4	23.2	410
Lead (mg/Kg)	6.72	13.4	400
Selenium (mg/Kg)	ND	0.894	680
Silver (mg/Kg)	ND	ND	680
Mercury (mg/Kg)	ND	0.0782	41
Diesel Range Organic (mg/Kg)	ND	ND	12500[b]
Residual/Heavy Oil Organics (mg/Kg)	54.6	141	13700[c]
Total Solids (mg/Kg)	70.1	60.7	N/A

[a] from Table B1 in 18 AAC 75

[b] from Table B2 in 18 AAC 75; mg/kg ingestion limit

[c] from Table B2 in 18 AAC 75; mg/kg ingestion limit