Summaries of 2022 Environmental Field Studies

Each year, ConocoPhillips Alaska conducts scientific field studies throughout the Colville River and northeastern National Petroleum Reserve – Alaska (NPR-A) on the North Slope of Alaska. These studies are conducted by respected scientists with many years of experience on the North Slope. In 2022, the studies focused on several avian species (eiders, loons, geese, shorebirds), air quality, fish and subsistence fisheries, caribou, hydrology, cultural resources, and subsistence.

In an effort to share the study information more broadly with stakeholders, the scientists prepared a one-page summary explaining their work; where it was conducted; the reason(s) for the research; and an overview of their preliminary study findings. This booklet contains the one-page summaries of the biological and physical environmental field studies conducted in the Alpine and Kuparuk areas and the NPR-A during calendar year 2022.

ConocoPhillips Alaska has also posted these one-page summaries on the North Slope Science Initiative (NSSI) Nuiqsut Environmental Information Website. This website contains all the ConocoPhillips scientific reports from environmental monitoring studies conducted within 50 miles of the Nuiqsut area.

https://northslopescience.org/nuiqsut/

Ambient air quality monitoring for Colville River Unit / SLR

Volatile organic compound study / SLR

Monitoring eider nests at Alpine / ABR

Aerial surveys of Eiders on the Colville River Delta / ABR

Aerial surveys for molting and brood-rearing geese in the Willow project area / ABR

Shorebird monitoring in the Willow project area/ ABR

Aerial surveys for molting and brood-rearing Brant and Snow Geese on the Colville River Delta / ABR

Monitoring Yellow-billed Loons in the Willow area / ABR

Eider study in the Greater Mooses Tooth and Willow areas / ABR

Yellow-billed Loon surveys on the Colville River Delta / ABR

Cultural resources surveys / Reanier & Associates

Tinmiaqsiugvik / Ublutuoch River fish surveys / Owl Ridge

Willow area fish surveys / Owl Ridge

Lake surveys / Owl Ridge

Ice bridge support and water quality monitoring / Michael Baker

Spring breakup monitoring and hydrological analysis / Michael Baker

Aerial infrared survey of polar bear denning habitat / ERC

Caribou in the Colville River Delta and Greater Mooses Tooth Unit / ABR

Caribou in the Greater Kuparuk Area / ABR

Bear Tooth Unit caribou monitoring/ ABR

Colville area summer fishery harvest monitoring / ABR

Colville River under-ice fishery harvest monitoring / ABR

Nuiqsut caribou subsistence monitoring project / SRB&A

Tundra rehabilitation - Alpine and Kuparuk / ABR
AMBIENT AIR QUALITY MONITORING FOR THE COLVILLE RIVER UNIT

What did we do?

On behalf of ConocoPhillips Alaska, Inc. (CPAI), SLR International Corporation (SLR) operates Air Quality Monitoring Stations in the Colville River Unit to collect continuous ambient air quality and meteorological data. These stations monitor concentrations of “criteria pollutants” (carbon monoxide, ground-level ozone, particulate matter, nitrogen dioxide, and sulfur dioxide). Each station utilizes pollutant-specific analyzers approved by the Environmental Protection Agency (EPA) to continuously measure ambient air quality. Meteorological sensors are installed on a tower in Nuiqsut to determine local climate and atmospheric dispersion conditions. Data has been collected at various sites since 1999, prior to the construction of the Alpine Central Processing Facility, and has continued throughout construction and operational phases of Alpine and its satellites.

Where did we go?

One station (Nuiqsut Monitoring Site, est. 1999) is located at the northern edge of the village of Nuiqsut, approximately 450 yards northwest of the community electrical generators, and is enhanced with a full suite of meteorological measurements. Another station is located at the Alpine CD1 facility (2012-2015; 2017-present), approximately 25 miles southwest of the Beaufort Sea and nine miles north of the village of Nuiqsut. A third location, at the Alpine CD5 drill site (est. 2015), is near the Colville River Delta, 51 miles west of the Kuparuk River and eight miles north of the village of Nuiqsut. The data collected at these sites are remotely monitored by technicians in SLR’s Anchorage office. On-site monthly maintenance is performed by SLR technicians to ensure quality data is being collected. Acceptable instrument performance is independently verified by a third-party auditor quarterly.

Why were we working in the area?

Nuiqsut Monitoring Site — This station collects Prevention of Significant Deterioration (PSD) quality data to document Nuiqsut air quality near regional oilfield development. This station measures a) background ambient concentrations of air quality pollutants and particulate matter to establish National Ambient Air Quality Standards (NAAQS) compliance status for the monitoring location, and b) meteorological observations at the project site from ground level up to 10 meters above ground level. It provides meteorological data for the American Meteorological Society/EPA Regulatory Model Improvement Committee Model modeling system that meets current Meteorological Monitoring Guidance for Regulatory Modeling Applications requirements for air quality permitting. Data from the Nuiqsut monitoring station is published to a state web page that displays current air quality conditions throughout the state - https://dec.alaska.gov/air/air-monitoring/alaska-air-quality-real-time-data

CD1 Monitoring Site — Originally, ambient air pollutant data was collected at this station to represent the CD1 area to support potential PSD permitting, for minor air quality permitting under the State of Alaska regulations and to demonstrate “real-world conditions” representative of an operating production facility. Since 2017, this station collects PSD-quality data to satisfy PM$_{2.5}$ collocation monitoring requirements under 40 CFR 58.

CD5 Monitoring Site — Complies with North Slope Borough rezone ordinance 75-6-46 stipulations. Additionally, this station collects ambient air pollutant data representative of the CD5 area and to support potential PSD or minor air quality permitting under State of Alaska regulations.

What are our preliminary findings?

Data collected in 2022:

- Demonstrates compliance with NAAQS and Alaska Department of Environmental Conservation standards.
- Meets or exceeds EPA data quality requirements for PSD monitoring.
- Documents ambient air quality to be in “good” to “moderate” categories defined by the United States EPA Air Quality Index.
VOLATILE ORGANIC COMPOUND STUDY

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), SLR International (SLR) has been collecting volatile organic compounds (VOC) samples since 2014. The United States Environmental Protection Agency (EPA) defines VOC as “any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions.” VOC originates from natural sources (forest, soil, etc.) and anthropogenic sources (urban and industrial activities). Samples of ambient air have been collected monthly in Summa canisters (see diagram below) from multiple sites near the Alpine oilfield and at an urban area, then transferred to Atmospheric Analysis and Consulting, Inc laboratory for analysis of VOC using TO-15 and TO-12M EPA Reference Methods. Method TO-15 analyzes for pollutants in the EPA national air toxics program and Method TO-12M analyzes for hydrocarbons typical of oilfield operations covered by the EPA photochemical assessment monitoring station program. In 2022, CPAI installed continuous VOC monitors at the CD1 and Nuiqsut air monitoring stations. These continuous samplers measure total ambient VOC (TVOC) concentrations using a photoionization detector. Monitor’s response is verified against a known standard to validate performance every month. Data is collected and summarized in monthly air quality reports.

Where did we go?
The study area includes Nuiqsut, CD1, and Anchorage. The North Slope samples are collected near the CPAI air quality monitoring stations. The Nuiqsut station is at the northern edge of Nuiqsut, approximately 450 yards northwest of the community electrical generators. The CD1 samples are collected at the Alpine CD1 facility, approximately nine miles north of the village of Nuiqsut. The Anchorage sampling site is in the CPAI downtown parking lot. The continuous monitors are installed inside the air monitoring stations at CD1 and Nuiqsut and sample ambient air continuously through a non-reactive glass and Teflon manifold.

Why were we working in the area?
VOC samples are collected to address concerns of the residents of Nuiqsut regarding air quality in the village and to assess for potential impact associated with nearby oilfield construction, drilling, and production activities. The VOC sampling program is an expansion of the ongoing air quality monitoring program on the North Slope. The VOC study program was designed to collect scientifically rigorous, accurate VOC data to document regional VOC concentrations that are representative of Nuiqsut, Alaska. The continuous TVOC monitors provide the ability to trend changes in VOC concentrations in the area and data is compared to that from the manual samples collected each month.

What are our preliminary findings?
The initial 2014 short-term VOC data results were below the method detection limits (MDL) and national toxic compound screening levels. The long-term ongoing VOC data results are similar to those observed during the initial survey, and 2022 results are in line with the long-term trend. VOC samples collected at the North Slope sites continue to demonstrate lower VOC concentrations than are observed in Anchorage and provides further evidence of good air quality conditions on the North Slope.
MONITORING EIDER NESTS AT ALPINE

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), in June 2022, ABR, Inc.—Environmental Research & Services (ABR) conducted ground-based searches for nests for 2 sensitive species: Spectacled and Steller’s eider. The goal of the nest searches is to find nests before off-pad activities are conducted that could disrupt nesting birds. If active eider nests are found, their locations are communicated to CPAI field environmental staff, and planned activities occurring near nests are modified to prevent disturbance. This summer was the 14th season that ABR conducted eider nest searches in advance of off-pad work in the Alpine Oilfield.

Where did we go?
ABR biologists conducted ground nest searches in the Alpine oilfield (which includes drill sites on the Colville River Delta (CRD) and Greater Mooses Tooth (GMT) units in the National Petroleum Reserve-Alaska [NPR-A]), in areas such as Alaska Clean Seas (ACS) spill-response sites, pipelines, ice roads, multi-season ice pads, and lake sites, where off-pad work was necessary during the breeding season. The team drove and walked to sites near the road system when possible and used a helicopter to access sites far from roads.

Why were we working in the area?
The Alpine oilfield is within the current or historical breeding ranges of Spectacled and Steller’s eiders, 2 species that are listed as threatened under the Endangered Species Act (ESA). Spectacled Eiders are regularly observed in the Alpine region while Steller’s Eiders are extremely uncommon. CPAI occasionally conducts off-pad activities necessary for regulatory compliance and operations during the eider breeding season (June and July) such as tundra clean-up after the ice-road season, spill-response equipment deployment, hydrological monitoring, water access, or civil surveys. Searching for and reporting active eider nests, before off-pad work is conducted, is a requirement of ESA compliance and development permitting used to protect these species.

What are our preliminary findings?
- In June 2022, a team of 4 biologists searched 25 sites in 6 days and found no Spectacled or Steller’s eider nests.
- The team recorded 169 nests of 16 species of birds. Most of the nests recorded were of 3 species of geese: Greater White-fronted Geese (97 nests), Snow Geese (29 nests), and unidentified Cackling/Canada Geese (16 nests). The remaining 27 nests recorded were of shorebirds, seabirds, passerines, and raptors.

Nest searchers at Alpine.

Peregrine chicks in a nest on the Nigliagvik bridge.

Spectacled Eider pair.

Alpine study area.
**AERIAL SURVEYS OF EIDERS ON THE COLVILLE RIVER DELTA**

**What did we do?**
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) conducted surveys of Spectacled and King eiders on the Colville River Delta during the pre-nesting season (early June) using a small fixed-wing aircraft. Biologists recorded species, numbers, locations, and habitats for all eiders observed. This long-term study began in 1993, prior to oil development on the delta. During the past three decades, ABR has identified important locations and habitats used by eiders and has monitored eider numbers throughout all phases of construction and operation of the oilfields in the Colville River Delta.

**Where did we go?**
ABR surveyed the area between the Nechelik and East channels of the Colville River, shown in the map to the right. The survey area was bounded on the north by the mud flats of the outer delta, and on the south by an east-west line about 2 miles (3.2 km) north of the village of Nuiqsut.

**Why were we working in the area?**
The Colville River Delta is recognized as an important breeding area for eiders. The Spectacled Eider was listed as threatened under the Endangered Species Act in 1993. CPAI was required by the U.S. Fish and Wildlife Service to survey the species when the CD3 drill site was built in the early 2000s. King Eiders are an important subsistence resource in North Slope Borough (NSB) communities, and migration studies have indicated that the species has declined in recent decades in the Arctic. The NSB has required continued monitoring of eiders on the Colville River Delta due to the value of the delta for these sensitive species and the importance of these species to local communities.

**What are our preliminary findings?**
- There were more King than Spectacled eiders on the Colville River Delta during the pre-nesting period in 2022. Although the Colville River Delta is noteworthy for its abundance of threatened Spectacled Eiders, King Eiders have outnumbered Spectacled Eiders in 13 of 29 years since 1993, including 7 of the last 10 years and every year since 2017.
- The density of Spectacled Eiders on the Colville River Delta was below average in 2022. Spectacled Eider numbers have varied from year to year, but overall, their numbers on the delta have not changed much since surveys began in 1993. In contrast, the density of King Eiders was well above average in 2022, and numbers have increased within the study area over the past 30 years.
- As in previous years, most Spectacled Eiders were found north of Alpine and east of the Elaktoveach Channel. King Eiders were widely distributed, with concentrations occurring in river channels, bays, and flooded areas near the coast.
- Based on the habitats that Spectacled and King eiders were observed using and on past observations during ground nest searches, it is likely that most Spectacled Eiders seen during the pre-nesting survey were breeding on the Colville River Delta and that most King Eiders were likely moving through the area to breed elsewhere.

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**King Eider pair.**

**Aerial view of Colville River Delta.**

**Spectacled Eider pair.**

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**2022 STUDIES AVIAN**

**FINAL REPORTS WILL BE AVAILABLE ONLINE AT NORTHSLOPESCIENCE.ORG/NUIQSUT/**

ConocoPhillips Alaska, Inc. | Environmental Sustainability & Permitting
AERIAL SURVEYS FOR MOLTING AND BROOD-REARING GEESE IN THE WILLOW PROJECT AREA

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) conducted an aerial survey for molting and brood-rearing geese in the Willow project area during late July. Surveys were timed to avoid impacts to subsistence users in the area. Biologists recorded species, locations, and numbers of adults and young for all geese observed. This was the second year of a multi-year study. ABR previously surveyed molting geese in the Willow project area in 2001–2004 and resumed in 2021. Biologists will compare the current number of geese in the Willow project area with the number of geese observed in 2001–2004, and with the number of geese in other locations on the Arctic Coastal Plain.

Where did we go?
Using a small fixed-wing aircraft, ABR flew surveys in the GMT and Willow project areas, as shown in the figure to the right. The survey area, which included Fish and Judy creeks and existing and proposed infrastructure in the project areas, was 4.5 mi (7 km) west of Nuiqsut and encompassed about 760 mi² (1,970 km²).

Why were we working in the area?
CPAI funded these surveys to satisfy North Slope Borough rezone stipulations for the Willow project. Geese are an important subsistence resource, and molting and brood-rearing geese are sensitive to disturbance because they are unable to fly. These surveys provide valuable information on the status of goose species near current and future oil development. Data from this project will be used to identify any important goose brood-rearing and molting areas in the Willow project area.

What are our preliminary findings?
- Biologists recorded 67 groups of geese (3,221 adults and 606 goslings) on water bodies (excluding birds seen only in flight). Densities were highest in lakes and streams along the Fish Creek corridor in the northern half of the study area.
- Greater White-fronted Geese were recorded throughout the study area and were by far the most abundant species (3,026 adults and 451 goslings). The density of Greater White-fronted Geese appears to have increased in the area since 2001–2004.
- Snow Geese and Brant prefer coastal areas for brood-rearing and molting, and both species were found exclusively in the northeast corner of the survey area, within 5 mi of the coast. Very few Snow Geese were recorded in the area during earlier surveys in 2001–2004, but their numbers and range have increased substantially in the region over the past 15 years.
- Brant and Cackling and/or Canada geese were found in small numbers, similar to results from 2001–2004.
- Fewer White-fronted Geese were present in the survey area in 2022 than in 2021, possibly because the survey was conducted earlier in the season in 2022 to better target the flightless period for molting geese.
**SHOREBIRD MONITORING IN THE WILLOW PROJECT AREA**

**What did we do?**
On behalf of ConocoPhillips Alaska (CPAI), ABR, Inc.—Environmental Research & Services (ABR) searched for nests of shorebirds, songbirds, and waterfowl during early June through mid-July 2022. A team of biologists monitored plots that were established in 2021 at a variety of distances from planned infrastructure. The team found nests using 2 methods: 1) rope dragging to find nests of species that tend to flush from nests at close distances, and 2) behavioral observation to find nests of species that tend to flush at farther distances. They also visited 4 historical plots located north of the GMT2/MT7 pad that ABR surveyed during 2001–2004, and 2021. ABR is monitoring the plots to see whether there have been any changes to the distribution and number of shorebird nests since 2004. At all plots, biologists collected data on predators and environmental factors such as snow cover and habitat type. This was the second year of pre-construction monitoring, and the team will continue to monitor these plots during and after construction of the Willow project.

**Where did we go?**
Biologists used a helicopter to access research plots in the Willow project area and visited each plot multiple times during the season. As infrastructure is built, biologists will rely less on helicopters and more on trucks and walking to access plots in future years.

**Why were we working in the area?**
CPAI is funding this multi-year shorebird project to satisfy North Slope Borough (NSB) rezone stipulations for the Willow project. Data collected during this study will help CPAI and the NSB understand the baseline (pre-construction) distribution, numbers, and success rates of shorebird nests in the Willow project area. Comparing baseline (pre-construction) results to post-construction results will help biologists, land users, and land managers understand what effects development and environmental factors may have on breeding shorebirds.

**What are our preliminary findings?**
- For the second year in a row, ABR searched and monitored 24 research plots in the Willow and GMT2/MT7 areas.
- Cold temperatures in early June meant that birds started nesting later in 2022 than they did in 2021. Long-term studies such as this one help us understand how conditions vary in a given area from year to year.
- Biologists found 217 nests of 19 species across all plots, including 116 nests of 9 shorebird species. The most common nesting shorebird species were Pectoral Sandpipers, Long-billed Dowitchers, and Red-necked Phalaropes. The most common non-shorebird species was Lapland Longspur.
- We installed 20 small temperature loggers in the nests of Pectoral Sandpipers, Long-billed Dowitchers, Red-necked Phalaropes, and Red Phalaropes to help determine the exact date of hatch or failure. Nearly all (19 of 20) loggers successfully collected temperature data.
- Most shorebird nests found in 2022 hatched at least 1 chick. The number of shorebird nests that hatch varies widely by species.

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**Study area and plot locations for ground-based surveys of nesting shorebirds.**

**Biologist installing a temperature sensor in shorebird nest.**

**Long-billed Dowitcher on its nest.**

**Long-billed Dowitcher eggs hatching.**

**Female Red Phalarope.**

**Final reports will be available online at NorthSlopeScience.org/Nuiqsut/**
**What did we do?**

On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) conducted an aerial survey for molting and brood-rearing Brant and Snow Geese on the Colville River Delta in late July 2022. Surveys were timed to avoid impacts to subsistence users in the area. Biologists recorded the locations of all Brant and Snow Geese observed, estimated the numbers of adults and young, and photographed brood groups to obtain precise counts. ABR has conducted similar surveys on the Colville River Delta since 1992.

**Where did we go?**

ABR used a small fixed-wing airplane to survey the area between the Nechelik and East channels of the Colville River, as shown in the map to the right. The survey area included a series of east-west oriented transects, each 0.5 mile (0.8 km) wide, and evenly spaced 1 mile (1.6 km) apart, resulting in 50% coverage of the delta. Biologists surveyed a total of 13 transects, which were bounded on the north by the mud flats of the outer delta and on the south by an east-west line about 6 mi (9.7 km) north of Nuiqsut. The total area surveyed was about 87 mi² (225 km²).

**Why were we working in the area?**

CPAI funded these surveys to satisfy North Slope Borough rezone stipulations for the Greater Mooses Tooth 2 project. Geese are an important subsistence resource, and these surveys provide valuable information on the status of Brant and Snow Geese near current and future oil development. Data from this project will be used to look for changes in numbers of Brant and Snow Geese over time and to identify important habitats and specific locations used by brood-rearing geese on the Colville River Delta.

**What are our preliminary findings?**

- Biologists visually estimated 1,352 Brant (981 adults and 371 goslings) and 25,536 Snow Geese (12,477 adults and 13,089 goslings) during the survey in 2022. The photos have not yet been examined for precise counts.
- Numbers of brood-rearing Brant have increased on the Colville River Delta over the past 3 decades, from fewer than 2,000 birds/year prior to 1998, to over 5,000 birds/year in some years since 2017. Most Brant rear their broods on the outer delta north of CD3.
- Snow Geese were rarely seen on the Colville River Delta prior to the early 2000s, but their numbers have increased dramatically over the past 16 years, from fewer than 1,000 brood-rearing birds in 2005 to over 50,000 in 2021 and 2022.
- Much like Brant, Snow Geese prefer coastal habitats for brood rearing, but in recent years their range has expanded, and in 2021 and 2022, Snow Geese were found south of Alpine, up to 9 miles (45.5 km) from the coast.
- The brood survey requires careful coordination with the village of Nuiqsut to avoid impacts to subsistence hunters. The survey was delayed by several days in 2022 due to the presence of caribou in the study area, but molting adults and goslings were still flightless at the time of the survey and the results were not affected by the delay.
MONITORING YELLOW-BILLED LOONS IN THE WILLOW AREA

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) flew surveys around lakes to look for Yellow-billed Loon nests in June and chicks in August. The purpose of the study is to determine the abundance, distribution, and nesting success of Yellow-billed Loons in the proposed Willow project area. During the surveys, a biologist flew in a helicopter along the shoreline of lakes, islands, and peninsulas, and recorded loon observations. Scientists also set up time-lapse cameras at some nests to monitor the behavior of loons and identify egg predators. ABR has conducted Yellow-billed Loon surveys in the Willow area since 2017.

Where did we go?
The Willow survey area includes over 300 lakes within 3 miles of the proposed Willow roads and pads—a survey area that extends 330 m², shown in the map to the right. A helicopter must be used for surveys because the study area is large, and nests and young are most visible and best counted during short periods of the summer. It is important to fly surveys at the same time each year to compare the number of adults, nests, and chicks seen among survey years. Biologists also conduct a similar survey on the Colville River delta.

Why were we working in the area?
The Bureau of Land Management (BLM) designated the Yellow-billed Loon as a Sensitive Species, meaning that the BLM works cooperatively with other agencies and organizations to proactively conserve Yellow-billed Loons and their habitat. They have specific habitat requirements for breeding and need large, deep lakes capable of supporting fish populations. Yellow-billed Loons are sensitive to disturbances and leave nests when people are nearby, exposing nests to predators. BLM stipulations for oil and gas leases in the National Petroleum Reserve-Alaska specify setbacks between infrastructure and nest sites and lakes used by Yellow-billed Loons. Data from this study may help evaluate the effectiveness of the BLM stipulations. Monitoring nesting Yellow-billed Loons also satisfies North Slope Borough rezone stipulations for the Willow project.

What are our preliminary findings?
- Biologists counted 31 nests and 18 young during surveys in 2022. These numbers are nearly identical to the 5-year averages for the Willow study area, meaning that 2022 was a typical year for Yellow-billed Loons.
- A large lake that supported one pair of breeding Yellow-billed Loons drained into Judy Creek Kayyaaq during 2022. The event was captured by field scientists on time-lapse cameras. This lake supported a nest in 42% of survey years but never produced chicks.
- Wolverines ate the eggs and caused nest failure at 3 of the 15 camera-monitored Yellow-billed Loon nests.

Yellow-billed Loon nest with camera in background. Wolverine (yellow arrow) eating eggs at nest. Adult Yellow-billed Loon near nest.
EIDER STUDY IN THE GREATER MOOSES TOOTH AND WILLOW AREAS

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) flew a survey over 2 new oil development areas searching for pairs of pre-nesting King and Spectacled eiders in early June. Following the aerial survey, 4–5 biologists searched for eider nests on the ground in 20 treatment plots (near planned or existing oil development) and 21 control plots (located far from developments), as shown in the figure to the right. At each plot, biologists recorded details of all nests found (including those of non-eider species) and counted potential predators. A trail camera was set up on each active eider nest and each nest was revisited post-breeding to determine nest fate. This was the third year of a 5-year study.

Where did we go?
For the aerial survey, a small fixed-wing aircraft flew along transects spaced evenly at half-mile intervals from Fish Creek south to include the Greater Mooses Tooth (GMT) and Willow project areas. For nest searching, the team used a truck to access all plots near the GMT road (within approximately 0.25 mile) and a helicopter to access plots that were far from the road.

Why were we working in the area?
As part of the rezone ordinance for GMT2, the North Slope Borough (NSB) required a waterfowl study to examine the potential impacts of oil development on nesting birds. CPAI and NSB biologists decided that eiders—an important subsistence species in NSB communities—would be the focal species of the study. The goal of the study is to determine if construction and post-construction activities of the GMT and Willow projects affect the nest site selection or reproductive success of eiders.

What are our preliminary findings?
Aerial surveys:
• The team flew approximately 740 miles (1,200 km) of linear transects.
• King Eiders were broadly distributed throughout the study area. Biologists counted 96 King Eiders in 2022, about 28 percent fewer than in 2021. Most occurred as pairs or single males (assumed to be paired with females that are more difficult to see).
• No Spectacled Eiders were observed from the airplane in 2022. During the first 3 years of this study, the only Spectacled Eider recorded was a single male in 2021.

Ground surveys:
• In 10 days of nest-searching, the field crew found 10 active eider nests in reference (1 at GMT, 4 at Willow) and treatment (3 at GMT, 4 at Willow) sites.
• Cameras successfully recorded the fate of each active nest. Camera images will also be used to quantify incubation behaviors of female eiders.
• Of the 10 eider nests, 2 nests failed from predation by arctic foxes, 1 was in the GMT2 study area and 1 in Willow study area. Eight nests successfully hatched at least 1 chick.

Biologist aging eider eggs.  Female King Eider on nest.  Biologists setting up a camera.
YELLOW-BILLED LOON SURVEYS ON THE COLVILLE RIVER DELTA

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) flew surveys around lakes to look for Yellow-billed Loon nests in June and for chicks in August. During the surveys, a biologist flew in a helicopter along the shoreline of specific lakes, islands and peninsulas, and recorded loon observations. The purpose of the study is to document the abundance, distribution, and nesting success of Yellow-billed Loons in the project area. ABR first surveyed the area in 1993, prior to the development of the Alpine Oilfield. Surveys have continued throughout the construction and operational phases of Alpine and its satellites. This is the 28th summer that ABR has been monitoring breeding Yellow-billed Loons on the Colville River Delta for CPAI.

Where did we go?
When surveys were first conducted, ABR surveyed all large lakes on the Colville River Delta. In more recent years, however, only the lakes where Yellow-billed Loons had been seen during the previous 22 years were included. The survey area, shown in the map to the right, is more than 200 mi² and contains roughly 120 survey lakes.

Why were we working in the area?
Yellow-billed Loons breeding in Alaska belong to a small, unevenly distributed population. In 2009, the species was proposed but not listed under the Endangered Species Act. Today, state and federal agencies still consider the Yellow-billed Loon a species that warrants special management. These surveys have been critical in assessing the status of the population and are helping land managers understand how future oilfield development in the National Petroleum Reserve in Alaska might affect loons. Continued monitoring of this species also satisfies North Slope Borough requirements (2018 Alpine-GMT Rezone Ordinance).

What are our preliminary findings?
- Biologists counted 23 nests and 11 young during surveys in 2022. These numbers are close to what biologists count in a typical year, so 2022 was an average year for Yellow-billed Loons.
- A landscape change in 2022 impacted the breeding territory of a large lake along the Colville River that supported three pairs of breeding Yellow-billed Loons. This event caused a 6% reduction in the number of breeding territories in the study area.
- Although the numbers of adults, nests, and young counted each year can vary widely, biologists have not detected increasing or decreasing trends over the long-term dataset and consider the Yellow-billed Loon population on the Colville Delta to be stable.

Nest (yellow arrow) in relation to Alpine. Adult Yellow-billed Loon. Nest (yellow arrow) during June in an ice-filled lake.

ConocoPhillips Alaska, Inc. | Environmental Sustainability & Permitting
What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), Reanier and Associates, Inc. conducted cultural resource surveys in CPAI’s areas of operation, the Willow area, and near Anaktuvuk Pass in 2022. The Willow development area was previously examined for archaeological sites in 2017, 2018, 2019, and 2021. Examinations of the area date back to 1976 – only three years after Nuiqsut was re-settled and the first year that Dr. Rick Reanier worked in the Nuiqsut area. For the past several years CPAI has collaborated with the North Slope Borough (NSB) Planning Department to conduct surveys to protect cultural resources, including NSB Traditional Land Use Inventory (TLUI) sites. In the photo to the left, Tommy Nageak examines a newly recorded sigļuaq, an ice cellar, reported by Elders to be at the TLUI site, but not previously documented by archaeologists. The cellar lacks a ladder and a framed entrance, but does display saw-cut wood in its central depression. Another 2022 survey north of Anaktuvuk Pass recorded a number of cultural resource sites, including the hunting blind illustrated below. The blind is situated next to a stream where caribou are known to cross. It is made of local boulders stacked several courses high. Remains of campfires are present inside the blind, and several caribou antlers tell of successful hunts.

Where did we go?
From 2017 to 2022, all of the areas for proposed Willow gravel roads and pads, including the airstrip and gravel mine, were searched for evidence of these old sites. Both aerial and on-the-ground surveys were conducted. Transportation to and from survey sites was made by helicopter. As development plans evolved, new studies were conducted on the revised areas. Surveys in 2022 included an area to the north of Anaktuvuk Pass where trail hardening may occur.

Why were we working in the area?
Archaeological and historic sites are places where people once lived and worked, leaving behind traces of their presence. Many such sites are also part of the cultural heritage of North Slope villages. There are numerous Borough, State, and Federal laws and regulations that prevent damage to archaeological sites. In order to adequately protect such sites, their locations must be precisely known, which requires an archaeological survey to find and record them. Visiting previously recorded sites to verify locations with modern GPS coordinates is also an ongoing part of the program.

What are our preliminary findings?
- Although there are a few cultural resource sites near the Willow area, sites in the area are generally located near lakes and streams, away from the proposed locations for development. At Anaktuvuk Pass, sites can be avoided during any environmental work.
- Humans have lived on the North Slope for thousands of years, but the sites found in the Willow area relate mostly to historic Iñupiat use of the region. Similarly, sites recorded north of Anaktuvuk Pass in 2022 are mostly Nunamiut sites from the 20th century.

This data is shared with appropriate cultural resource agencies, but reports are not available on the North Slope Science Initiative website due to confidentiality requirements.
**TINMIAQSIUGVIK/UBLUTUOCH RIVER FISH SURVEYS**

**What did we do?**
On behalf of ConocoPhillips Alaska, Inc. (CPAI), Owl Ridge Natural Resource Consultants conducted a fish monitoring study in the Tinmiaqsiugvik River drainage in the National Petroleum Reserve-Alaska. This study builds upon earlier studies in the area that began in 2001.

Researchers sampled the drainage for three 7-day periods in 2022: after break-up in June, during mid-summer in July, and just before freeze-up in late August. Fish moving both upstream and downstream were captured in specialized nets, called fyke nets, that funnel fish into a live-trap end. Water chemistry measurements were recorded daily at each site and all fish captured were identified and measured. Fish longer than approximately seven inches were tagged with a unique number to help evaluate seasonal and annual movements within and between drainages. Local fishers who catch a tagged fish can help researchers understand fish movement by calling the phone number printed on the tag to report it.

**Where did we go?**
Researchers sampled seven sites in 2022 and six sites in 2021. Sampling took place throughout the open water season at sites along the mainstem of the Tinmiaqsiugvik River and in small creeks flowing into the river. Sites were located both downstream and upstream of the bridge crossing and were accessed solely by boat.

**Why were we working in the area?**
The goal of this study is to better understand how, when, where, and what species, numbers, and ages of fish are using the Tinmiaqsiugvik River drainage. The 2022 surveys were the third year of a four-year monitoring study in the drainage. Data collected will support Greater Mooses Tooth 2 rezone monitoring conditions required by the North Slope Borough. Fish tagging data is used to track fish movements and to develop population estimates that can be compared to past and future estimates. Continued monitoring of fish using the Tinmiaqsiugvik River may also allow an assessment of the potential effects of development activities and climate change on these fish populations.

**What are our preliminary findings?**
- A total of 2,282 fish and 11 species were captured across 2,982 total effort hours in 2022.
- Six hundred ninety-one fish were newly tagged in 2022 and 121 previously tagged fish were recaptured. One fish was recaptured in the Beaufort Sea near Prudhoe Bay, over 200 miles away.
- In 2022, Arctic grayling accounted for 40 percent of the total catch, followed by ninespine stickleback (27 percent), round whitefish (10 percent), and least cisco (6 percent). All other species accounted for about 17 percent of the catch.
- Species diversity was typically greatest at downstream mainstem areas of the river and was lowest in upstream reaches and in small creeks.
- Fish movement is extensive, both within the drainage and surrounding drainages, like Fish Creek.
- Continued data analysis in 2022 will be conducted to generate population estimates and to determine the age, growth, maturity, and other characteristics of fish populations using the drainage.
WILLOW AREA FISH SURVEYS

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), Owl Ridge Natural Resource Consultants studied fish use of streams in the Willow area. Researchers identified the composition of fish species, their seasonal distribution and movements, and population characteristics, such as the size and numbers of fish using streams in the study area.

The team sampled fish in three 7-day periods each year of the study: just after break-up in June, mid-summer in July, and just before freeze-up in late August. Fish moving both upstream and downstream were captured using specialized nets, called fyke nets, that funnel fish into a live-trap end. Each fish was identified, measured, and released. Fish longer than approximately seven inches were tagged with a unique number to help evaluate seasonal and annual movements within and between drainages. Water chemistry was recorded each day at each site. Local fishers who catch a tagged fish can help researchers understand fish movement by calling the phone number printed on the tag to report it.

Where did we go?
In the 2022 season, the team sampled six fyke net sites distributed across the mainstem and headwater lakes of Judy Creek Kayyaaq and along a tributary of Fish Creek (Uvlutuuq), named Willow 2. Researchers traveled to and from the sampling sites by helicopter.

Why were we working in the area?
This study was initially required by the Bureau of Land Management and the Alaska Department of Fish and Game to provide a baseline for understanding how fish use streams in the Willow area and to assess potential future impacts to fish from development activities and climate change. The study is also required by the North Slope Borough and Willow Rezone to help detect and understand possible changes to fish within the project area over time. Collected data is used in bridge and culvert design and construction to ensure and maintain fish passage and fish habitat at stream crossings. The 2022 sampling goals placed emphasis on two specific streams to enable estimates of fish population sizes in addition to monitoring fish seasonal use patterns.

What are our preliminary findings?
- The team captured 7,300 fish consisting of 9 different species from 3,150 hours of net soaking time.
- A total of 2,285 fish were tagged, and another 143 fish were recaptured from being tagged earlier in the 2022 season or during past seasons.
- Ninespine stickleback were the most abundant fish captured and accounted for about 40 percent of total catch, followed by least cisco (19 percent), Arctic grayling (17 percent), broad whitefish (12 percent), and humpback whitefish (10 percent). All other species accounted for about 2 percent of the remaining catch.
- Compared to 2021, 1,500 fewer fish were caught in 2022. However, the number of ninespine stickleback caught was 17 times greater in 2022.
- No salmon were caught in the Willow area during 2022; however, low numbers of pink, chum, and sockeye salmon have been captured in the past.
- Fish were widely distributed across the study area and readily moved within and between drainages.
- Results from 2022 and previous years highlight the importance of maintaining habitat connectivity and season-long fish passage.

2022 Breakdown of Captured Fish From the Willow Area

- Least Cisco, 1418
- Arctic Grayling, 1254
- Humpback Whitefish, 714
- Round Whitefish, 901
- Slimy Sculpin, 1
- Burbot, 1
- Alaska Blackfish, 29

Willow exploration area lakes and streams surveyed in 2022.
**LAKE SURVEYS**

**What did we do?**

On behalf of ConocoPhillips Alaska, Inc. (CPAI), Owl Ridge Natural Resource Consultants surveyed 15 lakes for fish presence, water quality, and water depth. The purpose of the surveys was to document fish species presence and habitat within each lake and estimate the volume of water available for potential use based on identified fish and habitat. Surveyed lakes may be used as sources of freshwater during exploration and potential future development for ice road and ice pad construction, drilling support, and as potable water supplies.

Field researchers surveyed lakes during mid-July and mid-August 2022. Fish sampling made use of gill nets, minnow traps, seine nets, dip nets, and visual surveys. Each fish was identified, measured, and released. Water chemistry was recorded daily at each site and water samples were taken for laboratory analysis of water quality. Bathymetric data were collected by two methods to estimate lake volume – GPS/sonar units for lakes deeper than 4 feet, and spot depth measurements to approximate maximum depth for lakes shallower than 4 feet deep.

**Where did we go?**

Lakes were surveyed west of Nuiqsut in the greater Willow project area, north of Nuiqsut along the Nechelik Channel, and southwest of Nuiqsut in the Bear exploration area east of the Colville River. Researchers were transported to and from lakes by helicopter.

**Why were we working in the area?**

Lake survey information is required by the Bureau of Land Management (BLM), Alaska Department of Fish and Game (ADF&G) and Alaska Department of Natural Resources (ADNR). Data informs the permitting process for withdrawal of water during operation and exploration activities. Agency permitting decisions on water withdrawal consider potential impacts to fish that depend on an adequate water supply for surviving winter. Water may be either withdrawn directly, withdrawn from below the ice, or collected as ice aggregate from the lake surface. Data collected during lake surveys ensures that water withdrawal is consistent with the fish species-specific limits established jointly by the ADF&G, ADNR, and BLM, that protect fish and fish habitat.

**What are our preliminary findings?**

- Detailed bathymetric, fish, and water chemistry data were collected from 13 lakes and spot depth measurements and water chemistry data were recorded at two lakes.
- Fish were found in 12 of the 15 lakes; species included round whitefish, humpback whitefish, least cisco, Alaska blackfish, and ninespine stickleback.
- Deep lakes with connections to adjacent lakes or streams most often had multiple species of fish, while isolated lakes distant to other waterways either did not have fish or were limited to ninespine stickleback.
- Many lakes were shallow with depths less than 10 feet, while other lakes, especially near the Colville River, exceeded 20 feet in depth.
ICE BRIDGE SUPPORT & WATER QUALITY MONITORING

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), Michael Baker International (Michael Baker) supported the ice bridge across the Colville River by monitoring three locations upstream and three locations downstream of the ice bridge. Data collected includes ice thickness, freeboard, snow and water depth, as well as in-situ water quality readings consisting of temperature, specific conductance, dissolved oxygen, salinity, and water velocity. The team also monitors pH and performs a settleable solids test on water collected at gravel mine sites specified by the CPAI Field Environmental Coordinators (FECs). Lastly, measurements are collected on the total dissolved solids, conductivity, and salinity of various lakes used in ice road construction.

Where did we go?
Hydrologists work at locations 1200, 800, and 400 feet upstream and downstream of the Colville River Ice Bridge crossing, and travel to the mine sites on the east side of the Colville River. Additionally, the team travels to Nanuq Lake, Lake M0675, and other lakes as requested by CPAI FECs. Monitoring locations are depicted on the map to the right. Travel to the monitoring locations is typically overland using vehicles approved for tundra and ice travel, as depicted in the photos.

Why were we working in the area?
This work meets permit stipulations set forth by the Alaska Department of Fish and Game, Fish Habitat Permits, and Alaska Department of Natural Resources Temporary Water Use Authorizations. Monitoring reports are provided to agencies weekly during ice bridge construction and operation.

What are our preliminary findings?
- As of April 26, 2022, the average ice thickness at CPAI sites on the Colville River was 5.4 feet.
- Colville River ice thickness grew an average of 0.21 feet every week.
- Colville River water velocity measured at 1200 feet downstream was an average of 0.23 ft/s.
- The water at the ice bridge location is fairly salty due to influence from the Harrison Bay. The average salinity reading was 15.2 parts per thousand (ppt) on April 26, 2022; normal saltwater is 33-38 ppt and freshwater is 0.5 ppt or less.
- Measured pH did not exceed permit limits throughout the sampling season at the mine site.

Interesting facts!
Candle ice is seen much throughout the Colville River, especially during the spring when the ice starts to melt. Candle ice is a form of ice that has developed in columns perpendicular to the surface of the water. When it melts, it melts in columns or “candles” that are easily broken apart. The formation of this ice increases with time, temperature, and quantity of water melt runoff. The reason for this column shape is due to the hexagonal structure of the ice crystals, or when contaminants, such as salt, get trapped between ice crystals.
**What did we do?**

On behalf of ConocoPhillips Alaska, Inc. (CPAI), Michael Baker International (Michael Baker) deployed remote equipment and field personnel to monitor and assess spring breakup flooding within the existing Alpine and Greater Mooses Tooth (GMT) developments as well as in the proposed Willow development area. Michael Baker measured hydrologic data including stage and discharge; observed breakup water levels around oil and gas facilities (pipelines, roads, pads, and locations of hydraulic importance); monitored performance of culverts and bridges; and documented breakup flood extents, ice jams, and associated backwater effects. The team additionally monitored proposed stream crossing locations during the summer to document base flow conditions.

**Where did we go?**

Michael Baker worked at lakes, streams, and flow paths throughout the Colville River Delta and west into the National Petroleum Reserve–Alaska (NPRA). Field personnel used the road system to access sites along the CD1, CD2, CD4, CD5, GMT1/MT6, and GMT2/MT7 roads. Helicopter use was required to access sites in the delta not on the road system and sites in the proposed Willow development area.

**Why were we working in the area?**

This work meets permit stipulations set by the U.S Army Corps of Engineers (USACE) and the Alaska Department of Fish and Game to monitor and mitigate the impacts of installing infrastructure in and around water bodies and to support maintenance of fish habitat. Flood monitoring is also required to inform facility design. Spring breakup monitoring is required at Alpine facilities annually throughout the life of the project per the CD5 USACE permit and for three years post-construction at facilities outside the Colville River Delta (standard USACE stipulation). This was the 31st consecutive year of monitoring in the Colville River Delta.

**What are our preliminary findings?**

- The 2022 spring breakup flood occurred over a one-week period and water levels were above average in the Colville River Delta.
- Peak flooding in 2022 occurred on May 31 and June 3. Peak breakup flooding typically occurs between May 23 and June 5.
- This year’s breakup event had many ice jams resulting in backwater and overbank flooding in the flood plain.
- Preliminary 2022 peak stage (water level) at the MON1 monitoring location (see map) was 21.86-ft. The highest observed stage on record was 23.47-ft in 2015 and the average stage is around 17-ft (from the last 31 years).
AERIAL INFRARED SURVEY OF POLAR BEAR DENNING HABITAT

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), Environmental Research and Consulting (ERC) conducted aerial infrared surveys in the winter of 2022/2023 to locate potential maternal polar bear dens in the vicinity of ongoing and planned industrial operations occurring on the North Slope of Alaska. Mapped polar bear denning habitat in the CPAI project area was surveyed twice (in early December and early January) to increase the likelihood of den detection. The surveys were conducted using an aircraft equipped with an infrared sensor. Infrared sensors are used to detect heat signatures on the snow surface from the emitted body heat of denned bears.

Where did we go?
Prime terrestrial maternal polar bear denning habitat in northern Alaska has been identified as snow drifts that form on banks or bluffs measuring ≥16° in slope and ≥1.3 m in height. These features have been mapped as denning habitat and were overlaid with the proposed CPAI winter activities. Denning habitat within the Kuparuk River Unit, Colville River Unit, Greater Mooses Tooth Unit, Bear Tooth Unit, non-unit areas, and along the pipeline routes connecting to TAPS were surveyed. The above map shows survey flight tracks in the project area.

Why were we working in the area?
These surveys are an integral part of a multi-tiered approach to minimizing potential den disturbance from industrial activities, and to better understand bear’s use of the landscape. CPAI conducts surveys for polar bear dens prior to initiating winter activities in order to maintain compliance with the U.S. Fish and Wildlife Service issued Letters of Authorization. CPAI has relied on aerial infrared surveys since the early 2000s as the preferred method to meet this requirement.

What are our preliminary findings?
- No suspected den sites were identified in the CPAI project area.
- One potential polar bear den was detected on a remote island while calibrating the IR equipment, this area is not directly in CPAI’s planned area of activity.
- Other points of interest were identified during the survey effort. Several points of interest required re-visits or additional scrutiny of recorded survey footage and were determined to be landscape features, fox excavations, or other snow conditions, and were rejected from further consideration as potential polar bear dens.

Twin Otter survey aircraft.

Polar bear den detected on a remote island.
What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) used a combination of aerial surveys from small fixed-wing aircraft, satellite imagery, and analysis of radio collar data to assess the seasonal distribution and movements of caribou in northeastern NPR-A, the National Petroleum Reserve, Alaska, and Colville River Delta. ABR has been conducting aerial surveys between February and October annually since 2001. Radio collar data for the Teshekpuk caribou herd has been collected since 1990 to determine how the distribution of caribou vary seasonally and annually (see map to the right). In 2022, CPAI funded 20 new collars: 10 were deployed on caribou of the Central Arctic herd; and 10 were deployed on the Teshekpuk herd by the ADF&G. Satellite imagery is used to map the timing of spring snowmelt and the growth of vegetation in the spring and summer. The team uses these data to examine how seasonal movements are influenced by snow cover, vegetation, terrain ruggedness, insect harassment, distance to coast, and distance to roads. This multiyear dataset provides detailed information on which areas are used consistently during different seasons, how those areas correspond with proposed development, and if patterns change after construction.

Where did we go?
For this project, ABR studies caribou in the Greater Mooses Tooth Unit (GMTU) and the Colville River Delta, which includes the Alpine development, Alpine satellite pads, and the GMT pads. A related project studies caribou use within the Bear Tooth Unit.

Why were we working in the area?
Caribou are a culturally important subsistence species and the most abundant large terrestrial mammal in the area. The potential impacts of oilfield development on caribou distribution, movements, or abundance are of great interest to stakeholders. Caribou studies are required by the North Slope Borough rezone ordinances and the NPR-A Integrated Activity Plan to better understand how caribou use the area and detect any impacts from development to mitigate potential impacts of future development.

What are our preliminary findings?
- Preliminary results suggest that seasonal use of the area in 2022 was similar to recent years. Caribou were somewhat farther west during calving.
- Most caribou in the GMTU are from the Teshekpuk herd. Both the Teshekpuk and central Arctic herds may use the Colville River Delta during summer. Large numbers of central Arctic herd animals were on the Colville River Delta during midsummer insect harassment seasons during the last two years.
- Species distribution models indicated that broad geographic patterns were important factors influencing caribou distribution during all seasons, but caribou distribution can also be explained by differences in vegetative biomass, landscape topography, snow cover, and plant abundance.
- At the scale of movements every two hours, caribou selected different landscape attributes during different seasons. Caribou selected areas with more lichens during winter and with more deciduous shrubs during summer. Caribou also selected areas with earlier snow-free dates during spring, but selected areas with later snow-free dates during calving.
- Large numbers of collared caribou moved along the north side of the GMT roads during the oestrid fly season. There was some indication of less use of the area within 4 km of the GMT roads during fall. Unlike the roads in the Kuparuk oilfield, these roads are used for hunting. Potential changes in density or movements near the roads will continue to be assessed.
CARIBOU IN THE GREATER KUPARUK AREA

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) is collaborating with the Alaska Department of Fish and Game (ADF&G) to monitor caribou in and near the Kuparuk oilfield using radio collars. ABR has studied caribou near the Kuparuk oilfield since the 1980s, including aerial surveys from 1993 to 2017. The team is now using data from radio collars to better understand caribou use of the Kuparuk area. Data from these collars can be used to describe seasonal caribou movements and distribution in relation to infrastructure. In 2022, CPAI funded 20 new collars: 10 were deployed on caribou of the Central Arctic herd; and 10 were deployed on the Teshekpuk herd by the ADF&G.

Where did we go?
Biologists studied caribou distribution and movements near the Kuparuk Oilfield, between the Colville and Kuparuk Rivers (see map). The main herd in this area is the Central Arctic herd, currently estimated to have a population of 30,000 caribou. No fieldwork was conducted for this project in 2022, but data from radio collars is being analyzed to expand our knowledge of caribou movements and distribution in relation to oilfield infrastructure.

Why were we working in the area?
Caribou are a culturally important subsistence species and the most abundant large terrestrial mammal on the North Slope. The Central Arctic herd has been interacting with the Prudhoe Bay, Milne Point, and Kuparuk oilfields seasonally for more than 40 years. This herd, therefore, provides an opportunity to study caribou within existing oilfield infrastructure to see how those findings can be applied to new developments to help minimize potential impacts on caribou distribution, movements, or abundance.

What are our preliminary findings?
- In 2022, most of the collared Central Arctic herd caribou were west of the Kuparuk River during calving and moved through the oilfields repeatedly during early and mid-summer. Some large groups were on the Colville River delta during the insect harassment seasons in July for the second year in a row. Most of the herd spent the winter farther south than usual.
- Results of recent analyses have been generally consistent with previous studies in the area showing behaviors and response to oilfields differ depending on the season.
- During calving, caribou tend to avoid roads and pads, but the avoidance declines after calving.
- In late June and early July, caribou moved rapidly through the oilfields and crossed roads frequently to reach coastal mosquito-relief habitat.
- In late July and early August, some caribou used gravel roads and pads to avoid harassment by oestrid flies.

Final reports will be available online at northslopecience.org/nuiqsut/
BEAR TOOTH UNIT CARIBOU MONITORING

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) used a combination of aerial surveys from small fixed-wing aircraft, satellite imagery, and analysis of radio collars to assess the seasonal distribution and movements of caribou in northeastern NPR-A, the National Petroleum Reserve, Alaska. ABR has been conducting aerial surveys between February and October annually since 2001. Radio collar data for the Teshekpuk caribou herd has been collected since 1990 to determine how the densities of caribou vary seasonally and annually (see map to the right). In 2022, CPAI funded 20 new collars: 10 were deployed on caribou of the Central Arctic herd; and 10 were deployed on the Teshekpuk herd by the Alaska Department of Fish & Game. Satellite imagery is used to map the timing of spring snowmelt and the growth of vegetation in the spring and summer. Using these data, the examines how the seasonal movements of caribou are influenced by snow cover, vegetation, terrain ruggedness, insect harassment, distance to coast, and distance to ice roads. This multiyear dataset provides detailed information on which areas are used consistently during different seasons, how those areas correspond with proposed development, and if patterns change after construction.

Where did we go?
For this project, ABR studied caribou in the Bear Tooth Unit, which includes the area of the proposed Willow Development and an area to the south. A related project studied caribou use within the Greater Mooses Tooth Unit and the Colville River delta.

Why were we working in the area?
Caribou are a culturally important subsistence species and the most abundant large terrestrial mammal in the area. The potential impacts of oilfield development on caribou distribution, movements, or abundance are of great interest to stakeholders. Data from this project can help address and mitigate public concerns related to potential impacts from oil development on caribou. Caribou studies conducted prior to construction are required by the North Slope Borough rezone ordinances and the NPR-A Integrated Activity Plan because they are necessary to understand how caribou use the area prior to development to predict and minimize potential changes after development occurs.

What are our preliminary findings?
- Most caribou in this area are from the Teshekpuk herd. Most of the herd remains on the Coastal Plain during winter, but approximately 30 percent of Teshekpuk herd females and a higher percentage of males spend the winter in the Brooks Range in most years.
- Preliminary results suggest that seasonal use of the area in 2022 was similar to recent years. Caribou were somewhat farther west during calving. Many caribou of the Teshekpuk herd moved into the area near Utqiagvik in early winter.
- Caribou distribution and movements vary widely by season. Most calving occurs near Teshekpuk Lake, and the area north of the lake is important during periods of mosquito harassment.
- Species distribution models indicated that broad geographic patterns were important factors influencing caribou distribution during all seasons, but caribou distribution can also be explained by differences in vegetative biomass, landscape topography, snow cover, and plant abundance.
- At the scale of movements every two hours, caribou selected different landscape attributes during different seasons. Caribou selected areas with more lichens during winter and with more deciduous shrubs during summer.
- Riverine areas along Fish and Judy creeks are important areas for caribou in late summer, likely due to use for insect-relief and the availability of high-quality forage.

View from the plane during a March 2022 aerial survey.

Cow and calf grazing during July.

Seasonal movements of female caribou of the Teshekpuk Caribou Herd based on GPS collar locations (from 2021 BTU Caribou monitoring report).
**What did we do?**

On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) conducted year 2 of a 2-year survey of summer subsistence fishing activities on Colville River near the community of Nuiqsut. During year 1, ABR worked with local hires and several fishers to assess harvest activities during 2 site visits (see figure). In 2022, ABR made 2 additional visits on 8–14 July and 10–15 August. We were unable to hire locally in 2022, but we rented a boat from a local fisher and observed fishing activities on both the Níglíiq Channel and mainstem Colville River. We considered an additional visit in September 2022 but cancelled due to lack of fishing activity. Our primary objective was to document the number of nets actively fishing and inactive (i.e., drying onshore between fishing events) to determine relative fishing effort. We worked with fishers to assess harvest numbers and, when possible, to obtain otoliths (hard tissue with annual banding patterns) from a subset of the harvest for ageing in the laboratory. We also collected ambient water quality data (temperature, salinity, dissolved oxygen, conductivity, and turbidity) at fishing locations.

**Where did we go?**

The field survey was focused on the Níglíiq Channel of the Colville River, from the Nuiqsut boat launch to the mouth of the Colville River Delta. We also traveled upstream on the Colville River to the mouth of the Itkillik River. Scientists traveled to the monitoring sites by small boat.

**Why were we working in the area?**

CPAI is funding this summer fishery monitoring to satisfy North Slope Borough (NSB) rezone stipulations for the Greater Mooses Tooth 2 project. The surveys were designed to better characterize and understand summer (open water)-based subsistence fishing for Nuiqsut.

**What are our preliminary findings?**

- Fishers targeted Aanaa'álik (Broad Whitefish; Coregonus nasus) as well as Pacific Salmon (Oncorhynchus spp.). Along with Aanaa’álik, Chum Salmon (Oncorhynchus keta) was the most abundant salmonid species that we observed in nets in 2022.
- Summer fishing is sporadic, and often undertaken in conjunction with other subsistence activities (e.g., hunting). In 2021 we documented fishing effort downstream of the Nuiqsut boat launch, while in 2022 we documented more fishing effort upstream of the boat launch.
- Weather impacted fishing activity during both July and August visits. Sunny days with warm air and water temperatures in July created undesirable river conditions. This is because fish that are left in the nets too long during warm days are likely to be dead at the time of harvest. These fish are typically discarded, and nets are pulled until temperatures drop. During the final day of our July visit, and throughout our August visit, rain and snow reduced fishing effort.
- Overall, summer fishing effort was reduced in 2022 compared to 2021. In addition to weather constraints, organic debris in the river (i.e., peat moss) was prevalent during both site visits. This debris fills nets quickly, weighing them down and sometimes destroying the net completely. There were 5 active nets during the July 2021 survey and 2 active nets in the July 2022 survey. August effort was similar in both years, 3–5 active nets in 2021, and 2–5 active nets in 2022.
- During our July visit, we assisted Todd Sformo (NSB Dept. of Wildlife Management) in deploying an underwater temperature monitoring device in the Níglíiq Channel near the boat launch.
- Our July 2022 field trip overlapped slightly with Woods Camp activities, including Youth Camp where young residents are instructed in gill-net and hook-and-line fishing as well as the preparation of pivi strips (a salted, dried, and then smoked jerky-type fish treat). However, Youth Camp was cut short in 2022 due to poor weather conditions in July.
COLVILLE RIVER UNDER-ICE FISHERY HARVEST MONITORING

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) conducted on-site harvest monitoring surveys from 12 October to 18 November 2022 during the annual under-ice Nuiqsut fall fishery on the Nügilq Channel of the Colville River. Additional monitoring continued after the field season via social media. ABR’s fish and aquatics team:

- Monitored timing of deployment and removal of nets, total fishing effort, and total harvest of Arctic Cisco and other subsistence fish.
- Deployed an ABR-managed multi-panel gillnet in the East Channel of the Colville River.
- Regularly monitored salinity and other ambient water conditions at 4 stations on the Nügilq Channel.
- Dissected donated fish tissues in the laboratory to assist in analyzing length, weight, and age data.

ABR has monitored the fall fishery in the Village of Nuiqsut with support from CPAI since 2007 and Oil Search Alaska/Santos since 2020.

Where did we go?
Most of the 2022 subsistence fishing effort, and hence harvest monitoring, was conducted via snowmachine in the Nügilq Channel. One fisher set a net for 2 days in the eastern portion of the delta and ABR managed 1 net in the East Channel for a week in November.

Why were we working in the area?
This monitoring program has operated under various permit requirements over the years since its inception in 1985. CPAI and Santos continue to support the monitoring program as required by the North Slope Borough (NSB) rezone ordinances.

What are our preliminary findings?
- We conducted 163 interviews while in Nuiqsut for the 2022 season.
- A total of 21 fishers set 35 nets (with 1 net reset to a second location) during the 2022 fall fishery, an increase of 5 nets compared to 2021 (30 nets). A total of 15 net sets were in the Upper Nügilq near town, 9 net sets occurred in the Nanuq area, and 11 net sets were in the Nügilq Delta.
- Nets fished for a total of 208 days in the Upper Nügilq, 200 days in the Nanuq, and 187 days in the Nügilq Delta areas. One subsistence net was set for 2 days in the eastern delta, but the fisher determined that fishing results were not worth the expense and extra travel time to and from the village.
- During harvest interviews, 6,891 fish were documented by monitors (17.1% increase compared to 2021). Arctic Cisco represented 77.6% of the documented harvest and Fourhorn Sculpin represented 15.3% with 6 other species contributing to the remaining 7.1% of documented harvest.
- In the Nügilq Channel, fishers harvested at least 4 fish infected with *Saprolegnia* mold. Samples were sent to NSB biologists for analysis.
- ABR’s 4-panel net (20 ft length per panel) with variable stretched mesh sizes caught a total of 382 fish over 1 week of sampling. The 1.5-in mesh caught 42 fish, the 2.25-in mesh caught 184 fish, the 3-in mesh section caught 152 fish and the 4.5-in mesh section caught 4 fish (including 1 Broad Whitefish with *Saprolegnia* mold). A total of 6 species were caught (Least Cisco 60%, Artic Cisco 19%, Humpback Whitefish 19%, Fourhorn Sculpin 0.79%, Broad Whitefish 0.52%, Rainbow Smelt 0.26%).
- At the time of our departure on 18 November 2022, 12 nets (5 fishers) were still on the river. By 23 November there were 8 nets, and by 24 November, 5 nets (2 fishers). One of the remaining fishers pulled his 3 nets on 30 November. The last remaining fisher continues to fish as of early January 2023. Data were collected via social media/direct messaging after the harvest team left Nuiqsut.
NUIQSUT CARIBOU SUBSISTENCE MONITORING PROJECT

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), in 2021, Stephen R. Braund & Associates (SRB&A) conducted annual active harvester interviews with Nuiqsut caribou hunters to document harvest activities, and household harvest surveys to document community-level harvests in hunting year 2020. This represents Year 13 of the Nuiqsut Caribou Subsistence Monitoring Project. These interviews and surveys document baseline caribou subsistence harvesting data and harvester observations regarding development-related impacts on caribou harvesting activities. In 2022, SRB&A completed active harvester interviews and household harvest surveys for the 2021 (Year 14) study year and completed interviews for a one-time comprehensive (all resources) 10-year mapping study.

Where did we go?
The 2021 field season was delayed as SRB&A waited for staff to become vaccinated and to determine an appropriate time to travel to Nuiqsut due to Covid-19 concerns. SRB&A took one trip to Nuiqsut in June 2021 to conduct active harvester interviews and household harvest surveys for the 2020 (Year 13) study year. The study team conducted additional 2020 (Year 13) household surveys remotely via local liaisons, by telephone, and using an online survey form. The study team took multiple additional trips to Nuiqsut in 2021 (December) and 2022 (January, April, June, and July) to conduct active harvester interviews and household surveys for the 2021 (Year 14) study year and to complete interviews for the 10-year mapping study. The study area for the Nuiqsut Caribou Subsistence Monitoring Project is all areas used by Nuiqsut residents for caribou hunting activities.

Why were we working in the area?
CPAI initiated the Nuiqsut Caribou Subsistence Monitoring Project in response to a stipulation in the North Slope Borough (NSB) permit for the CD4 development. While the original stipulation required that the study occur for 10 years, both the NSB (2018 Rezone Ordinance) and BLM (GMT2 ROD) required that monitoring continue beyond the initial 10-year time period. The monitoring study, which began in 2009 for the 2008 study year, is now in its 14th year. The purpose of the subsistence monitoring project is to monitor caribou subsistence harvester activity, harvest experiences, and harvester observations of impacts related to CD4 and other Alpine satellite developments. The one-time comprehensive all-resources mapping study started in 2020 is required by the BLM (GMT2 ROD).

What are our preliminary findings?
Participation in the 2020 (Year 13) active harvester interviews was on the low end, but higher than interviews conducted in the first year of the pandemic (Year 12/2019); the response rate for the household harvest surveys were within the range of previous years. Year 13 (2020) findings include the following:

- In 2020, the community of Nuiqsut harvested an estimated 629 caribou, within the range of all previous study years (between 258 and 774 caribou).
- The majority of 2020 caribou subsistence use areas and harvest locations for the 2020 study year were located along the Colville River and Delta, and north and west of the community along the Nuiqsut Spur Road, the CDS Road, and the GMT1/GMT2 Road.
- In 2020, the area “West of Nuiqsut” accounted for 50 percent of the caribou harvested, on the high end of previous study years.
- The overall extent of travel in 2020 was similar to many previous years, but with increased use along the road system and more extensive travel along the Colville River system (e.g., along the Anaktuvuk and Chandler rivers). The highest concentrations of harvests were documented along the road system including the newly built Colville Access Road, near Nigliq Camp, near CD3 in the middle Colville Delta, and on the Itqiliq River.
- In 2020, 31 percent of respondents reported one or more perceived development-related impacts on their caribou hunting, the lowest of all study years. Helicopter traffic and man-made structures were the most commonly reported impact sources.

Data from the Year 14 Caribou Subsistence Monitoring study (2021 hunter year) are not yet analyzed and will be reported later in 2022/2023. Interviews for the all resources 10-year mapping study are complete and data processing and analysis are underway.

FINAL REPORTS WILL BE AVAILABLE ONLINE AT NORTHSLOPESCIENCE.ORG/NUIQSUT/
TUNDRA REHABILITATION—KUPARUK AND ALPINE

What did we do?
On behalf of ConocoPhillips Alaska, Inc. (CPAI), ABR, Inc.—Environmental Research & Services (ABR) has worked to encourage vegetation recovery after different kinds of disturbance, including exploratory well sites, gravel mines, off-road vehicle traffic, and multi-season ice pads (MSIPs). Each year, some sites are monitored to check on the success of recovery. This program began in the early 1980s.

Where did we go?
ABR scientists visited nine sites in the Kuparuk and Alpine oilfields to assess vegetation recovery. All the sites that were visited this year were accessed from the road system. The map shows the sites that were monitored in 2022.

Why were we working in the area?
CPAI is required by local, state, and federal regulations to rehabilitate disturbed tundra within the oilfields. Scientists monitor the sites regularly to make sure they are recovering well, with healthy plant communities that provide habitat for wildlife. If a site is not recovering as expected, additional treatments can be planned to improve conditions.

What are our preliminary findings?
While each site is different, below are some general results:

- Vegetation recovery is usually a slow process in the Arctic because of the short, cool growing season.
- At some sites, dry soil or naturally high salt levels can limit plant growth.
- Heavy grazing, especially by geese, can also slow down vegetation recovery.
- It is usually best to seed or plant typical tundra plants, similar to those growing nearby.
- Small disturbances (e.g., vehicle tracks) can often be repaired quickly by replacing chunks of soil and plants that have been displaced.
- Damage to tundra from off-road traffic can be reduced or prevented by choosing the route carefully and not making too many trips over the same route.