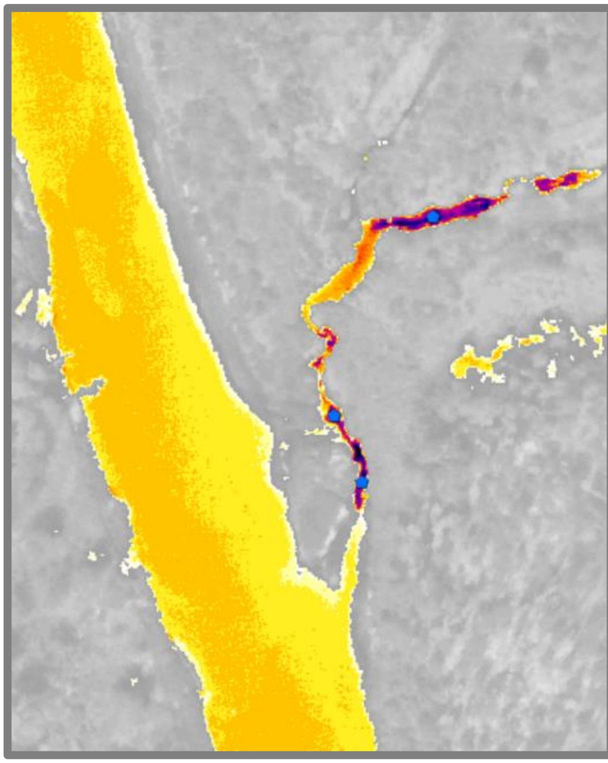

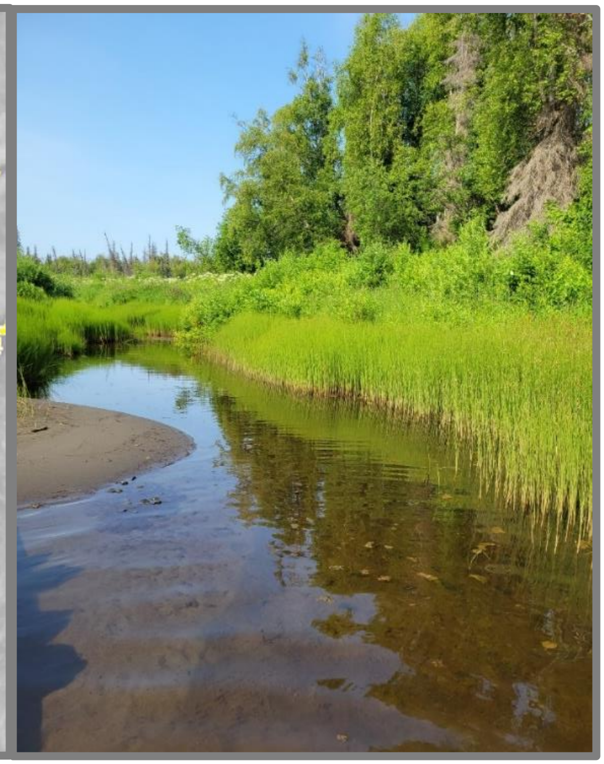

Building Habitat Resiliency for Chinook Salmon in the Deshka River Watershed

January 2023

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ArcGIS Online map of inflows: http://bitly.ws/zt9X

Building Habitat Resiliency for Chinook Salmon in the Deshka River Watershed

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ABSTRACT

Cook Inletkeeper and partners began a long-term effort to map the spatial heterogeneity of water temperature within the Deshka River watershed starting in 2017. This report details objectives from an Alaska Sustainable Salmon Funded project which builds on that effort and identifies key salmon habitats within the Deshka River and determines high-priority land parcels for long-term conservation efforts by using thermal imagery data. Cook Inletkeeper acquired thermal imagery for 32 miles of the Deshka River in July 2020, starting from the confluence of Moose and Kroto creeks upstream and ending at the confluence with the Susitna River. This infrared technology is an effective method for mapping small-scale temperature patterns in streams and to identify cold-water inflows. Productive conservation actions in the Deshka River watershed will rely on unique opportunities based on public land ownership (state and Mat-Su Borough) and private landowners. By coordinating with the Mat-Su Basin Salmon Habitat Partnership on a series of “Science to Conservation Outcomes” discussions, Cook Inletkeeper has developed a workplan of prioritized strategies with a timeline and key collaborators identified. Through this effort we have an excellent opportunity to implement strategic conservation actions to ensure the Deshka River remains a salmon stronghold into the warming future.

Building Habitat Resiliency for Chinook Salmon in the Deshka River Watershed

INTRODUCTION

Spatial variation in water temperature is a key feature of habitat complexity that contributes to the movement, resilience, and persistence of cold-water fishes. Fish exploit thermal heterogeneity through a variety of behavioral responses with different ecological outcomes. For instance, movement among freshwater habitats of different temperatures allows fish to track seasonal shifts in food resources (Ruff et al. 2011) or to manage their metabolism during periods of high food abundance (Armstrong et al. 2013). During spawning migration, periods of high river temperatures can block migratory corridors and cause thermal stress or mortality (Richter and Kolmes 2005). If available, fish seek out localized patches of cool water (i.e. thermal refugia), allowing persistence in streams that would otherwise be unsuitable (Torgersen et al. 1999, Sutton and Soto 2012). Additionally, thermal refugia originating from groundwater upwelling are relatively warm during winter and can also provide ice-free overwintering habitats (Bradford et al. 2001, Huusko et al. 2007).

In southcentral Alaska's Cook Inlet basin, maximum weekly temperature in many streams routinely exceeds thresholds regarded as deleterious for incubating eggs (13°C) and rearing juveniles (18°C) and, during warm summers, some attain temperatures that may be harmful to migrating adults (>20°C) (U.S. EPA 2003, Mauger et al. 2017). Among Cook Inlet streams, those draining low-elevation landscapes currently have the warmest summer temperatures and are projected to warm the most (Mauger et al. 2017). Increasing summer temperatures associated with anthropogenic climate change will increase the importance of the reliable presence of cold-water pockets within a warming river for the persistence of salmonids and other fish species in the decades ahead (Chang & Psaris 2013; Johnson et al. 2014).

The Deshka River, draining extensive lowlands in the Susitna valley of upper Cook Inlet (Figure 1), is important habitat for migrating and spawning Chinook and Coho salmon. These salmon are critical contributors to the subsistence resources for the Indigenous residents of Tyonek (Holen and Fall 2011) and wildlife species, like bears, which drive environmental productivity and support a tourist-based economy. In recent years, the Deshka River has recorded temperatures as high as 27°C, with an average increase of 1.5°C since 1980 (Jones et al. 2020). Weekly water temperature averages are projected to exceed 26.0°C by 2060 and is already exceeding weekly averages projected for 2030 (Mauger 2017).

This report outlines the methods used to identify key thermal habitats within the lower Deshka River and identify conservation actions for locations with persistent cold water that salmon will increasingly rely upon as stream temperatures increase. Excellent opportunities exist for future conservation actions to ensure the Deshka River remains a salmon stronghold into the future.

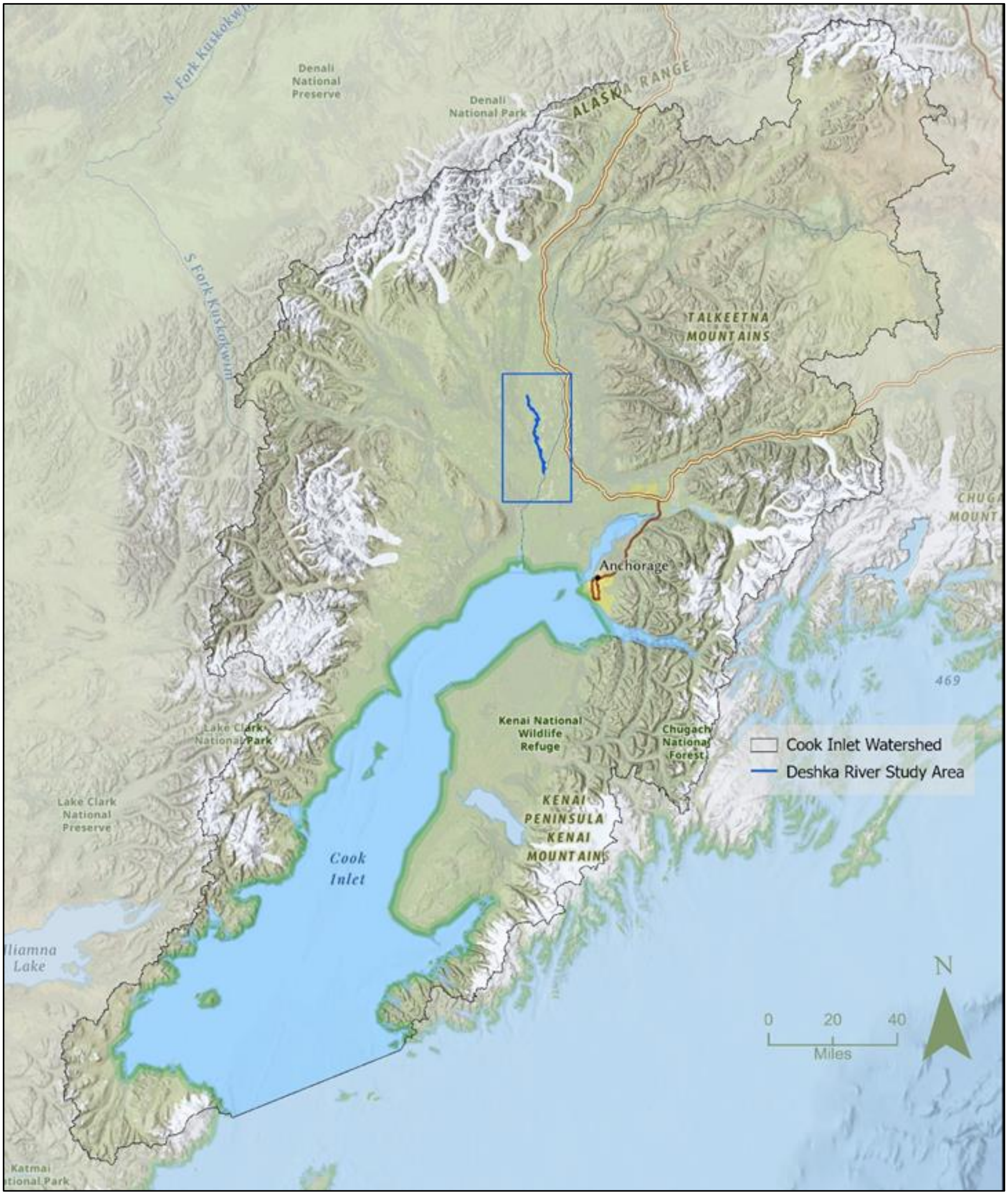


Figure 1. Map of the Cook Inlet watershed with the 32-mile reach of the Deshka River identified (blue line) where thermal infrared imagery was collected in July 2020.

PROJECT GOALS AND OBJECTIVES

Cook Inletkeeper and U. S. Fish and Wildlife Service (USFWS) coordinated a 5-year effort (2017-2021) to map broad-scale spatial heterogeneity of water temperature within the Deshka River watershed. Year-round water temperatures were monitored at 60 sites with clusters of data loggers at 20 major tributary junctions. In July 2020, with funding through the Alaska Sustainable Salmon Fund, Cook Inletkeeper acquired thermal imagery for 32 miles of the Deshka River starting from the confluence of Moose and Kroto creeks upstream and ending at the confluence with the Susitna River. The overall goal of these efforts is to build landscape-scale resilience within the Deshka River watershed by identifying and protecting thermal heterogeneity.

Funding through the Alaska Sustainable Salmon Fund (AKSSF grant #53004) supported the following objectives:

- characterize fine-scale thermal heterogeneity during summer maximum temperature along the lower Deshka River;
- identify cold-water refugia used by adult Chinook salmon to avoid high summer temperatures; and
- guide future conservation actions to protect high-value habitat and thermal refugia.

STUDY AREA: DESHKA RIVER WATERSHED

Deemed a world-class fishing destination, the Deshka River produces the largest Chinook salmon returns in upper Cook Inlet, accounting for 21% of the Susitna River system's escapement to upriver spawning grounds (Ivey 2014). The watershed is 626.5 square miles, with 40% wetlands, and a maximum elevation of 1,504 feet (Mauger et al. 2017). The Deshka River contains all five Pacific salmon species and provides habitat for Rainbow trout, Arctic grayling, and Dolly Varden. Most recently, invasive Northern Pike have been introduced to the watershed and are increasing in number.

The Deshka is primarily managed for its Chinook population (Ivey 2014; Reimer & DeCovich 2020). The timing of the Deshka Chinook lifecycle makes them most vulnerable to patterns of thermal change. Maximum temperatures, which typically occur in July, coincide with the annual return of adult Chinook from the ocean swimming upstream to spawning grounds, which begins in June. These temperatures also affect juvenile Chinook and Coho salmon because both populations rear in the Deshka River for one to two years before journeying downstream to the ocean (Ivey 2014). Adult Coho salmon enter the Deshka River primarily during August, after temperatures begin to decline (Ivey 2014). While this project focuses specifically on Chinook populations and habitat, successfully implemented conservation strategies will have positive impacts on all native fish within the watershed.

METHODS

Thermal Imagery

Cook Inletkeeper acquired thermal infrared (TIR) imagery to map discrete cold-water refugia, which will be important to protect for long-term resilience of the Deshka Chinook salmon population. In 2020, Cook Inletkeeper contracted NV5 Geospatial Inc. to obtain airborne TIR imagery from the main channel of the Deshka River, starting at the confluence of Moose Creek and Kroto Creek and ending at the confluence with the Susitna River. NV5 collected the high-resolution imagery by helicopter with a pixel resolution of 0.5 meters (1.6 ft) on July 4, 2020 (NV5 Geospatial 2021), thus providing fine-scale temperature data to pinpoint each pocket of water with lower-than-average temperatures. In-stream temperature data loggers assisted in the calibration of the TIR imagery after the flight to ensure accurate temperature readings. Sites with large thermal contrasts (Significant Feature Sites or SFS), revealed locations where cold groundwater contributed to the mainstem of the river through point sources, tributaries, and surface springs.

Ground Truthing

Ground truthing is an important step in validating remotely-sensed imagery. On-the-ground identification of different sites allows for a more accurate understanding of the shapes and areas of cold water SFS depicted in the thermal imagery.

Cook Inletkeeper received the TIR imagery from NV5 Geospatial in November 2020 and loaded the imagery and SFS points into ArcMap. With 239 sites identified, Cook Inletkeeper planned to ground truth 20% (48 sites) as the maximum reasonable amount to visit in the summer of 2021. The ground truthing process involves using GPS coordinates of the identified SFS to locate and travel to the cold-water inputs to assess:

- thermal variability between SFS and mainstem; and
- viability for salmon habitat for juveniles and adults.

In July 2021, Cook Inletkeeper ground truthed 58 sites by canoe (Figure 2).

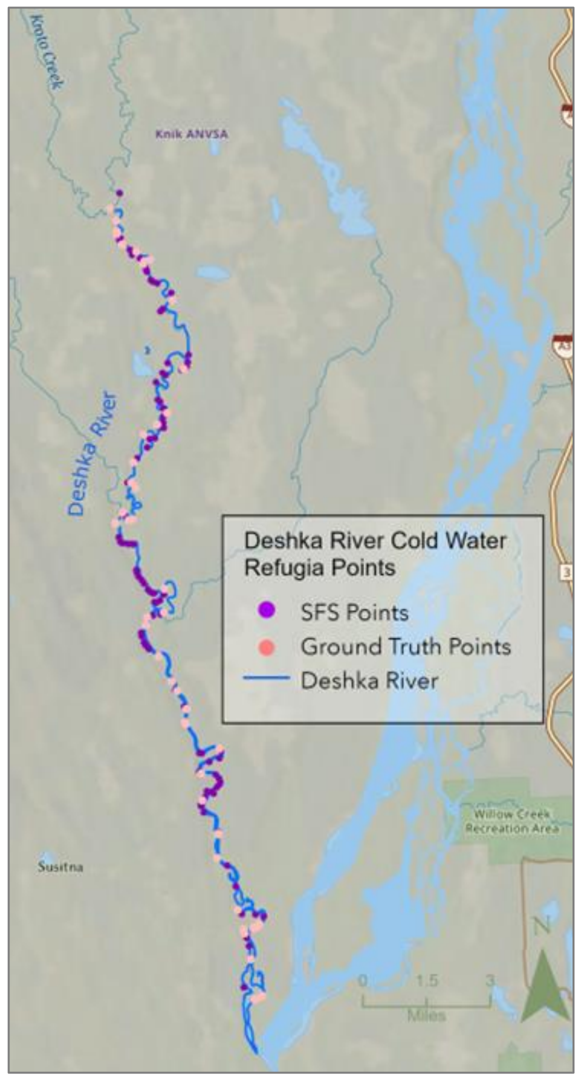


Figure 2. Map of the Significant Feature Sites (SFS) locations and ground truthing points.

While projects with TIR imagery have been used in high density areas to support private land owner engagement with conservation (e.g. AKSSF Project # 44628), this project focused on large swathes of unpopulated riparian land. Consequently, conservation recommendations are relevant to support permanent protections on large publicly-owned parcels managed by the state of Alaska and the Matanuska-Susitna (Mat-Su) Borough.

RESULTS: Land Ownership

Despite the Mat-Su Borough being the fastest growing area in Alaska, the Deshka River watershed remains minimally developed, especially toward the river's upper reaches. This is due primarily to the absence of roads, restricting use of the river to boats traveling downstream on the Susitna River from Deshka Landing in Willow off the Parks Highway.

Ownership and/or Management	Acres	Percent of Watershed Area
State	62,117	84.3%
Mat-Su Borough	10,110	13.7%
Private	1,467	2.0%
Total	73,694	

Table 1. Deshka watershed land ownership.

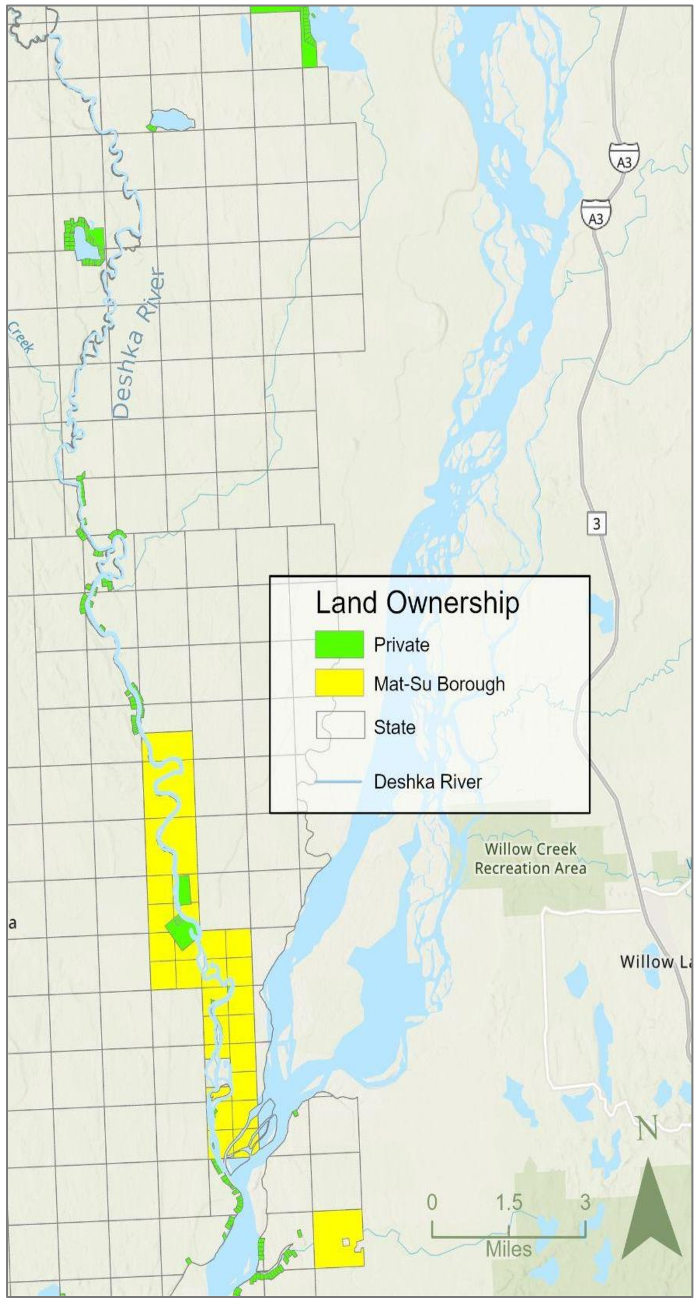


Figure 3: Cadastral Parcels (Mat-Su Borough; LINK data source) for the lower 32 miles of the Deshka River.

The ground truthed sites discussed below represent examples of cold-water refugia which intersect with the three land ownership types in Figure 3: State, Mat-Su Borough, and privately-owned land. The highest priority areas for conservation are significant cold-water flows with viable salmon habitat. Appendix A provides field observations, if available, and coordinates for all sites identified in the TIR imagery.

RESULTS: Upper Deshka River

In the upper Deshka River section (Figure 4), 145 features where identified in the TIR imagery from the confluence of Kroto and Moose creeks (RM 31.89) to Trapper Creek (14.75). Most of the parcels along this section are owned by the State of Alaska with some SFS points located on or near privately-owned parcels.

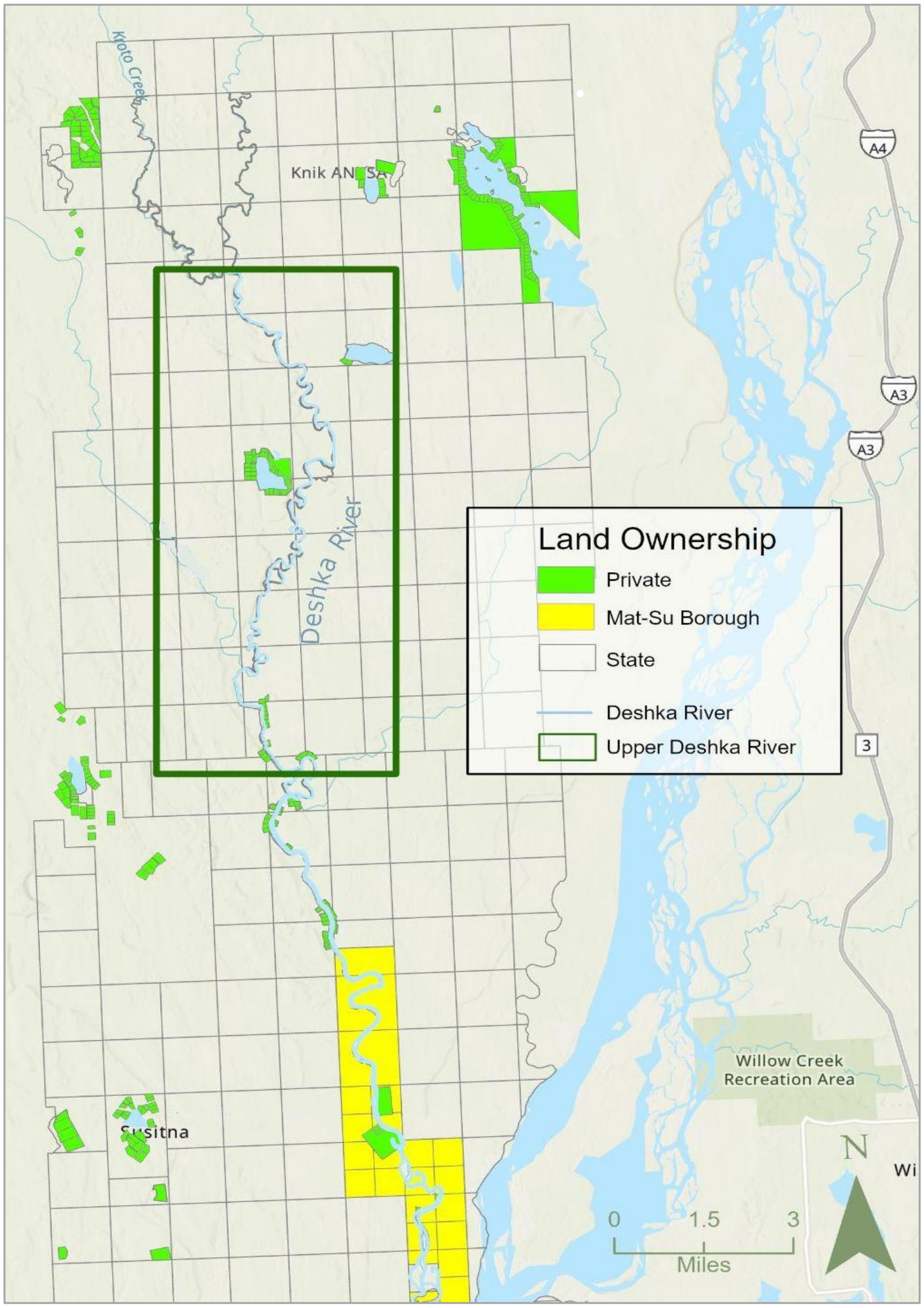


Figure 4. Upper Deshka River section.

Cook Inletkeeper conducted site evaluations at 31 of the 145 locations to assess the value of each location as a cold-water inflow and viable juvenile and adult Chinook salmon habitat. A full list of the significant feature sites can be found in Appendix A, including the site evaluations of the ground truthed sites. Below are examples of significant feature sites:

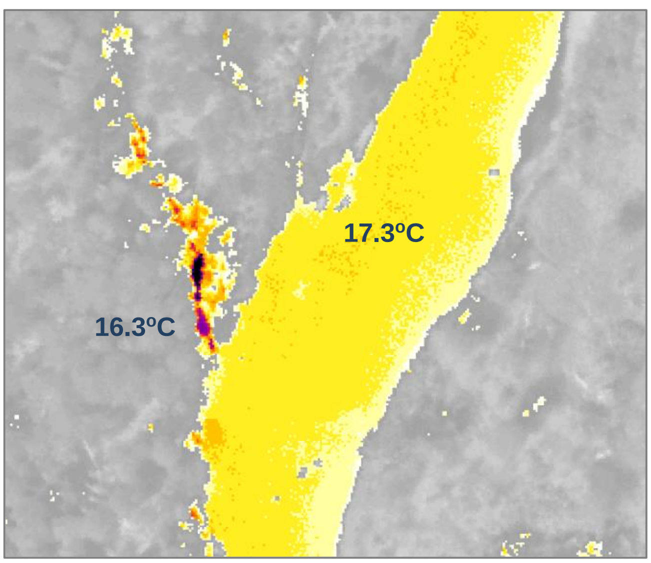
Upper Site #1

Description: This SFS is located at the Kroto-Moose confluence at the top of the study reach, and designates Kroto Creek as the tributary.

Salmon Habitat: large number of salmon present; important habitat for adult and juvenile salmon. Both creeks are in the state's Anadromous Waters catalog.

Land Ownership: State

Photo 1. Confluence of Kroto and Moose creeks on July 14, 2021.



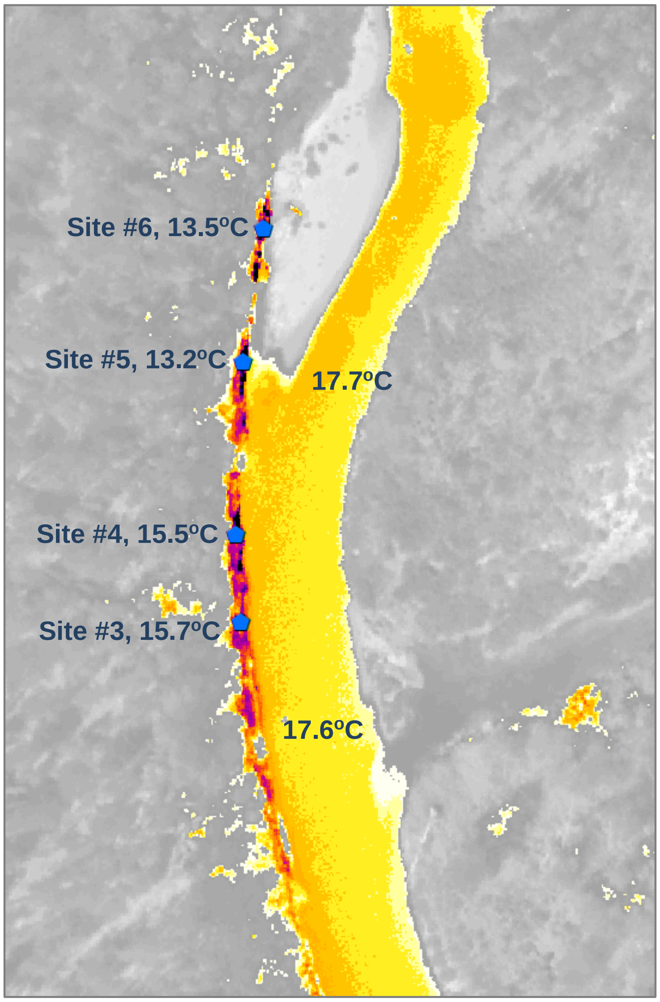
Upper Site #2

Description: This SFS is a side channel providing cold water refugia to the mainstem.

Salmon Habitat: viable juvenile habitat; not in the state's Anadromous Waters Catalog

Land Ownership: State

Photo 2. Thermal imagery (7/4/2020) with water temperatures collected on 7/14/2021 noted.



<u>Upper Sites # 3 - 6</u>

Description: This is an example of one surface spring of cold water that was identified by 4 SFS points provided by NV5 Geospatial.

Salmon Habitat: viable juvenile habitat; not in the state's Anadromous Waters Catalog

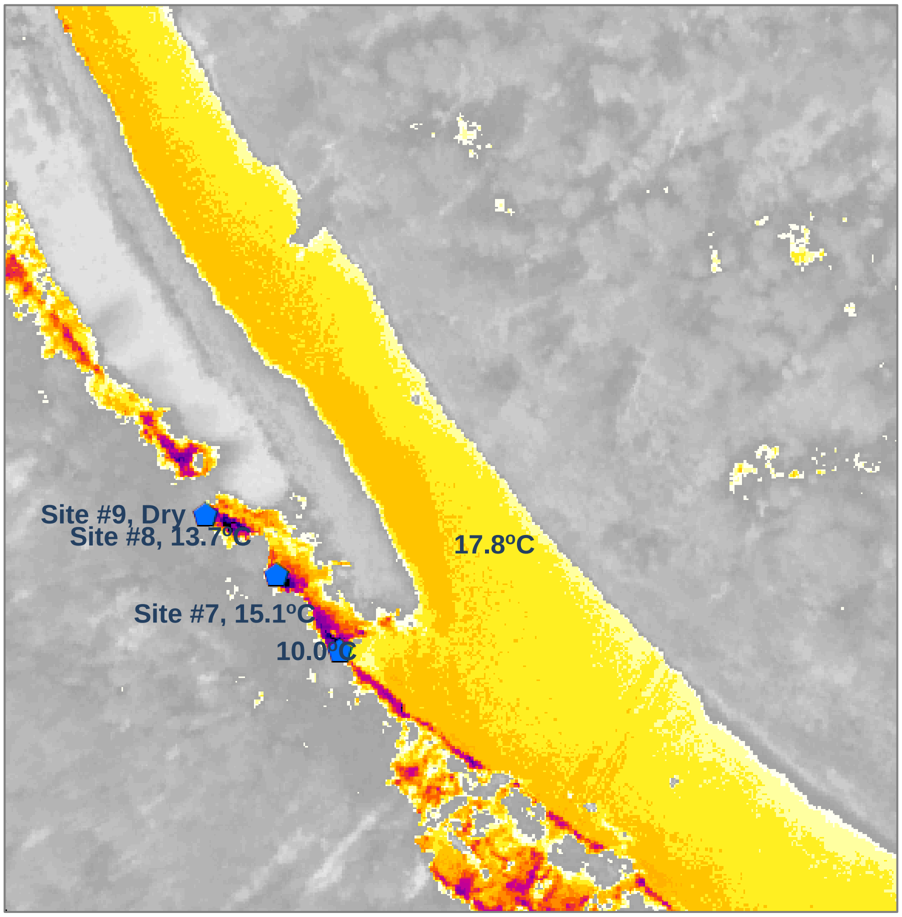
Land Ownership: State

Photo 3a. Site #6; disconnected from channel downstream.

Photo 3. Thermal imagery (7/4/2020) with water temperatures collected on 7/14/2021 noted.

Photo 3b. Site #5; juvenile habitat.

Photo 3c. Site #4; no distinct channel



<u>Upper Sites # 7-9</u>

Description: While these sites were disconnected from the mainstem, there was a channel directly downstream which measured 10.0ºC. This is another example of a cold-water surface spring with multiple SFS points.

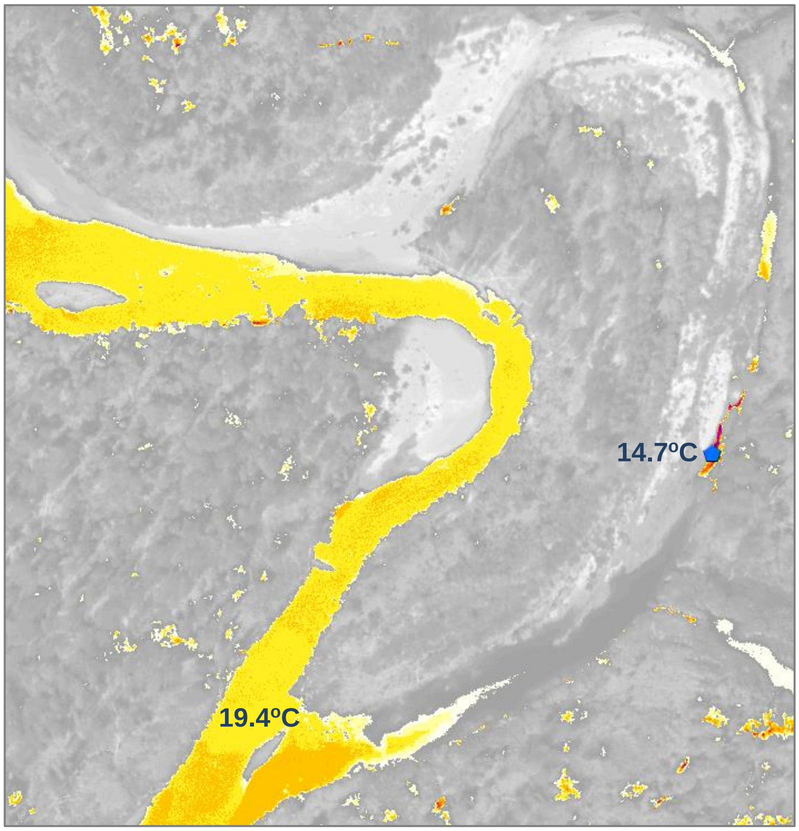
Salmon Habitat: viable juvenile habitat; not in the state's Anadromous Waters Catalog

Land Ownership: State

Photo 4. Thermal imagery (7/4/2020) with water temperatures collected on 7/14/2021 noted.

Photo 4a. Site #8; juvenile habitat.

Photo 4b. Site #7; juvenile habitat.



Upper Site # 10

Description: This site is in an old oxbow. Although it is not clear in the imagery, it is connected to the mainstem and offers a pocket of cold water refugia (14.7°C) near a particularly warm portion of the mainstem, which was 19.4°C.

Salmon Habitat: viable habitat for juveniles and adults; oxbow is in the state's Anadromous Waters Catalog, although the current mainstem channel is not.

Land Ownership: State

Photo 5. Thermal imagery (7/4/2020) with water temperatures collected on 7/14/2021 noted.

Upper Site # 11

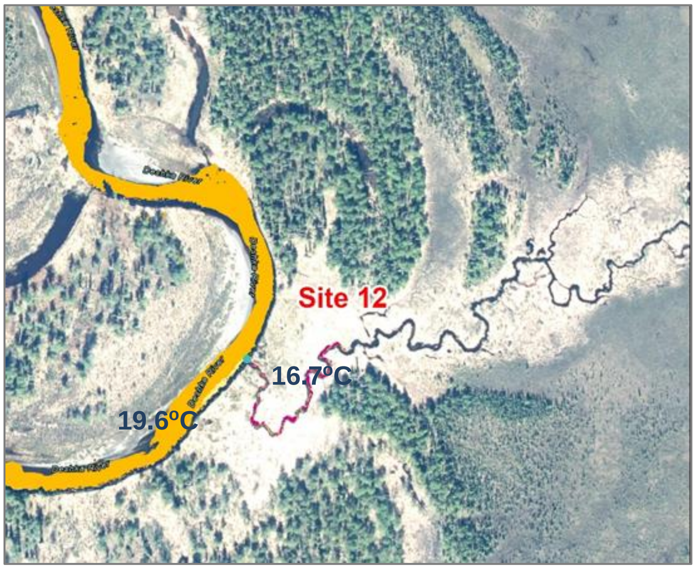
Description: The tributary offers a particularly cold pocket of water for salmon at approximately 12°C while the mainstem it runs into was 19.6°C. Two SFS points represent the same tributary feature.

Photo 6. Site #11; tributary.

Photo 6a. Site #11, upstream.

Salmon Habitat: viable habitat for juveniles; not in the state's Anadromous Waters Catalog

Land Ownership: State



Upper Site # 12

Description: This is an example of a cold-water tributary (16.7°C) that offers significant flow into the mainstem (19.6°C) and important habitat.
Salmon Habitat: viable habitat for juveniles and adults; this tributary is in the state's Anadromous Waters Catalog.
Land Ownership: State

Photo 7. Thermal imagery (7/4/2020) with water temperatures collected on 7/14/2021 noted.

Note: This site had two temperature data loggers from the 5-year field data collection project, verifying the temperature collected at the time of ground truthing and the average temperature picked up by the TIR imagery. The data loggers recorded temperature data during the survey period at 15-minute intervals. These records are used for the radiometric calibration of the TIR images.

Photo 7a. Site #12; juvenile and adult habitat.

RESULTS: Lower Deshka River

Cook Inletkeeper conducted site evaluations at 27 of the 94 SFS points to assess the value of each location as a cold-water inflow and viable juvenile and adult Chinook salmon habitat. The following set of ground truth site evaluations are in the Lower Deshka region (Figure 5). The majority of land ownership is the Mat-Su Borough with some SFS points located near privately owned property.

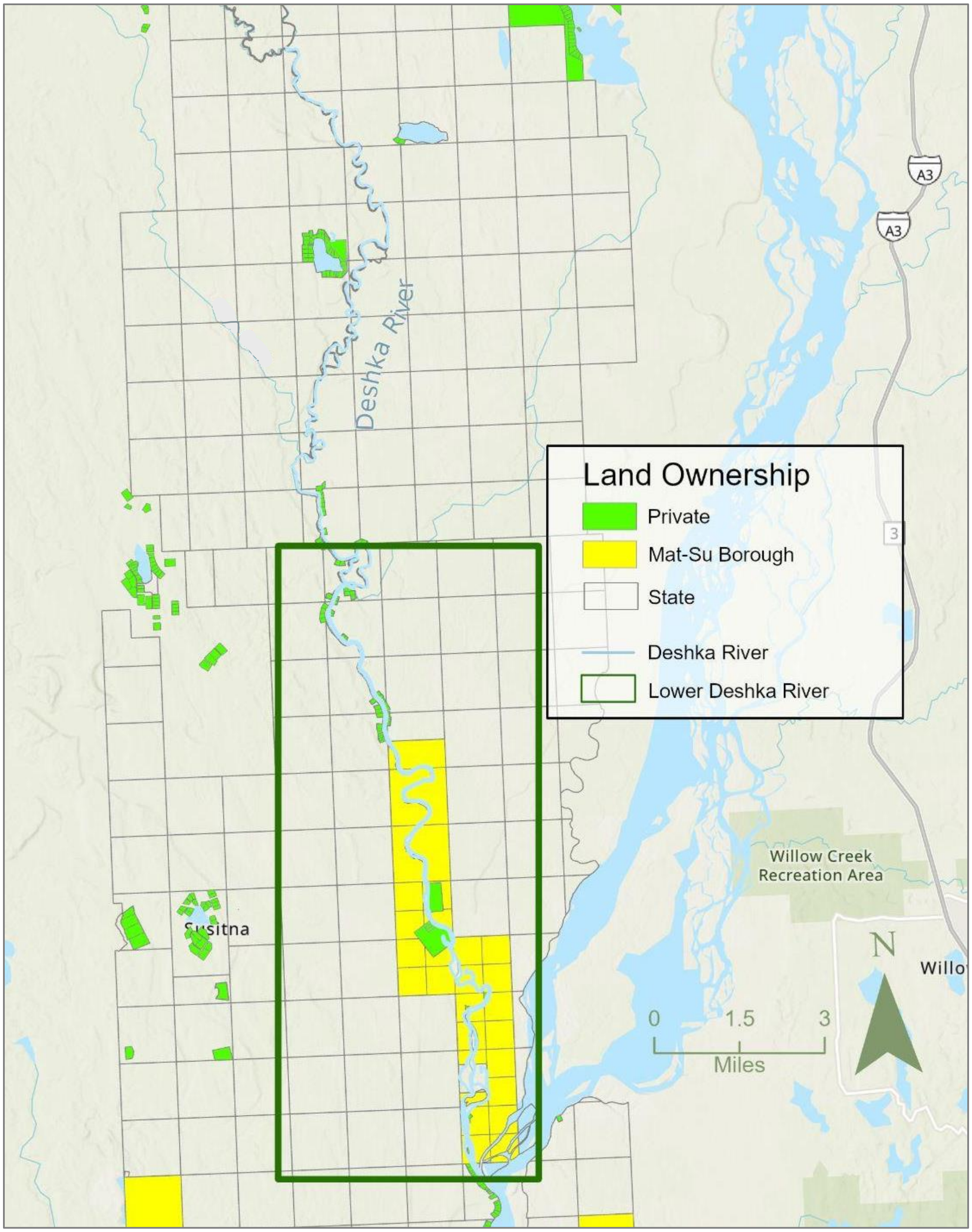
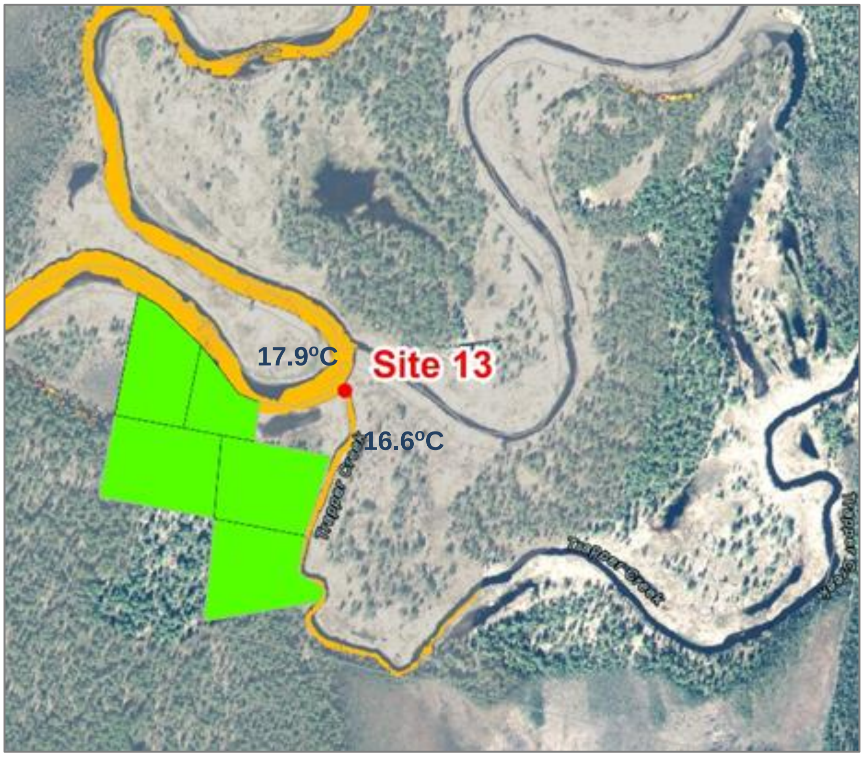


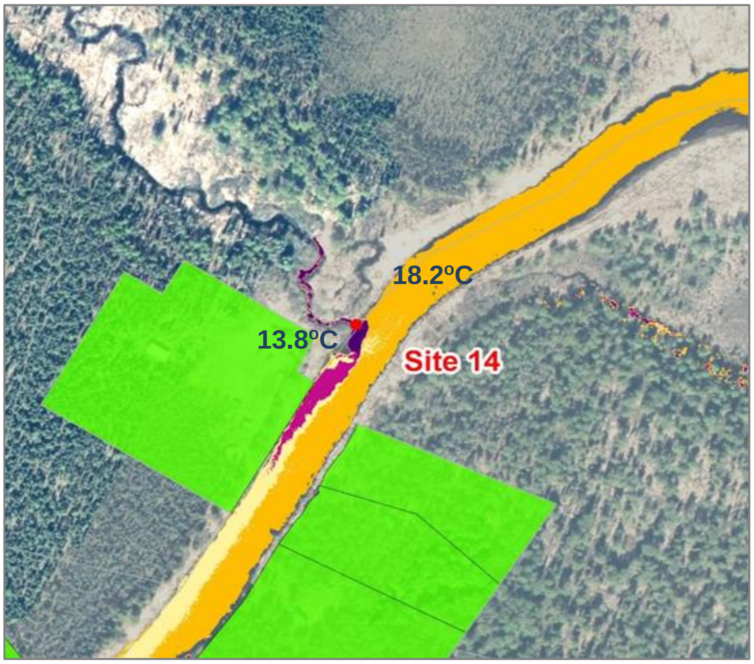
Figure 5: Lower Deshka River section.



<u>Lower Site # 13</u>
Description: This tributary is Trapper Creek and has data loggers from the 5-year temperature study. This parcel is within proximity of five private land holdings.
Salmon Habitat: Viable juvenile and adult habitat and in the state's Anadromous Waters Catalog.
Land Ownership: Private: File #61292; File # 54600 File #54598; File #54597 File #54599

Photo 8. Thermal imagery (7/4/2020) with water temperatures collected on 7/15/2021 noted.

Photo 8a. Trapper Creek; adult and juvenile habitat.



Lower Site # 14

Description: This tributary is slightly downstream from Trapper Creek and has data loggers from the 5-year temperature study. The thermal imagery illustrates the plume created by the cold-water inflow into the main channel.

Salmon Habitat: viable juvenile habitat

Land Ownership: Private parcel adjacent to this site. This tributary is in the state's Anadromous Waters Catalog.

[File # 62288]

Photo 9. Thermal imagery (7/4/2020) with water temperatures collected on 7/15/2021 noted.

Lower Site # 15

Description: While the water is not deep enough to hold fish, these cold-water inflows have notably lower temperatures (5.5°C and 8.8°C) than the mainstem (17.8°C).

Salmon Habitat: Not viable habitat

Land Ownership: Private

[File #62193] - property directly upstream of these two inflows

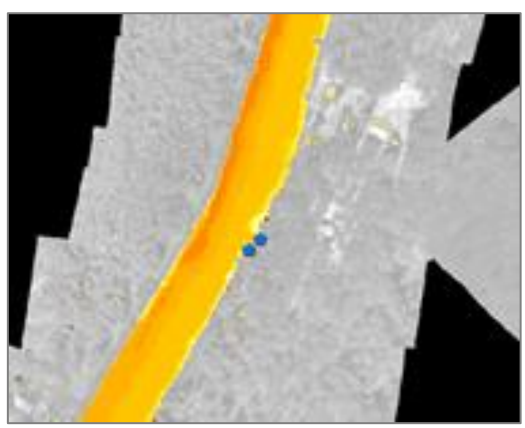
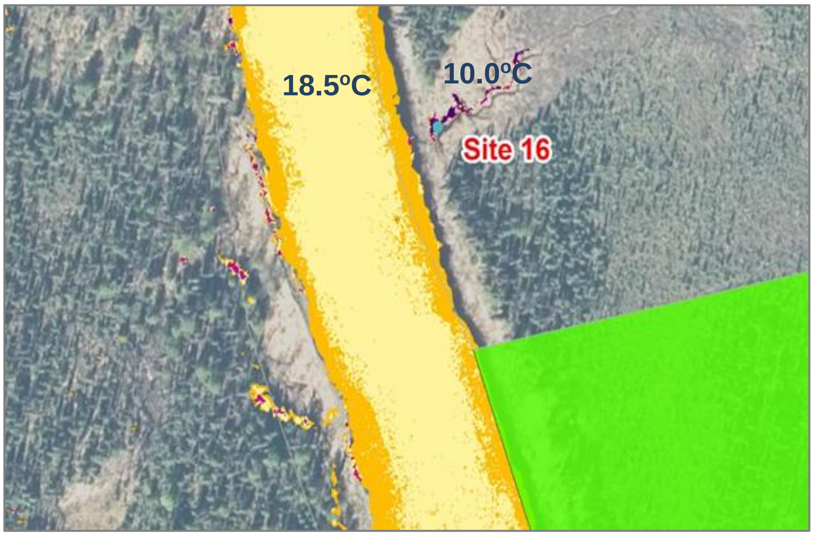


Photo 10a. Two inflows make up this site.

Photo 10. Site #15 with no adult and juvenile habitat.



Lower Site # 16

Description: Significant flow is coming from the inflow with an 8.5ºC temperature difference compared to the mainstem. There is a defined channel.

Salmon Habitat: no viable habitat

Land Ownership: Private and State; this site is slightly upstream of a series of private property parcels. The closest parcel is File #52805.

Photo 11. Thermal imagery (7/4/2020) with water temperatures collected on 7/15/2021 noted.

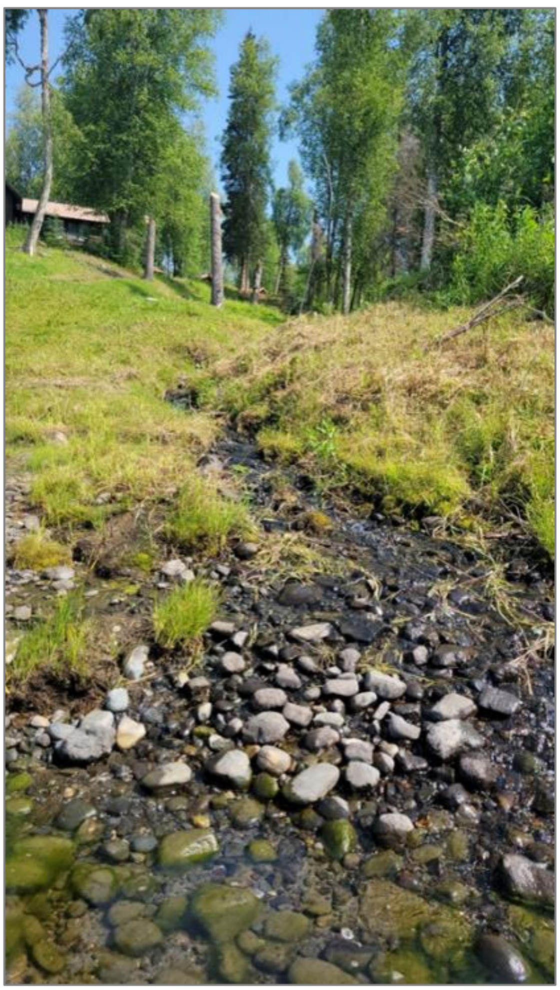


Photo 12. Site #17 on private land.

Lower Site # 17

Description: Significant flow is coming from the inflow with an 11.7ºC temperature difference to the mainstem. The flow and low temperature are notable considering the disturbance at the site.

Salmon Habitat: no viable habitat

Land Ownership: Private; File #52727

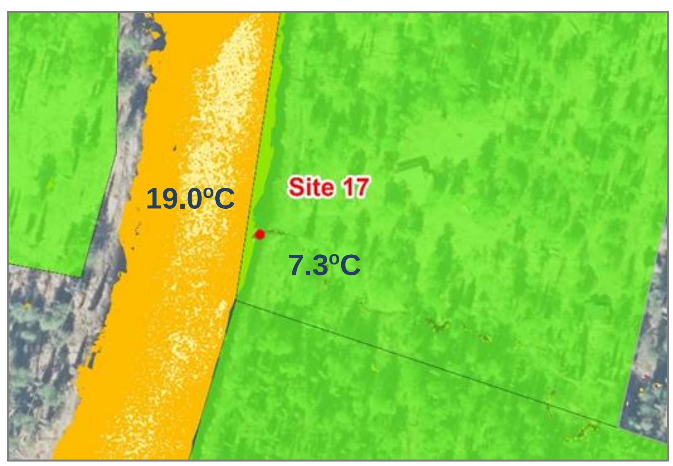


Photo 12a. Thermal imagery (7/4/2020) with water temperatures collected on 7/15/2021 noted.

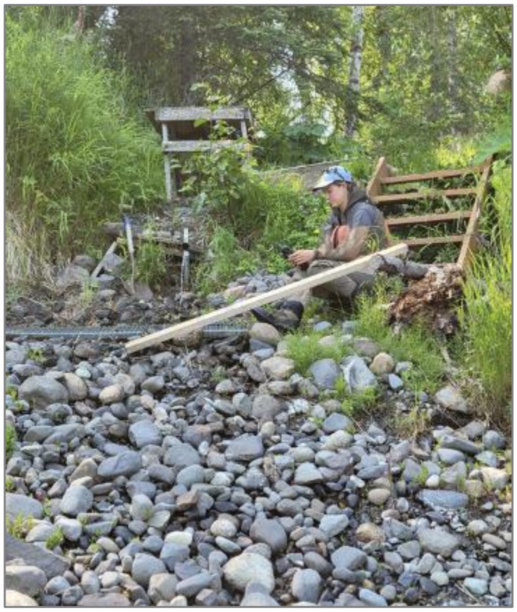


Photo 13. Site #17 on private land.

Lower Site # 18

Description: This ground water spring (4.8°C) runs through two private properties. Both properties had man-made pipes that tapped the groundwater and contributed it to the main channel at 19.3°C.

Salmon Habitat: no habitat

Land Ownership: Private

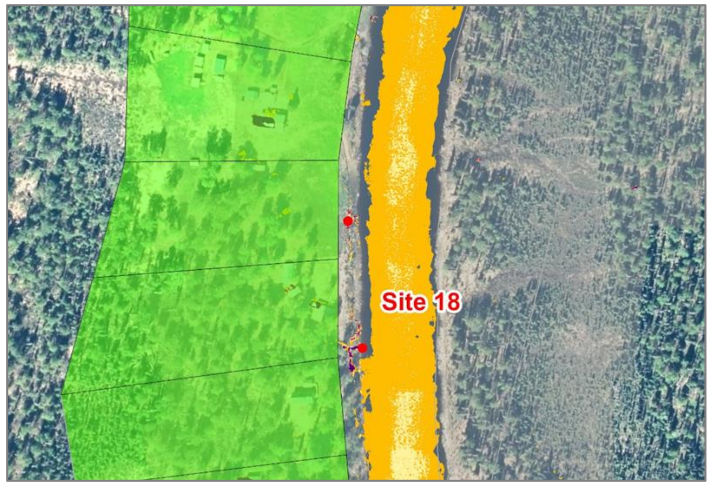


Photo 13a. Thermal imagery (7/4/2020) with private parcels

Lower Site # 19

Description: This is a large tributary running through Mat-Su Borough owned land with a large, 72-acre privately-held property (Laub Landing) just downstream.

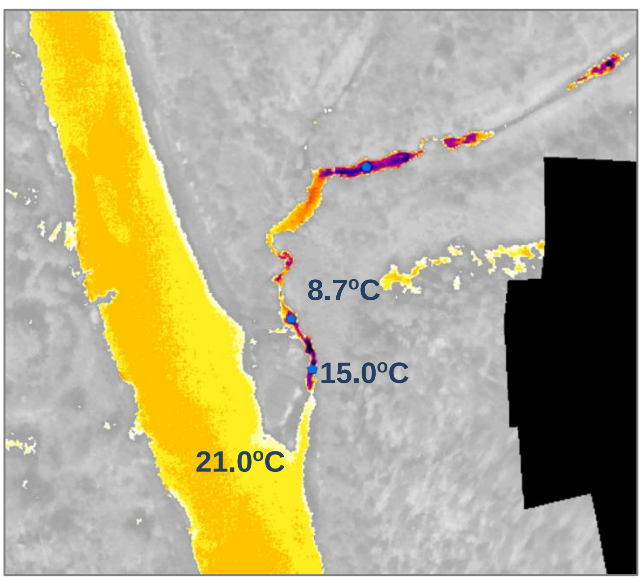


Photo 14. Thermal imagery (7/4/2020) with water temperatures collected on 7/15/2021 noted.

Salmon Habitat: Viable for juveniles; not included in the state's Anadromous Waters Catalog

Land Ownership: Borough

Photo 14a. Site #17; viable habitat.

RESULTS: Longitudinal Profile

Unlike many rivers, where a downstream warming trend is present as the channel gets wider and more exposed to direct solar radiation, the longitudinal profile for the Deshka River showed an overall downstream cooling gradient (Figure 6). This reflects the influence of numerous cold-water inflows from tributaries and seepage spots along the river banks. The overall water temperature gradient declined from 22.7°C at the confluence of Moose Creek and Kroto Creek to 18.5°C at the confluence with Susitna River (NV5 Geospatial 2021). The overall downstream cooling consisted of intermittent short sections of downstream warming from warm water inflows (relative to the mainstem) or unshaded reaches of the river. Warm water inflows could be outlets of meadows, marshes, or side channels where water warmed up from solar loading.

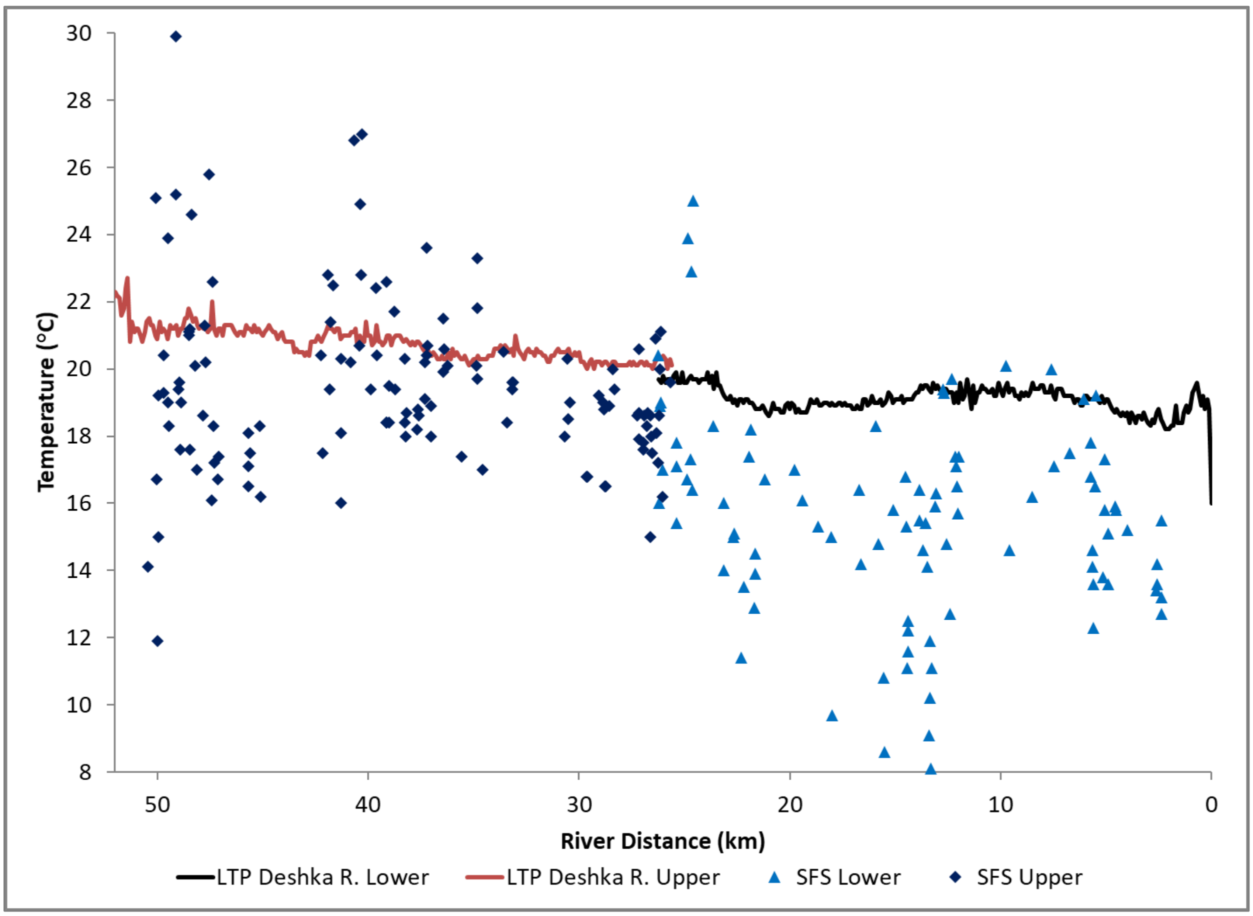


Figure 6: Longitudinal temperature profile and mean water temperature of significant features at the banks of the river plotted against river length along Deshka River, July 4th, 2020 (NV5 Geospatial 2021).

DISCUSSION

Thermal infrared imagery has proven to be a successful remote-sensing tool for assessing the location of cold-water inflows into the Deshka River. By acquiring the thermal data mid-summer, the warm water profile captured in the imagery provided good contrast to the riparian vegetation, thus resulting in clear imagery to characterize fine-scale thermal heterogeneity along the lower 32 miles of the Deshka River. By following up with field visits, Cook Inletkeeper was able to confirm the influence of more than 20% of the inflows and assess their value as juvenile and/or adult Chinook salmon habitat.

Based on the longitudinal profile, the imagery also illustrates that the aggregate of inflows plays a significant role in keeping water temperatures buffered in the lower reaches of the river. The value of each inflow goes beyond providing discrete cold-water habitat. This buffering affect reinforces the importance of protecting inflows and their groundwater sources for Chinook salmon to persist in this thermally sensitive and highly-valued recreation system.

Thermal imagery does have limitations. In this project, the source and extent of each inflow is not captured in the imagery because the flight path followed the main river channel. Ground-water sources, such as springs or seeps, may originate a significant distance away from the river channel. Since activities that divert groundwater pathways or disrupt surrounding landscapes can reduce, contaminate or warm these cold-water contributions, not having the full extent of the inflow mapped is not ideal. Another limitation of this method is the cost of imagery and spatial analysis (approx. $1,800/river mile). Drone-based thermal imagery is a promising future approach; however; data quality continues to be an issue (Dugdale et al. 2019).

<u>Conservation Actions by Ownership</u>

Effective conservation actions in the Deshka River watershed will rely on unique opportunities based on land ownership. With only 2% of the study area under private ownership (119 parcels), significant conservation efforts will require working with public land managers. The Alaska Department of Natural Resources and the Mat-Su Borough own and/or manage over 98% of the watershed, so future conservation actions will largely depend on the borough's and state's involvement and support.

Fortunately, Deshka River management plans exist at both the state and borough level. In 1991, the Alaska Department of Natural Resources released the Susitna Basin Recreation Rivers Management Plan designating the Deshka River - along with its upper tributaries, Kroto Creek and Moose Creek - a *Recreation River* by the State of Alaska. The plan is currently under revision thus providing a timely opportunity to incorporate the findings from this project to strengthen riparian protections. In addition, the Mat-Su Borough adopted the Deshka River Recreation Management Plan in 2004 to guide the borough's management decisions to address the increased use and accessibility of borough-owned lands.

A small portion of the land mapped and cold water refugia sites identified do run through privately-owned property. While reaching out to the general public is always worthwhile, this project's mapping and identification allows for targeted outreach that can lead to enthusiastic engagement in conservation by individual landowners, who have the most direct influence on the habitat and water quality of their land.

Conservation Actions through Collaboration

The Mat-Su Basin Salmon Habitat Partnership, which includes multiple stakeholders, is interested in integrating climate change research and projections into future land protection strategies as written in their 2019 Addendum to the Partnership's Strategic Action Plan (Eischeid et al. 2019). The Partnership's strategies include: 1) survey, map, and prioritize Mat-Su riparian lands for long term legal protection and/or restoration by 2020; 2) secure long-term protective status (e.g., conservation easements, designated parks, land acquisition, local ordinance) for at least 10% of priority riparian habitats that have not been significantly altered by 2023; 3) restore an additional 5% of priority riparian salmon habitats that have been altered by 2023; and 4) integrate climate change vulnerability into habitat conservation strategies and prioritizations by 2023.

The Partnership has prioritized and supported stream temperature monitoring to increase our collective knowledge about thermal regimes in Mat-Su Basin streams as a strategy to integrate climate change vulnerability into prioritization efforts. Now, with long-term datasets and the recent acquisition of thermal imagery on the Deshka River, we have an opportunity to apply these data and collaborate for conservation actions.

Cook Inletkeeper coordinated with the Partnership to hold a work session with land managers during the Mat-Su Basin Science & Conservation Symposium in November 2021. Following the Symposium, Cook Inletkeeper, U.S. Fish & Wildlife Service, and the Partnership's Coordinator hosted a series of "Science to Conservation Outcomes" discussions from January – March 2022 to dive deeper into existing tools for conservation. Representatives from the Alaska Department of Fish & Game, Alaska Department of Natural Resources, Alaska Department of Environmental Conservation, Mat-Su Borough, University of Alaska Anchorage, Chickaloon Village Tribe, Fish Tale River Guides, U.S. Fish & Wildlife Service, Kachemak Heritage Land Trust and Great Land Trust shared their feedback, knowledge and identified next steps. Examples of existing tools included reclassifying Mat-Su Borough parcels as "watershed" lands, engaging in the Recreation Rivers Management Plan review process, exploring source-water zones of influence for each groundwater inflow, sending outreach mailers to private landowners, using the Mat-Su Partnership's Science and Data Committee to approve local science for use in the permitting process, creating a Partnership project mapper to make information more accessible to decision makers, getting refugia info into the state's Anadromous Waters Catalog, and supporting local writers to submit articles or letters about the value of cold water.

When the whole group came back together in April 2022, each idea was discussed, prioritized and placed on a timeline. Progress over the next six months included getting support from the Mat-Su Fish & Wildlife Commission to reclassify Mat-Su Borough parcels as “watershed” lands and submitting scoping comments during the Recreation Rivers Management Plan review process highlighting the critical role cold-water inflows play for salmon. In November 2022, Cook Inletkeeper shared progress with Mat-Su Partners and opened up small group discussions about conservation actions to all those at the Symposium. Based on the interest expressed during those discussions, the Partnership will continue to work with Cook Inletkeeper on conservation actions into the future.

Outreach

Recent project outreach included the Mat-Su Basin Salmon Habitat Partnership’s summer site tour. The Partnership brought 33 people out on the Deshka River to share the collaborative scientific research happening there, and to provide community leaders with current information on stream temperature and potential impacts to salmon and their habitat in the Mat-Su – both today, and in the future. Additionally, the National Fish Habitat Partnership announced its list of 10 “Waters to Watch” for 2022 and the Deshka River was listed #1. This recognition reflects the work Cook Inletkeeper, the U.S. Fish and Wildlife Services, and University of Alaska Anchorage have done to close data gaps by monitoring water temperature, streamflow and the distribution of juvenile Chinook and Coho salmon throughout the Deshka watershed; conducting long-term stream temperature monitoring, coupled with remote sensing data to identify cold-water refugia in the Deshka River system which may be critical habitat for salmon in a warming climate; and modeling to estimate how the extent and distribution of thermally suitable habitat has changed over time and how it will change in the future.

CONCLUSION

Anticipating the inevitability of climate-related change to freshwater habitats is essential for the management of Alaska’s salmon populations, which contribute substantially to global wild salmon production and are exceedingly important to Alaska’s ecology, economy, and societal health of Tribal and local communities. Working with the Mat-Su Basin Salmon Habitat Partnership, this project demonstrates the importance of bringing science forward to achieve conservation outcomes by using remote-sensing technology and practical conservation strategies in the upper Cook Inlet watershed. Conservation strategies discussed here are feasible and in-line with existing stakeholder’s goals for protection of important salmon habitat to increase climate resilience.

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