National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Cascades Fisher Reintroduction Project

Progress Report for March 2018 to March 2019

Natural Resource Report NPS/PWR/NRR—2019/1982

Washington Department of FISH and WILDLIFE

Conservation Northwest
Keeping the Northwest Wild

calgaryzoo

ON THE COVER

Male M124 being released (left photo; by Jason Ransom/NPS), Female F092 resting in her cubby box at Calgary Zoo (upper right photo; by Jason Ransom/NPS), and male M120 being released (lower right photo; by Paul Bannick/Conservation Northwest)

Cascades Fisher Reintroduction Project

Progress Report for March 2018 to March 2019

Natural Resource Report NPS/PWR/NRR—2019/1982

Prepared by:
Jeffrey C. Lewis,[1] Jason I. Ransom,[2] Tara Chestnut,[3] David O. Werntz,[4] Sandie Black,[5] Jose Luis Postigo,[5] and Axel Moehrenschlager[5]

[1]Washington Department of Fish and Wildlife
600 Capitol Way N.
Olympia, WA 98501

[2]North Cascades National Park Service Complex
810 State Route 20
Sedro-Woolley, WA 98284

[3]Mount Rainier National Park
55210 238th Avenue East
Ashford, WA 98304

[4]Conservation Northwest
1829 10th Avenue West, Suite B
Seattle, WA 98119

[5]Calgary Zoo
1300 Zoo Road NE
Calgary, AB T2E 7V6
Canada

August 2019

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

This report is available in digital format from the Natural Resource Publications Management website. If you have difficulty accessing information in this publication, particularly if using assistive technology, please email irma@nps.gov.

Please cite this publication as:

Lewis, J. C., J. I. Ransom, T. Chestnut, D. Werntz, S. Black, J. L. Postigo, and A. Moehrenschlager. 2019. Cascades fisher reintroduction project: Progress report for March 2018 to March 2019. Natural Resource Report NPS/PWR/NRR—2019/1982. National Park Service, Fort Collins, Colorado.

NPS 963/160125, August 2019

Contents

Contents (continued)

Figures

Tables

Page

Abstract

Fishers (*Pekania pennanti*) were extirpated from Washington due to over-trapping, habitat loss, and predator eradication programs. A mid-sized member of the weasel family, fishers occurred in the coniferous forests of Washington until the early and mid-1900s. We established a partnership between federal, state, and non-profit organizations with the goal to restore fishers to their former range in Washington. This partnership reintroduced 90 fishers from British Columbia to Olympic National Park from 2008 to 2010. We are now in the fourth year of a reintroduction project to restore fishers to Mount Rainier National Park (MORA), Gifford Pinchot National Forest (GPNF) and the larger South Cascade Ecosystem, and in the first year of reintroducing them to North Cascades National Park Service Complex (NOCA), Mount Baker-Snoqualmie National Forest (MBSF), and the larger North Cascades Ecosystem. To date, we have released 69 fishers (38 F, 31 M) from British Columbia, Canada, at MORA and GPNF in the South Cascades Ecosystem. As of March 2019, we have collected 1,016 locations of these fishers using radio-telemetry. The majority of fisher locations occurred within the boundaries of the recovery area. Annual survival of reintroduced fishers has remained above 50% each year and across both sexes, and thus remains within the parameters for likely population establishment. We confirmed reproduction of fishers in the South Cascades in 2017, when female F023 was photographed with one kit at her den tree, and again in 2018, when female F082 was photographed with one kit at her den tree. Due to extensive wildfires in the British Columbia source population capture area, we shifted operations to Alberta, Canada, in 2018, and began a new partnership with the Alberta Ministry of Environment and Parks, Alberta Trappers Association, Bushman, Inc., and Calgary Zoo. During the winter of 2018/2019, we captured 26 fishers (15F, 11M) in Alberta and translocated them into the North Cascades Ecosystem, including NOCA and MBSF. We also released four more fishers (3F, 1M) in MORA that were captured in Alberta in late 2018. In addition to monitoring movements, survival, and reproduction in the North Cascades, we have also initiated a suite of studies aimed at better understanding reintroduction success and improving animal welfare throughout the process. Our aim is to meet the overall Cascades fisher reintroduction goals of releasing ≥80 animals in the South Cascades and ≥80 animals in the North Cascades by the end of 2020.

Acknowledgments

Fishers were reintroduced on the traditional lands of the Cowlitz Indian Tribe, Nisqually Indian Tribe, Confederated Tribes and Bands of the Yakama Nation, Puyallup Tribe of Indians, Muckleshoot Indian Tribe, Squaxin Island Tribe, Sauk-Suiattle Indian Tribe, and Upper Skagit Indian Tribe.

We thank and acknowledge the support provided by individuals from many agencies, organizations, Tribes, and First Nations:

- Alberta Ministry of Environment and Parks: Dave Kay
- Alberta Trappers Association and the many trappers who helped us capture fishers
- Animal Care Hospital of Williams Lake, BC: Dr. Doug Magnowski, Katharina Koppe and staff
- British Columbia Ministry of Environment: Rich Weir
- British Columbia Ministry of Forests, Lands, Natural Resource Operations, and Rural Development: Dave Reedman, Becky Cadsand, Kristy Palmantier, and Carla Grimson
- British Columbia Trappers Association and the many trappers who helped us capture fishers
- Bushman Inc.: Bill Abercrombie, Malcolm Abercrombie, and staff
- Calgary Zoo: Clément Lanthier, Deanna Snell, Cara Johnson, Trish Exton-Parder, Larissa Mark, Natasha Lloyd, Hannah Edwards, Sian Wilson, Alyssa Friesen, Lacey Hebért, Graham Dixon-MacCallun, Jamie Dorgan and the Animal Care staff, Adriana Pastor, Doug Whiteside, Emma Vaasjo, Alex Phillips, Lindsay Palmer, vet staff and keepers
- Candidate Conservation Agreement with Assurances (CCAA) participants: 54 landowners who provided conservation measures on 3,027,453 acres to protect reintroduced fishers in Washington
- Cascades Carnivore Project: Jocelyn Akins
- Cedar River Watershed: Bill Richards, Sally Nickelson
- Cispus Learning Center: Chase Buffington and staff
- Conservation Northwest: Mitch Friedman, Chase Gunnell, Paul Bannick, and Jen Watkins
- EarthFix: Ken Christenson
- Oregon Field Guide: Ed Jahn
- Evan’s Training Center: Marg and Don Evans
- Davis Environmental Ltd.: Larry Davis
- National Institute of Food and Agriculture McIntire-Stennis Capacity Grant
- National Park Service: Mount Rainier National Park – Roger Andrasik, Darin Swinney, Mason Reid, Tracy Swartout, Randy King, Chip Jenkins, Elissa Gordon, Kevin Skerl, Jon Franco-Bowman, Glenn Kessler, Kathy Steichen, Kevin Bacher, Fawn Bauer, Annie Runde, Mitch Anderson, Erin Burke, and Rory Trimbo. North Cascades National Park Service Complex–

Karen Taylor-Goodrich, Jack Oelfke, Kristin Rine, Roger Christophersen, Dan Camiccia, Tucker Pruett, Ellie Boerke, and Denise Shultz. Olympic National Park – Patti Happe

- National Science Foundation Graduate Assistance Fellowship Program
- Northwest Trek and Point Defiance Zoo and Aquarium: Karen Povey, Rachael Mueller, Allison Case, Sara Dunleavey, and vet staff
- Port Blakely Tree Farms: Blake Murdon
- Rite Bros. Aviation: Jeff Wells
- Seattle City Light Wildlife Grant Program
- Skagit Environmental Endowment Commission
- Silver Fir Media: Don O'Brien
- The People of the Dakelh Nation
- The People of the Lummi Nation: special thanks to Cultural Arts teacher Denise Soloman and the Blackhawk Singers, and Policy Representative Frank Bob
- The People of the Nisqually Indian Tribe: Nisqually Indian Tribal council and council member Hanford McCloud for hosting a welcoming ceremony for fishers, and hosting visiting nations
- The People of the Nooksack Indian Tribe
- The People of the Sauk-Suiattle Indian Tribe: special thanks to Emily Wirtz for telemetry assistance
- The People of the Stillaguamish Indian Tribe: special thanks to Jen Sevigny for telemetry assistance
- The People of the Tsilhqot'in Nation: Chief Roger William and Councilor Loretta Williams
- The People of the Upper Skagit Tribe: special thanks to Natural Resources Director Scott Schuyler
- The People of the Williams Lake Band of the Secwepemc Nation: Councilor Rick Gilbert, Julie Palmantier, and Kristy Palmantier
- U.S. Fish and Wildlife Service: Anne Froschauer, Zach Radmer, Kevin Connelly, Kevin Maurice, Officer Mike Williams, Officer Art Rodriquez
- U.S. Forest Service: John Jakubowski, Mitch Wainwright, Phyllis Reed, Jesse Plumage, Sonny Paz, Aja Woodrow, Joan St. Hilaire, Josh Chapman, Carol Chandler, Erin Burke, Neil Chartier, John Rohrer, Keith Aubry, and Officer Ryan Martin.
- U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center: Kurt Jenkins
- University of Montana: Tanner Humphries and Jedediah Brodie
- University of Washington: Mitch Parsons and Laura Prugh
- Washington Department of Fish and Wildlife: Penny Becker, Hannah Anderson, Harriet Allen, Marty Kimbrel, David Anderson, Jeff Bernatowitz, Eric Holman, Nicholle Stephens, Gary Bell,

Gerry Hayes, William Moore, Stefanie Bergh, Michelle Tirhi, Paul DeBruyn, Sandra Jonker, Brian Calkins, Warren Michaelis, Kristin Mansfield, Jason Wettstein, Peggy Ushakoff, Ruth Milner, Robert Waddell, Callie Moore, Officer Jennifer Maurstad, Officer Shawnn Vincent, and Officer Clinton Lucci.

- Washington's National Park Fund: special thanks to Laurie Ward, Nicky Ducommun

Introduction

Fishers (*Pekania pennanti*) are a mid-sized member of the weasel family (Mustelidae) that historically occurred in the dense coniferous forests of Washington (Powell 1993, Lofroth et al. 2010). Unregulated harvest, loss and fragmentation of habitat, and predator control campaigns beginning in the late 1800s collectively resulted in the decline and extirpation of fishers from Washington by the mid-1900s (Lewis and Stinson 1998). Consequently, the fisher was listed as an endangered species in the state, and recovery actions have been outlined to restore fishers in Washington (Lewis and Hayes 2004, Hayes and Lewis 2006).

Given the success of reintroductions for restoring fisher populations to other parts of their historical range (Lewis et al. 2012), Washington Department of Fish and Wildlife (WDFW), the National Park Service (NPS), Conservation Northwest (CNW) and U.S. Geological Survey (USGS) partnered to plan, implement, and monitor the success of fisher reintroductions on the Olympic Peninsula, beginning in 2008 (Lewis 2014, Happe et al. 2017). The Calgary Zoo joined WDFW, NPS, and CNW in 2018 for the reintroduction of fishers in the Cascade Range, and to help sustain the effort to restore fishers in the largest portions of their historical range in Washington (Lewis et al. 2018).

Planning for the Cascades fisher reintroduction project began in 2013 with WDFW's Implementation Plan for Reintroducing Fishers to the Cascade Range in Washington (Lewis 2013). North Cascades National Park Service Complex (NOCA) and Mount Rainier National Park (MORA) led the National Environmental Policy Act process and completed a Fisher Restoration Plan / Environmental Assessment in May 2015 (NPS 2015). Project partners worked with the British Columbia Ministry of Forests, Lands and Natural Resource Operations (FLNRO), British Columbia Ministry of Environment (MOE), and the Tsilhqot'in, Secwepemc, and Dakelh First Nations to obtain capture and transport permits for the translocation of up to 160 fishers over five years to Washington. Planning efforts also required contracting with organizations to 1) coordinate trapping efforts with licensed British Columbia trappers, 2) house and care for captive fishers, and 3) provide veterinary services for health inspections and preparing fishers for release.

The planning efforts established for project operations in British Columbia were completed in 2015 and these plans were implemented effectively until the summer of 2017, when our implementation efforts were interrupted by a number of large forest fires that occurred throughout the fisher capture area in central British Columbia. Because of the extensive loss of habitat that resulted from these fires, Ministry (FLNRO) officials were concerned about the uncertain status of fishers in central British Columbia and discontinued our permits. Consequently, in the fall of 2017, we explored the possibility of working with Ministry officials and other potential partners in Alberta to complete our reintroduction implementation for the Cascades Recovery Area. We are now collaborating with the Alberta Ministry of Environment and Parks, the Calgary Zoo, the Alberta Trapper's Association, and new trapper coordinators (Bushman, Inc., Fort Saskatchewan, AB). We moved our capture, housing and veterinary operations to Alberta in the summer of 2018 and continued the Cascades fisher reintroduction project in the autumn of 2018.

Our goal is to re-establish a self-sustaining fisher population in both the southern and northern portions of the Cascade Recovery Area as outlined in the fisher recovery plan for Washington State (Hayes and Lewis 2006), and the National Park Service Detailed Implementation Plan for Re-establishing Fisher in the Washington Cascades (Project 195423). We have the following objectives to meet our goals in the southern and northern portions of the recovery area:

- **Objective 1:** Capture at least 160 fishers with a sex ratio of ≥50% females from central and northern British Columbia and/or Alberta, Canada, and release at least 80 into the southern portion of the Cascade Recovery Area over two years, and at least 80 into the northern portion of the Cascade Recovery Area over two years.
- **Objective 2:** Release fishers at few (i.e. 2–3) locations in each portion of the recovery area to increase the likelihood of fishers interacting (i.e., finding mates and obtaining social cues from previously released fishers).
- **Objective 3:** Release as many fishers as possible before January 1st each season, so that the stress of the reintroduction process occurs well before the active gestation period of female fishers (from late-February to late-April). This is expected to improve reproductive success in the first year (Facka et al. 2016).
- **Objective 4:** Monitor post-release movements, survival, home range establishment, and reproduction to evaluate initial success of the reintroduction project during the two years following their release. Each released fisher will be equipped with a VHF radio-transmitter with a 2-year lifespan.

In this report we provide a detailed summary of progress of the fisher reintroduction project in the southern and northern Cascade Range in Washington made from March 2018 to March 2019. A detailed summary of the process and methodologies of this fisher reintroduction project are in former progress reports (Lewis et al. 2017, Lewis et al. 2018).

South Cascades Progress to Date

Objective 1: Capture a founder population of at least 80 fishers with a sex ratio of ≥50% females from central British Columbia and release them into the southern portion of the Cascade Recovery Area over 2–3 years (Table 1).

Table 1. The number of fishers released and fisher release sites in the southern portion of the Cascade Recovery Area from December 2015 to October 2018.

Location	Date	Females	Males	Total
Cispus Learning Center	December 3, 2015	4	3	7
Cispus Learning Center	December 23, 2015	1	3	4
Cispus Learning Center	January 16, 2016	2	4	6
Cispus Learning Center	February 6, 2016	4	2	6
Mount Rainier National Park – Longmire	December 2, 2016	4	6	10
Cispus Learning Center	December 10, 2016	4	2	6
Mount Rainier National Park – Longmire	December 17, 2016	4	4	8
Cispus Learning Center	December 31, 2016	2	4	6
Cispus Learning Center	January 13, 2017	4	3	7
Cispus Learning Center	February 3, 2017	4	0	4
Cispus Learning Center	February 20, 2017	5	0	5
Mount Rainier National Park – Ohanapecosh	October 27, 2018	3	1	4
Totals	–	41	32	73

In the first year of the project (December 2015 to November 2016), 23 fishers (11 female [F], 12 male [M]) were successfully captured in central British Columbia (Appendix A), transported to Washington, and released on four occasions from 3 December 2015 to 6 February 2016 near the Cispus Learning Center (herein Cispus; Figure 1). In this report these 23 fishers are referred to collectively as Cohort 1. In the second year of the project (December 2016 to November 2017), 46 fishers were captured and transported to Washington (27F, 19M; Appendix A), and 16 (8F, 8M) were released at the MORA – Longmire release site and 30 (19F, 11M) were released at Cispus (Figure 1). In this report, these 46 fishers are referred to collectively as Cohort 2. In October of 2018, four additional fishers (3F, 1M from Alberta) without radio-transmitters were released at the MORA Ohanapecosh Campground to get us closer to our goal of releasing ≥80 fishers in the southern portion of the recovery area Cascade Range (Table 1). Due to radio-transmitter failure in Cohort 1 and the release of only four fishers in 2018, the team determined it was not cost effective to track the fishers released at MORA – Ohanapecosh using radio telemetry.

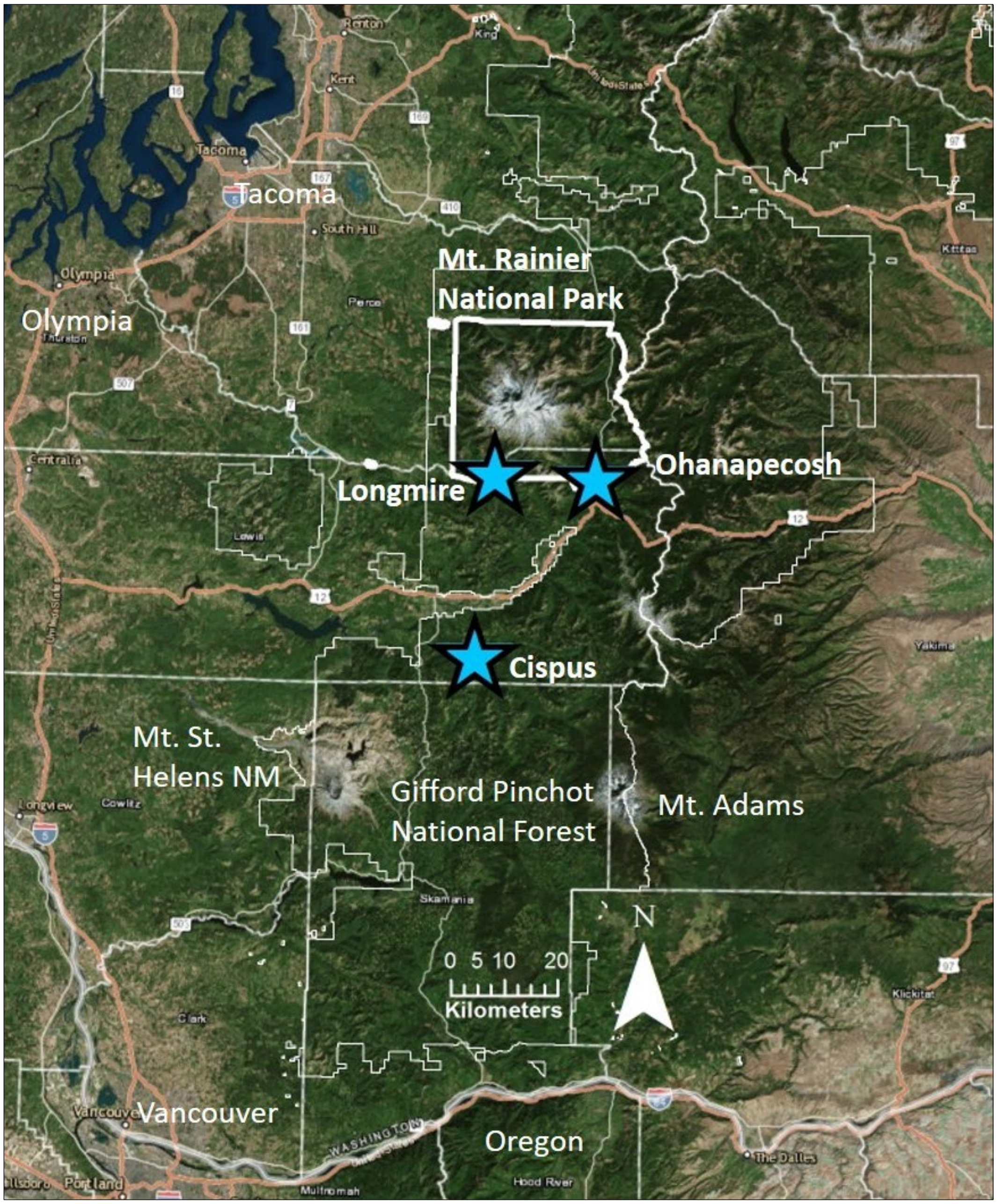

Figure 1. Locations of fisher release sites in the southern portion of the Cascade Fisher Recovery Area: the Mount Rainier National Park (Longmire and Ohanapecosh Campground), and Cispus Learning Center release sites.

Objective 2: Release fishers at two or three locations to increase the likelihood of fishers interacting, i.e., finding mates, and learning habitat suitability from previously released fishers.

We met this objective by releasing fishers at two primary release sites (Cispus and MORA – Longmire), and supplementing with the third release site in 2018 (MORA – Ohanapecosh; Figure 1, Table 1).

Objective 3: Release as many fishers as possible before January 1st to facilitate reproductive success by conducting the reintroduction process well before the active gestation period of female fishers (Facka et al. 2016).

We met this objective by releasing 22 of 41 translocated females (54%) before January 1st (Table 1, Appendix A). For context, 15 of the 50 females (30%) translocated during the Olympic fisher reintroduction project were released before 1 January (Lewis et al. 2011). Our success in meeting this objective was due to early recruitment of trappers, improved financial incentives, and favorable early-season trapping conditions in the fall/winter of 2016/2017 and in the fall of 2018.

Objective 4: Monitor post-release movements, survival, home range establishment, and reproduction to evaluate initial reintroduction success during the period (up to two years) when we can track fishers with functioning radio-transmitters.

Monitoring Methods

We used aerial radio-telemetry to obtain data and evaluate post-release movements, survival, home range establishment and reproduction. Our goal was to fly as many as five times per month to locate fishers; however, poor flying weather (and occasionally pilot/plane availability) prevented flying this frequently. We have conducted 88 aerial telemetry flights over a period of 34 months (2.58 flights per month) from 26 December 2015 to 19 September 2018, which included 347 hours of flight time, at a total cost of $160,706. During these flights we obtained 861 locations (533 for females, 328 for males; Figures 2 and 3), for an average of 2.48 locations per hour and an average cost of $186.65 per location (Figure 2). From these data, we determined fisher locations and survival status (live vs. mortality signal), and assessed movements between locations and the clustering of locations that may indicate home range establishment. We also used ground telemetry techniques to locate potential fisher den sites and deploy remote cameras at these sites to document reproduction, and to investigate mortality signals and recover dead fishers to determine cause of death.

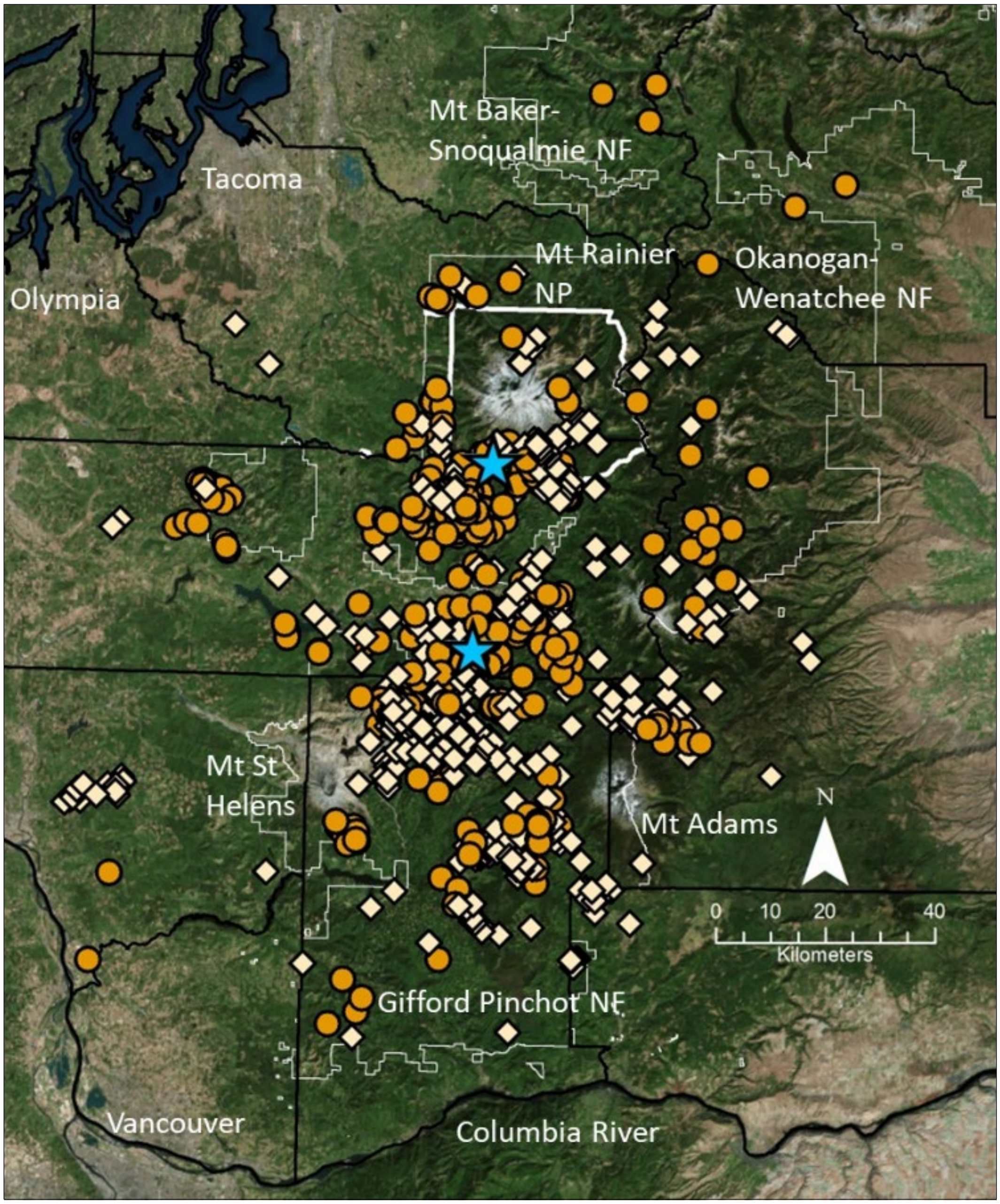

Figure 2. Aerial and ground telemetry locations (*n*=910; 572 female [white diamonds], 338 male [orange circles]) obtained from December of 2015 to September of 2018 for 69 fishers released in the southern portion of the Cascade Fisher Recovery Area in Washington (see Table 1). Blue stars indicate the locations of the Mount Rainier National Park – Longmire (northern star) and Cispus Learning Center (southern star) release sites.

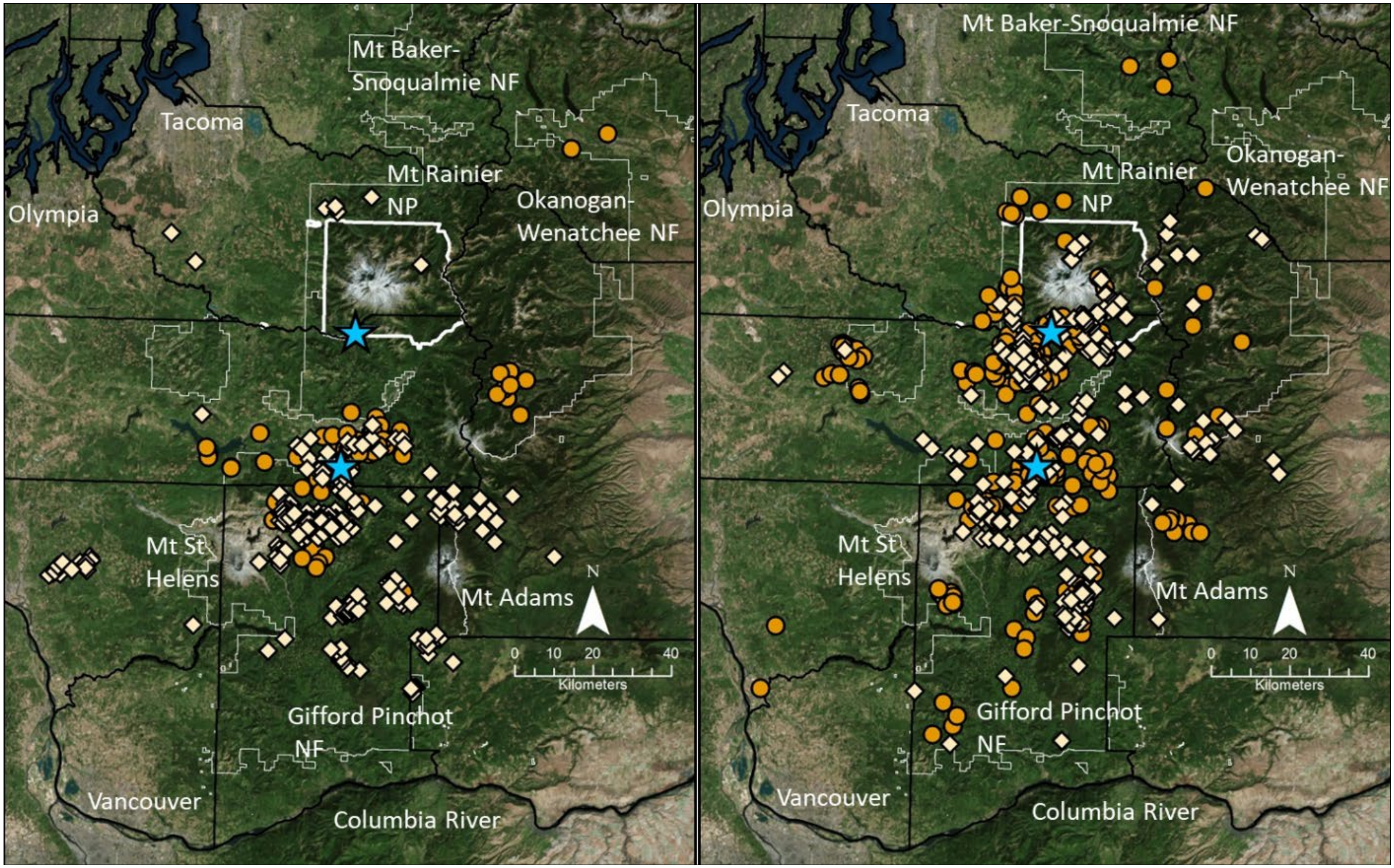

Figure 3. Locations of male (orange circles) and female (white diamonds) fishers from Cohort 1 (those released fall/winter of 2015/2016; all at one release site, the Cispus Learning Center; left graphic) and from Cohort 2 (released at two release sites, fall/winter of 2016/2017; right graphic). The two blue stars indicate the Mount Rainier National Park - Longmire (northern star) and Cispus Learning Center (southern star) release sites.

Movements and Home Range Establishment

A common strategy of wildlife reintroduction is to release individuals in landscapes dominated by high-quality habitat. Post-release movements and home range establishment by released individuals are indicators of how individuals perceive the suitability of the habitat within and outside the recovery area. Specifically, we used the proximity of the aerial telemetry locations of fishers to their release site, and the proximity of established home ranges to release sites, in the year following release, as indications of the occupancy/suitability of the recovery area.

Our initial analysis of movements indicated that the mean distance to all telemetry locations for Cohort 1 male and female fishers was approximately 25 km from the Cispus release site (Table 2). This mean distance indicates that many fishers used landscapes relatively close to the Cispus release site and the center of the recovery area, avoiding extended movements away from a release site that may pose greater mortality risks. The mean distance to telemetry locations was slightly smaller for Cohort 2 females and substantially smaller for Cohort 2 males as compared to Cohort 1 fishers (Table 2). This shorter distance may be an indication that the presence of previously released fishers (i.e., Cohort 1 fishers) prompted Cohort 2 fishers to remain close to the fishers that occupied areas near the release sites (Table 2). The suitability of the recovery area is also supported by the majority of the telemetry locations being located within the boundaries of the recovery area (i.e., National Forest and National Park lands; Figures 2 and 3).

Table 2. Mean distances between telemetry locations and release sites (Cispus Learning Center and Mount Rainier National Park – Longmire, MORA) and between established home ranges and release sites for fishers during their first year following release, by cohort and sex.

Fishers by Cohort and Sex	Data (n)	Mean distance ± SE from release site
Cohort 1 All Females (Cispus release)	Telemetry Locations (210)	26.8 ± 1.4 km
Cohort 1 All Males (Cispus release)	Telemetry Locations (129)	24.7 ± 1.9 km
Cohort 2 All Females	Telemetry Locations (173)	23.7 ± 1.3 km
Cohort 2 Females (Cispus released)	Telemetry Locations (68)	18.8 ± 1.9 km
Cohort 2 Females (MORA released)	Telemetry Locations (105)	26.9 ± 1.7 km
Cohort 2 All Males	Telemetry Locations (133)	19.6 ± 1.4 km
Cohort 2 Males (Cispus released)	Telemetry Locations (66)	15.2 ± 1.2 km
Cohort 2 Males (MORA released)	Telemetry Locations (67)	23.8 ± 2.4 km
Cohort 1 All Females	Home Range Centers (9)	33.0 ± 6.8 km
Cohort 1 All Males	Home Range Centers (5)	30.1 ± 8.4 km
Cohort 2 All Females	Home Range Centers (8)	19.7 ± 3.7 km
Cohort 2 Females (Cispus released)	Home Range Centers (5)	24.7 ± 4.7 km
Cohort 2 Females (MORA released)	Home Range Centers (3)	11.4 ± 0.5 km
Cohort 2 All Males	Home Range Centers (8)	20.2 ± 4.8 km
Cohort 2 Males (Cispus released)	Home Range Centers (4)	30.2 ± 6.2 km
Cohort 2 Males (MORA released)	Home Range Centers (4)	10.3 ± 2.5 km

While telemetry locations are informative of general movement patterns, home range establishment provides an additional indication of habitat suitability for reintroduced fishers, and we used it as one measure of reintroduction success. For example, home range establishment by ≥50% of individuals following release, and home range establishment relatively close to the release site, are positive indicators of habitat suitability and reintroduction success. For Cohort 1 fishers, we identified nine of 11 females (82%) and five of 12 males (42%) with clustered location points indicative of home range establishment. Eight of these nine females (88%) established home ranges within or partly within the recovery area; whereas all five males established home ranges within or partly within the recovery area. We also identified eight of the 27 Cohort 2 females (30%) and eight of 19 Cohort 2 males (42%) that appeared to establish a home range in their first year. All eight females and seven of the eight males established their home ranges within the recovery area. Even though a smaller percentage of Cohort 2 fishers appeared to establish home ranges in their first year (in part because nine Cohort 2 females died in their first year), this finding is likely an underestimate given the difficulty in getting enough data for each of the 46 Cohort 2 fishers to indicate home range establishment of some individuals. For context, among the fishers released during the Olympic fisher reintroduction project, 27 of 50 females (54%) and 21 of 40 males (46%) established home ranges in their first year (Lewis 2014).

Among the 11 Cohort 1 fishers (9F, 5M) that appeared to establish a home range in the southern Cascade Range, the mean distance from the Cispus release site to the center of a home range was 33.0 km for females and 30.1 km for males, and there was considerable variance among these distances (Table 2). The mean distance to home ranges was shorter for the 17 Cohort 2 fishers (23.1 km for nine females, 20.2 km for eight males; Table 2) that appeared to establish a home range in their first year as compared to Cohort 1 fishers. The mean distances to home ranges observed for fishers released in the southern Cascades tended to be smaller than those observed for fishers released on the Olympic Peninsula (i.e., 30.1 km for females; 44.5 km for males [Lewis 2014]), which may be explained in part by the difference in release strategies between the two recovery areas (i.e., fishers were released at 21 dispersed release sites in the Olympic project but at only three in the southern Cascades (MORA – Longmire and Cispus; Figure 1). Other explanations for differences in distance to home ranges may include prey distribution and availability, as well as differences in habitat types between the Olympic Peninsula and the southern Washington Cascade Range. Location data from Cohort 1 and Cohort 2 fishers also suggested that releasing fishers in Mount Rainier National Park facilitated greater occupancy of the recovery area within the Park, and on national forest lands to the south and southwest of the Park (Figure 3).

Survival and Mortality

We set our objective for total number of fishers to release (160 total, 80 each in the southern and northern part of the Cascades recovery area) based on annual survival rates of 50% or greater. Our objective to release enough fishers in 2–3 years to establish a self-sustaining population therefore requires annual survival rates of ≥0.50, especially for females. If survival is <0.50 we would likely need to conduct an additional year(s) of releases to meet our founder population goals.

For Cohort 1 fishers, we observed five mortalities (2F, 3M) the first year; survival rates met or exceeded 0.75 for males and females (Table 3). In Cohort 1's second year, we observed four mortalities (1F, 3M), a high survival rate for females and a moderate survival rate for males. Overall, survival rates for Cohort 1 fishers were above our initial estimated survival goal needed to establish a self-sustaining population.

For Cohort 2 fishers, we observed a greater number of female mortalities in their first year (*n*= 9F). The survival rate for Cohort 2 females was 58%. We documented three male mortalities in year 1 and estimated 80% annual survival for Cohort 1 males. In year 2, we obtained location and survival status data until September 2018, for 10 months of survival data before the remaining, functioning radio-transmitters failed. With these data, we calculated 10-month survival estimates (rather than annual survival estimates) for Cohort 2 males and females (Table 2). These estimates indicated a high overall survival rate for all fishers (81%), a moderate survival rate for females (60%; as a result of two of nine females dying), and 100% survival of 12 males. Similar to Cohort 1, overall survival rates for Cohort 2 fisher were also above the estimated annual survival goal of ≥50% needed to establish a self-sustaining fisher population.

Table 3. Annual survival rates and number of mortalities for fishers released in the southern portion of the Cascades Fisher Recovery Area from December 2015 to September 2018, by cohort and sex. Survival estimates for year 2 of Cohort 2 (bottom three estimates) are 10-month survival rates. Survival rates were estimated following methods described by Pollock et al. (1989).

Cohort[a]	Population segment	Observation period	Number of fishers	Number of mortalities	Annual survival rate (95% CI)
1	Females	Year 1 (Dec 2015–Nov 2016)	11	2	0.80 (0.34–1.00)
1	Males	Year 1 (Dec 2015–Nov 2016)	12	3	0.75 (0.38–1.00)
1	All fishers	Year 1 (Dec 2015–Nov 2016)	23	5	0.77 (0.59–0.95)
1	Females	Year 2 (Dec 2016–Nov 2017)	9	1	0.88 (0.45–1.00)
1	Males	Year 2 (Dec 2016–Nov 2017)	9	3	0.45 (0.00–0.91)
1	All fishers	Year 2 (Dec 2016–Nov 2017)	18	4	0.67 (0.38–0.96)
2	Females	Year 1 (Dec 2016–Nov 2017)	27	9	0.58 (0.28–0.88)
2	Males	Year 1 (Dec 2016–Nov 2017)	19	3	0.80 (0.57–1.00)
2	All fishers	Year 1 (Dec 2016–Nov 2017)	46	12	0.67 (0.48–0.86)
2	Females	10 months in Year 2 (Dec 2017–Sep 2018)	11	3	0.60 (0.17–1.00)
2	Males	10 months in Year 2 (Dec 2017–Sep 2018)	12	0	1.00 (N/A)[a]
2	All fishers	10 months in Year 2 (Dec 2017–Sep 2018)	23	3	0.81 (0.55–1.00)

[a] Confidence intervals cannot be calculated for survival estimates that equal 1.00 (i.e., no mortalities observed).

Overall, we observed moderate to high survival rates for males and females for both release cohorts, and although the precision of our estimates is low, we did not detect survival rates declining from year 1 to year 2 for males or females in either release cohort. Unexpectedly, we could not detect the signal from a large number of fishers within one year after being released. We suspect that a greater than expected number of radio-transmitter failures may explain the majority of these missing fishers. While we lack data for these missing fishers, and the lack of data for these fishers results in survival estimates with low precision, many of these missing fishers may still be contributing to the establishment of a self-sustaining population within the recovery area.

To date, we have documented a total of 23 fisher mortalities and we have recovered the remains, or a transmitter (or both), for 19 fishers. Of these 19 mortalities, we have determined the cause of death for six recovered fishers, which included predation (females F047 and F052), vehicle collision (female F021), injury/broken-back (female F045), starvation following an injury (female F006), and infection of wound following a fight (male M005). Of the remaining 13 fishers, we considered the cause of death unknown for seven fishers and unknown/possible predation for six fishers. Our ability to determine the cause of death has been hindered by the difficulty in locating and recovering fishers shortly after they die and before they are scavenged or decompose, especially in summer. Analyses are in progress to determine the carnivore species associated with predation-related mortalities.

Reproduction

No reproduction was observed for Cohort 1 females in the spring of 2016. Most Cohort 1 females were too young to reproduce in the spring of 2016, and it is also unknown if reproduction occurred in older females, due to insufficient aerial telemetry locations. We did document reproduction by female F023 in May/June of 2017. Female F023 was released on 6 February 2016 at 10 months of age, and mated with a reintroduced male fisher in April of 2016 at ~1 year of age. In March, April and May of 2017, we found F023 using a small, localized portion of her home range (i.e., behavior consistent with denning), and in May 2017 we set up trail cameras around a tree we suspected was F023's den site. We obtained photos from this site that showed F023 carrying one kit down this den tree on 1 June 2017 (Lewis et al. 2018).

Female F082 was released in the recovery area on 20 February 2017, at ~11 months of age. F082 mated with a male in Washington in the spring of 2017, at one year of age and gave birth to at least one kit in late March or early April of 2018 at two years of age, which is the youngest age a female fisher can give birth (Mead 1994).

In the spring of 2018, we documented female F082 using a localized area on the Gifford Pinchot National Forest, near the southwest corner of MORA. We set up cameras at a possible den tree on 14 June 2018 and we revisited the site on 19 June 2018. These cameras captured photos of female F082 repeatedly climbing the den tree with prey items (i.e., a squirrel and a mountain beaver) on 16 and 18 June 2018 (Figure 4). While we did not detect a kit at this time, F082's behavior is consistent with a female provisioning one or more kits.

Figure 4. Female fisher F082 was photographed ascending her den tree with a mountain beaver (*Aplodontia rufa*) in her mouth on 16 June 2018 (left), was detected with a kit on 4 July 2018 (center), and about to ascend a den tree at a second location on 11 September 2018 (right).

On 4 July 2018, we revisited the den site and obtained a number of photos of F082 interacting with a single kit on the ground by the den tree (Figure 4). The kit appeared to be exploring the area around the den tree while F082 watched over it and attempted to pick it up and move it. F082 appeared to move away from this den site and we were able to set up cameras at a second suspected den site in early September. At this second site, we obtained photos of female F082 repeatedly ascending the suspected den tree and carrying at least one prey item. Based on the evidence we obtained in these photos, it appeared that F082 was still provisioning at least one kit at this site from 11 to 22 September 2018, which indicates the survival of at least one kit for ≥6 months.

We achieved our recovery goal to confirm reproduction by at least one female from each cohort. Although we suspected denning by several females based on localized behavior documented through aerial and ground-based radio-telemetry, our field teams could not confirm denning by documenting a female attending kits at these other locations. Reproduction by 2-year old females (F023 and F082) is particularly meaningful because it indicates that even young adult females have the essential resources in the recovery area to produce young, which is a positive indication for population reestablishment.

North Cascades Progress to Date

Objective 1: Capture a founder population of at least 80 fishers with a sex ratio of ≥50% females from central Alberta, and release them into the northern portion of the Cascade Recovery Area over two years.

In the first year of the project (October 2018 to March 2019), 26 fishers (15F, 11M) were successfully captured in a 125,664 km^2 area in central and north-central Alberta (Table 4, Figure 5, Appendix B). Following veterinary evaluation at Calgary Zoo, these fishers were transported to Washington and released on five occasions from 5 December 2018 to 7 March 2019 near the NPS Newhalem Visitor Center and USFS Buck Creek Campground (Figure 6); in this report, these 26 fishers are referred to collectively as Cohort 3. We did not meet our target of capturing and releasing ~40 fishers into the northern portion of the recovery area during this first capture and release period (October 2018 to February 2019); however, we are hopeful that revised capture approaches planned for the next capture period (October 2019 to February 2020) will enable us to reach our total founder population goal of ≥80 fishers in early 2020.

Table 4. The number of fishers released and their release sites in the northern portion of the Cascades Recovery Area in North Cascades National Park Service Complex (NOCA) and Mount Baker-Snoqualmie National Forest (MBSNF) from December 2018 to March of 2019. Each of the 26 released fishers was equipped with a radio-transmitter.

Release site	Date	Females	Males	Total
Newhalem Visitor Center (NOCA)	December 5, 2018	5	1	6
Newhalem Visitor Center (NOCA)	December 13, 2018	0	1	1
Buck Creek Campground (MBSNF)	December 13, 2018	2	3	5
Buck Creek Campground (MBSNF)	January 17, 2019	4	2	6
Buck Creek Campground (MBSNF)	February 6, 2019	2	4	6
Whitechuck R.-Sauk R. confluence (MBSNF)	March 7, 2019	1	1	2
Totals	–	14	12	26

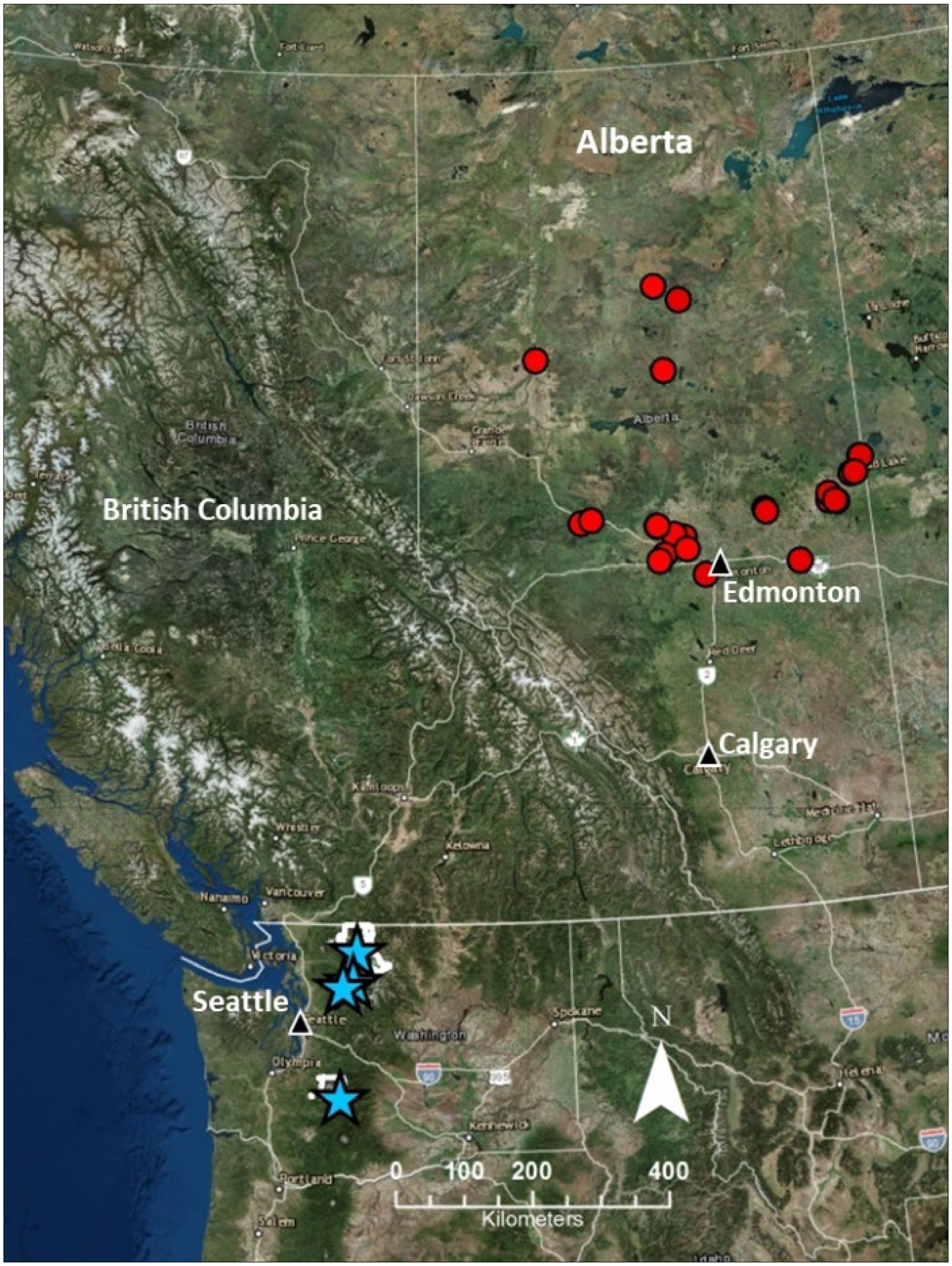

Figure 5. Locations of the 30 fishers captured in Alberta for translocation to Washington in relation to Washington State, with three release locations in the northern portion of the Cascades Recovery Area and one location in the southern portion of the recovery area, as indicated by blue stars (see also Figure 1, Table 1).

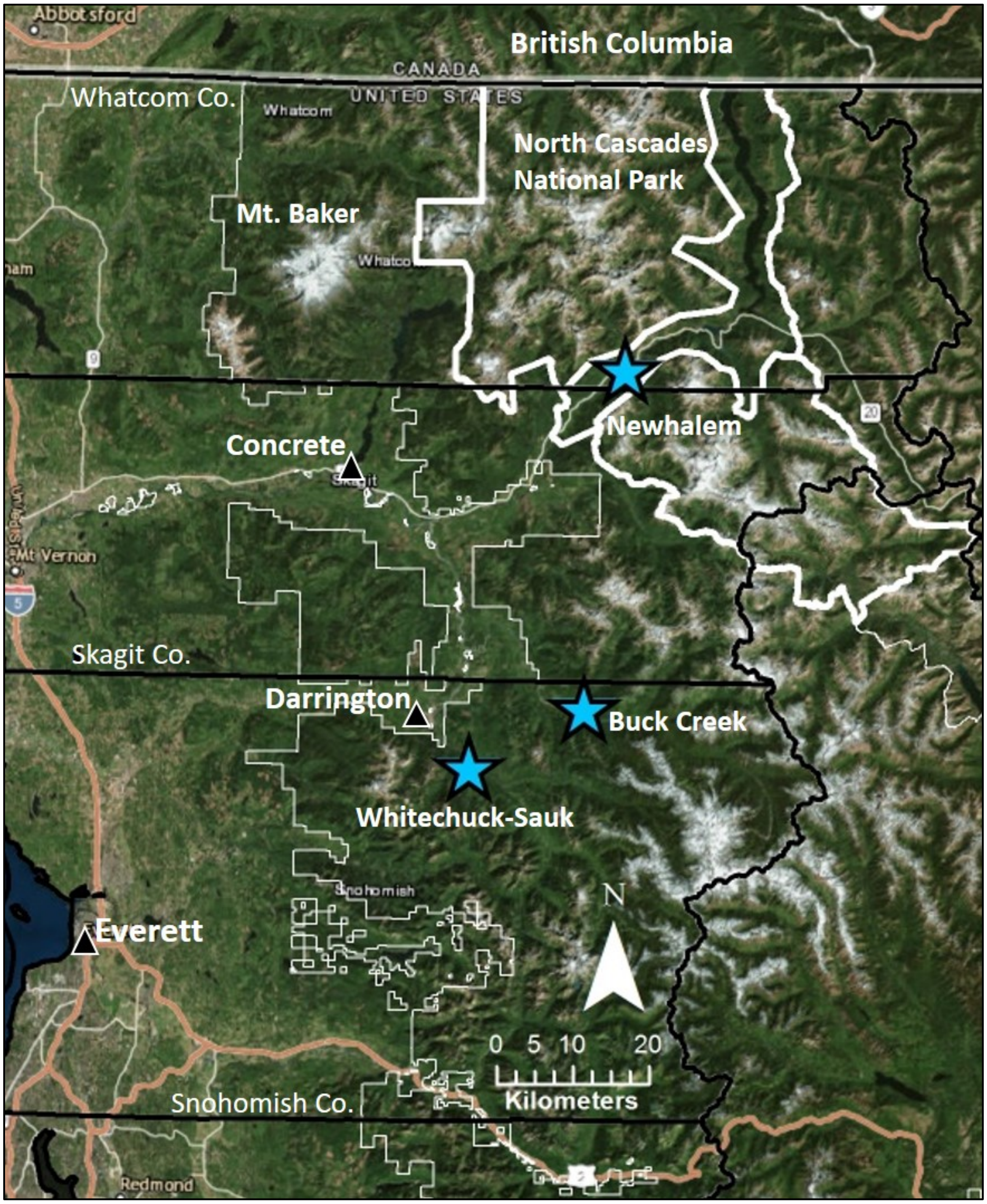

Figure 6. Locations (blue stars) of the three sites where fishers were released from December 2018 to March 2019 in the northern portion of the Cascades Recovery Area: the Newhalem, Buck Creek, and Whitechuck-Sauk release sites. Nearby towns are identified as black triangles (▲).

Mean time in captivity was 20 ± 1.6 (SE) days for fishers captured in Alberta and translocated to Washington. This mean time in captivity is greater than the mean time in captivity for the 69 fishers released in the southern portion of the recovery area from 2015 to 2017 (13 days) but is comparable to the mean time in captivity for fishers reintroduced to the Olympic Peninsula (21 days). The greater time in captivity for fishers released in the northern portion versus the southern portion of the Cascades Recovery Area was due to: 1) the greater transport distances from Alberta capture sites to the Calgary Zoo, and from Calgary Zoo to release sites in Washington, 2) requiring a minimum of six fishers per translocation event to accommodate shipping logistics and costs, and 3) the desire to release multiple animals at a given time and place to reduce their long distance movements in a novel landscape with no or few conspecifics.

Weight gain in captured fishers was positively correlated to time in captivity at Calgary Zoo, and mean weight gain was 0.6 ± 0.10 kg for females (range: 0.0–1.8 kg) and 0.9 ± 0.15 kg for males (range: 0.0–2.1 kg). No fisher lost weight while in captivity and two fishers (1M, 1F) gained no weight. We consider weight gain for males and females to be a positive indication because released fishers have improved energy reserves prior to the stress of being released into a foreign environment. We also consider weight gain to be an indication that we minimized stress to fishers during temporary captivity.

Objective 2: Release fishers at few (i.e. 2–3) locations in each portion of the recovery area to increase the likelihood of fishers interacting (i.e., finding mates and obtaining social cues from previously released fishers).

We met this objective by releasing fishers at only three release sites in close proximity to each other (Figure 5).

Objective 3: Release as many fishers as possible before January 1st to facilitate reproductive success, by conducting the reintroduction process well before the active gestation period of female fishers (Facka et al. 2016).

We released 46% of fisher (7 of 14 females [50%] and 5 of 12 males [42%]) in the northern portion of the Cascades Recovery Area prior to January 1 (Table 4). The duration of the 2018/19 capture and release period was October 2018 to February 2019. The 50% success rate for females is comparable to the success rate in the southern portion of the recovery area (54%, Table 1) and greater than the success rate during the Olympic reintroduction project (30%; Lewis 2014).

Objective 4: Monitor post-release movements, survival, home range establishment, and reproduction to evaluate initial reintroduction success during the period when we can track fishers with functioning radio-transmitters (up to two years).

Monitoring Methods

We used the same methods as described for the southern portion of the Cascades Recovery Area to track fishers in the northern portion: aerial telemetry supplemented with ground-based telemetry. To date, we have conducted 9 aerial telemetry flights from 15 January 2019 to 19 March 2019, which included 41 hours of flight time, at a total cost of $20,490. During these flights we obtained 52 locations (37 for females, 15 for males; Figure 7), for an average of 1.27 locations per hour and an average cost of $394.04 per location. To date, we have obtained 24 ground telemetry locations (16 for females, 7 for males), including 4 mortality recovery locations. Of the 26 fishers released, three fishers (M095, M104, and M120) have not been located since shortly after being released.

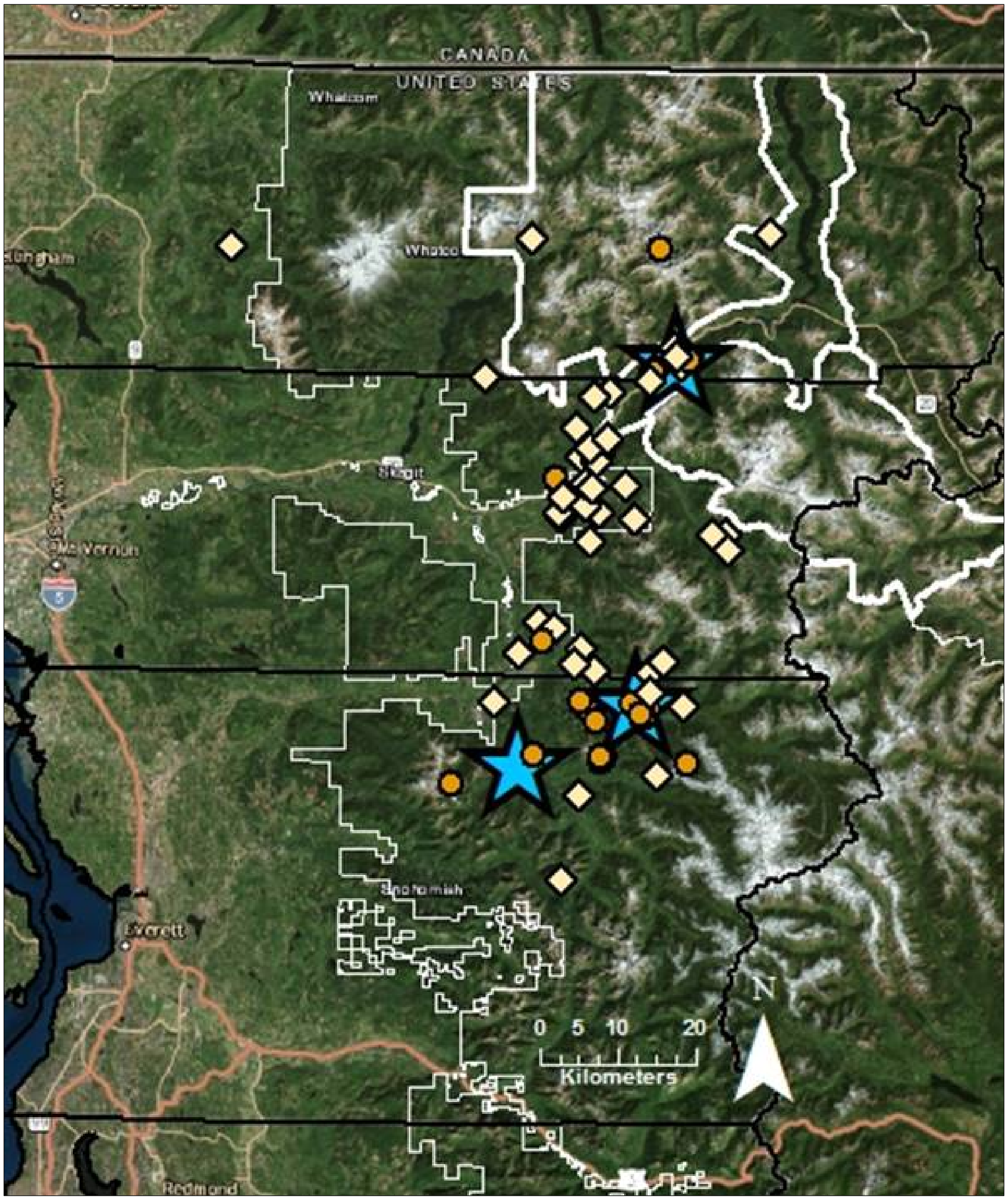

Figure 7. Aerial and ground telemetry locations of male (orange circles; *n*=22) and female (white diamonds; *n*=53) fishers released into the northern portion of the Cascades Recovery Area from December 2018 to February 2019. The three release sites are indicated by blue stars.

Survival and Mortality

Given the short time that fishers have occupied the northern Cascades, we lack sufficient data to calculate annual survival estimates, but we have information on the number and nature of mortalities among the 26 fishers released. Since the first releases in December of 2018, we have detected mortality signals for six fishers (4 males and 2 females), recovering three males and one female. (Appendix B). Of these four fishers, predation appears to be the cause of death for two individuals (M121 and F116), unknown/possible predation for one (M103), and unknown/possible humancaused for one (M112). Two fishers (M107 and F093) are located in remote areas of NOCA that are difficult to access and we have not been able to recover them. We are uncertain if we will be able to recover them this spring or summer.

Reproduction

Because this report is being completed at the beginning of the fisher birthing season in 2019, we have no reproduction information to report at this time.

Project Status and Plans for 2019/20

Since winter 2015/16, we released 99 fishers to the Washington Cascades Fisher Recovery Area, or 62% of the total number to reach our initial goals. We have completed radio telemetry monitoring of fishers released in the southern portion of the recovery area and are now five months into the first year of the reintroduction project in the northern portion of the recovery area (December 2018–April 2019). To reach our target goals, we plan to release at least seven additional fishers in the south and 54 in the north. For the remainder of this year, we will continue aerial telemetry flights, with supplemental ground-based telemetry, to obtain location data and determine the survival status of released fishers in the north. During the spring of 2019, our flights will focus on obtaining locations for females in an effort to document denning and reproductive success, while also documenting male survival. We will continue to collect data points to estimate home range of released fishers and localization of females to potential den sites. As in previous years, if reproduction occurs, our goal is document kit(s) from at least one den site. Our field efforts will also include recovering any additional mortalities that occur. Additionally, we will continue outreach and education to local communities to facilitate an understanding of project goals and as a means to protect fishers from interacting with humans (e.g., as non-target captures by trappers in the region, visiting residences, seen near roads). Based on prior experience where trapper participation increases after the first year of the project, we anticipate greater capture success in the fall of 2020 in Alberta, which will result in many additional fishers being released into the recovery area, and a need for increased monitoring efforts.

Challenges/Difficulties Encountered

In the spring and summer of 2018, we had difficulty locating many of our radio-transmittered fishers in the southern recovery portion of the area, and this was most noticeable for females because we focused our monitoring efforts on females during denning season. Despite extensive and repeated searches inside and outside the recovery area, we did not locate 11 of 46 fishers (24%; 7F, 4M) in Cohort 2 for more than 12 months after they were released, and we did not locate 18 of 46 (39%; 11F, 7M) for more than 18 months after they were released. Given the expected lifespan of 30 months for these transmitters, and the unexpectedly high number of missing fishers, we concluded that a significant number of transmitters failed and that many of these failures appeared to occur well before half of the specified lifespan had elapsed. These transmitter failures prevented us from locating 11 females (29% of the female population) and determining if they gave birth in 2018. The lack of data associated with these missing fishers also prevented us from evaluating their movements, survival, and home range establishment behavior using radio-telemetry.

Our findings with regard to transmitter performance led us to re-evaluate our use of this particular transmitter model and specifications for future fisher reintroductions. During our re-evaluation, we found that there were no appealing alternatives to this transmitter model and we decided to work with the manufacturer to design/program transmitters to perform more closely to expectations. We equipped the 26 fishers released in the northern portion of the recovery area with these new transmitters, and our ongoing monitoring of these fishers will allow us to evaluate the performance of these transmitters and inform our decision on their use for Cohort 4 fishers in the fall of 2019.

To meet our goal of obtaining and translocating ≥80 Alberta fishers to the northern portion of the recovery area over two years, we set a target goal to capture 40 fishers during the first capture period (October 2018 to February 2019). We translocated 26 fishers to Washington during this first capture period, which was similar to the numbers translocated in the first year of the Olympic (n=18) and South Cascades releases (n=23), but did not meet our targeted goal. Unfavorable weather early in the trapping season, as well as first season fine-tuning of process, contributed to the lower capture success. Prior to the 2019/20 trapping season, we will recruit additional trappers to the project, schedule additional trapper training sessions prior to the start of capture season (1 October 2019), and expand the capture area to include areas where fishers appear to be particularly abundant as indicated by 2018 and 2019 fur harvests, based on new harvest data. We expect that this increased outreach and word of mouth from last season's trappers will increase our capture success to meet the overall project goal of 160 fishers for the Cascades Recovery Area by the end of this upcoming capture period in Alberta (1 October 2019 to 28 February 2020).

Research

Much of the research associated with our reintroduction project involves investigating intrinsic and extrinsic factors (e.g., age, sex, release date, stress, time in captivity, cohort) that could influence measures related to reintroduction success (e.g., short movements, high survival, quick establishment of a home range, large number of females giving birth). Many of these studies will utilize telemetry data collected as we monitor released fishers. Other research investigations involving reintroduced fishers will focus on resource selection, influences of competitors and predators, disease exposure, parasite load, food habits, and animal welfare. These research projects rely heavily on collaborations with our project partners and the assistance of graduate students.

Predator and Prey Densities

There are two predator/prey studies for the fisher project. One of these studies investigates how habitat use by fishers in the year following release is influenced by prey and predator densities, and how these densities vary across forest conditions within the southern portion of the Cascade Recovery Area. This work is being done as a collaboration with graduate student Mitchell Parsons and his Advisor Dr. Laura Prugh at the University of Washington (UW), with Dr. Jeff Lewis serving on the graduate student committee. Mitchell completed his Master of Science thesis and is currently preparing manuscripts for submission to professional journals. The second study is similarly focused on pre-reintroduction predator and prey densities in the northern portion of the Cascades Recovery Area, paired with post-reintroduction habitat selection by fishers. Methods are comparable to those employed in the southern area in order to facilitate long-term analysis and modeling of the entire reintroduction effort. The northern area study is being conducted in collaboration with University of Montana (UM) graduate student Tanner Humphries and his Advisor at UM, Dr. Jedediah Brodie. Dr. Jason Ransom is serving on the graduate student committee.

Behavior/Personality and Stress of Fishers in Captivity

Research efforts at the Centre for Conservation Research of the Calgary Zoo are providing essential data on a number of factors (e.g., sex, age, health, allometry, endoparasite occurrences, blood chemistry, timing of release, duration of captivity, body weight) that may influence reintroduction success. We are also conducting studies on two additional factors: stress response and personality, which may be relevant factors influencing reintroduction success (Teixeira et al. 2007, Bremner-Harrison et al. 2004). In addition, stress physiology can be related with personality (Koohlas et al. 1999), so we are investigating their relationship and potential influence on reintroduction. This research is expected to help us determine what makes a good or excellent translocation candidate, and can inform our efforts to shape a founder population that gives us the greatest likelihood for reintroduction success.

Personality

To characterize the personality of individual fishers, Calgary Zoo designed a study to quantify two different behavioral traits and test their consistency: 1) Docility, by scoring the resistance of a fisher to leave a transport box and 2) Fearfulness, using a novel object test to score the interaction between fishers and 2–3 different unfamiliar objects. Docility is scored by a direct observer when fishers are receiving an anesthetic injection, as well as using the continuous video recording system when fishers are moved into a transport box. Fearfulness measures were recorded using only the video recording system to avoid the potential interference of the observer: fishers initially detected observer presence and stayed hidden when an observer was monitoring the tests in real time, even from an adjacent room using the video recording system. Methodology was thus adjusted to accommodate the sensitivity of some fishers, eliminating any real time observation and extending the exposition time to ensure some animal activity during the novel object test (some fishers had latency times of several hours, and irregular activity patterns). Docility was tested in 37 focal fishers during the 2018/2019 season, with a total of 68 tests measuring latency to the leave the nest box. The fearfulness trait was tested in 32 individual fishers, with a total of 89 tests performed during 1068 hours of video, measuring a number of variables (such as latency to interact with a novel object) (Figure 8). Correlation between both traits will be analyzed to describe potential behavioral syndromes. Most of the tests were replicated at least once, spaced at least 24 hours apart, with the order of novel objects randomized.

Figure 8. Fishers investigating novel objects as a test of fearfulness while in temporary holding facilities at Calgary Zoo.

Stress characteristics

Stress was monitored while fishers were in temporary housing at the Calgary Zoo facilities using two different approaches: 1) Measuring behavioral activity of the fishers and 2) quantifying fecal corticosteroids. The behavioral activity of 27 individual focal fishers was monitored for 1,416 hours over 118 days. We collected fecal samples from every fisher upon arrival at the zoo, and then every other day while they were in captivity (n=444 samples). All samples from traps and transport boxes were collected (*n*=8). Fecal samples were submitted for corticosteroid analysis. We will compare both approaches and test if stress levels are correlated with capture and handling, time in captivity, and behavioral traits.

Veterinary Assessments

During the 2018/2019 fisher translocation season, the Veterinary Services department of the Calgary Zoo received and cared for 37 fishers obtained from live wild captures in Alberta. Thirty animals (13M, 17F) were found to be suitable for release. On arrival, each animal was visually assessed (as far as possible without handling) for body condition, obvious injuries and behavior. Fisher were housed in individual enclosures and received a diet of a ground horse meat, herring or smelt, whole mice and whole chicks. While most animals ate within the first 24 hours, some took two or three days to settle in and begin to eat well. Fishers were not handled for 48 hours or more to allow recovery from trapping and transfer. When ready for a full assessment, each animal was moved into a transfer box, and from there into a handling cone for injection in the epaxial muscle with a mixture of dexmedetomidine (0.015–0.025 mg/kg), midazolam (0.08–0.1 mg/kg) and ketamine (2–3.5 mg/kg). Induction was rapid, and most animals were able to be safely handled within 3–4 minutes post injection. A surgical plane of anesthesia was then maintained via inhalant anesthesia with isoflurane. All animals received a detailed physical exam and assessment for potential release. Thirty animals which met the health criteria for release were prepared for abdominal midline celiotomy surgery to implant an abdominal radio-transmitter. Following surgery, each animal was treated with a long acting antibiotic, a non-steroidal anti-inflammatory (meloxicam 0.1 mg/kg), and an analgesic (buprenorphine). Recovery from surgery was uncomplicated in all 30 animals.

Four animals (1M, 3F) did not meet the requirements for the release program due to dental fractures, but were found to be in very good body and coat condition, and were returned to their original capture locations. Three animals were found to have significant damage to the facial area and jaws, including skin loss, bony infection and abscessation, likely due to self-inflicted injuries in the live trap. One animal with a draining wound and associated cellulitis was treated with flushing, and local and systemic antibiotics, recovering in approximately one week. Damage was so significant in the other two animals that euthanasia was elected. One additional animal required significant dental reconstruction work due to historic dental fractures, and was accepted by Northwest Trek zoo as a display animal to further public education about this species and the reintroduction efforts in the Cascades. The team took steps throughout the season to alleviate injuries from trapping by increasing trapper education and switching to plastic-lined traps that prevented animals from accessing metal wire to chew on (the likely source of broken teeth).

All animals received a full physical examination, blood samples were collected for complete blood counts and serum chemistries, serology for diseases of interest, and serum and whole cell banking. Following a local nerve block, a mandibular premolar was extracted from each animal for aging. Hair samples were collected for genetics and banking. Each fisher was vaccinated for rabies and canine distemper and was treated with a topical parasiticide. Whole body digital radiographs were taken in lateral and ventrodorsal views. The lateral cranial radiograph provides the ability to measure the height of the caudal sagittal crest (Figure 9) and length of baculum (in males); these measurements were previously collected by palpation and measurement through the skin. These more accurate sagittal crest and baculum measurements will be incorporated into analyses of age as a function of allometry, where age data from dental cementum analysis are available. If correlation is sufficiently high, this measure could provide a less painful and invasive aging technique than tooth extraction in future years.

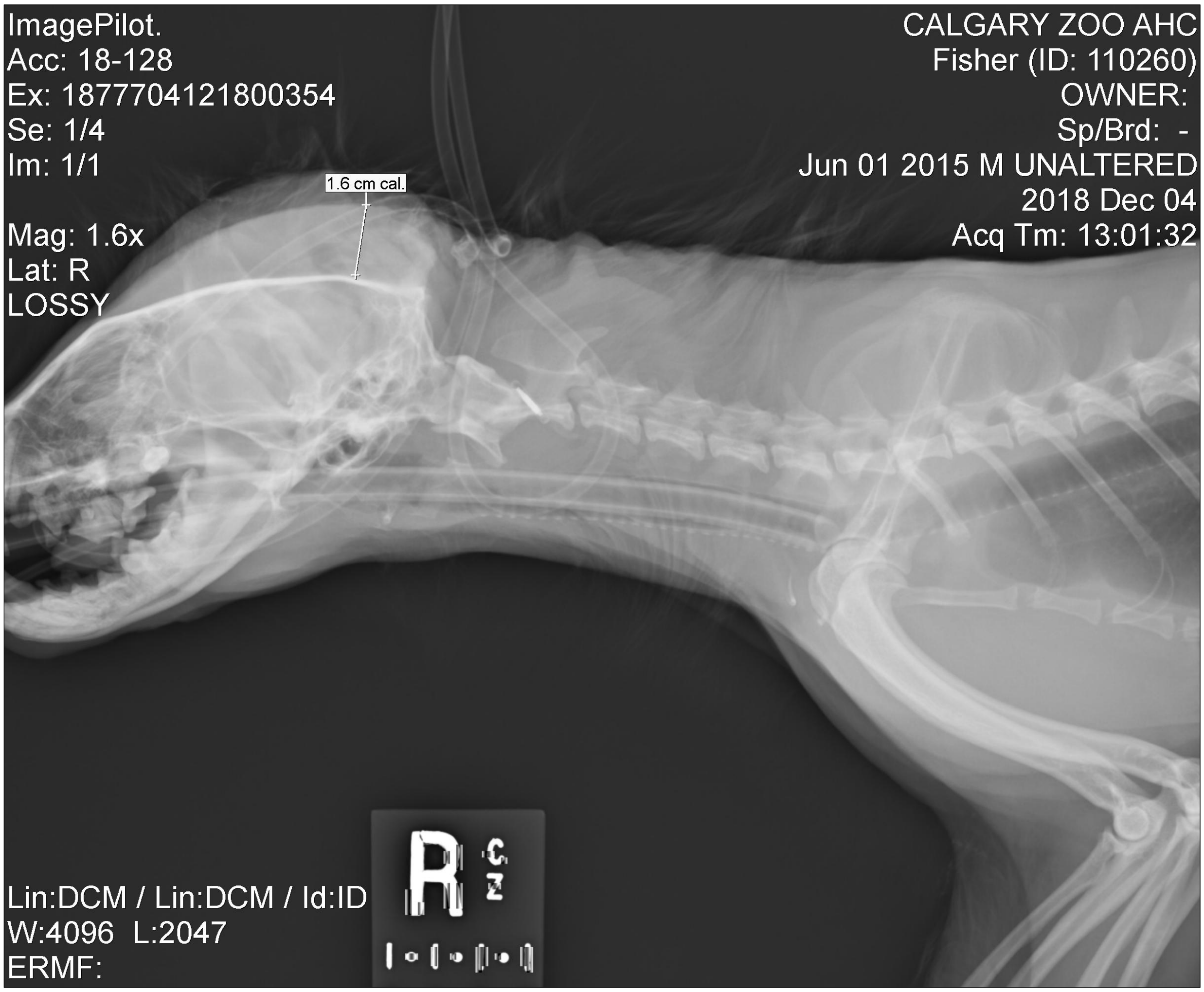

Figure 9. Lateral cranial radiograph of male fisher M104 showing 1.6 cm sagittal crest measurement.

Laboratory Samples and Associated Studies

Endoparasites

There are competing hypotheses among professionals involved with wildlife translocations about the benefits and risks of treating translocated animals for all possible parasites and pathogens that may be present. The primary concern about not treating animals is the introduction of novel pathogens and parasites: this risk must be weighed against the potential harm to immune function and other factors related to interventions and effectiveness of treatment, especially for parasites that are widely distributed (IUCN/SSC 2013). Based on consults and consensus of project veterinarians, we treated captive fishers for ectoparasites and vaccinated against rabies and distemper virus. We also considered vaccinating against parvo virus but decided against it, as there was no evidence that the available vaccinations (for cats and dogs) were effective in protecting mustelids against parvo virus, and their response to the vaccination was unknown. Given the ubiquity of common internal parasites and low risk of introducing novel parasites to the recovery area, we determined there was little benefit to deworming fishers prior to release. We did not deworm fisher, however we did conduct fecal parasite assays of all released fisher to characterize endoparasites.

We evaluated 82 fecal samples from fishers captured in British Columbia in the winters of 2015/16 and 2016/17 and documented endoparasites in 18 samples. Capillarids were the most common nematodes present (*n*=17). Fifteen fishers were infected with unidentified capillarids only. One fisher (M061) was co-infected with unidentified capillarids and unidentified ascarids and one (F075) was co-infected with three nematodes (unidentified Ascarids, unidentified Capillarids and *Soboliphyme baturini*). We also documented tapeworms (Taeniid, likely *Taenia martis*) in one fisher (M027).

We also collected fecal samples from all 37 fishers captured in Alberta during the 2018/19 season, and conducted ova and parasite assays. Seven of those (2M, 5F) did not contain any discernible parasites and 30 contained one or more endoparasite species. The intestinal trematode *Alaria* sp. was the most commonly identified parasite, seen in 12 males and 15 females in moderate count levels. Three of these females were concurrently infected with low counts of hookworms (*Ancylostoma* sp.), and two females with *Hymenolopis* sp. tapeworms. Three fecal samples from females contained coccidia (*Eimeria* sp.) and two samples (1M, 1F) contained Oxyurid pinworm eggs; however, the source of these may be whole prey items such as mice rather than primary infection. No clinical signs were associated with any of these findings.

Anticoagulant Rodenticide

Anticoagulant rodenticide (AR) poisoning is a known threat to many wildlife species, including fishers (Gabriel et al. 2012). Fishers in our project could have been exposed to ARs at their native capture location (see Thomas et al. 2017, for example), and/or could be exposed at their reintroduction location through a variety of private and public sources. Typically, such AR exposure arises from ingesting rodents that are incapacitated or killed by household rat poisons, but also may arise from larger-scale agricultural uses of wildlife pesticides. AR compounds can accumulate in the organs and tissues of fishers and be fatal.

We performed toxicology screening on six fishers (5F, 1M) that died during our study and whose bodies were recovered with adequate tissue to sample. Three of these fishers (F051, F052 and M112) did not test positive for any AR compounds. Toxicology screening was negative for all screened organic compounds (pesticides, environmental contaminants, drugs and natural products). Three fishers (F002, F049 and F065) had positive results for at least one AR compound: F002 tested positive Brodifacoum (trace - below quantifiable detection limit), Bromadiolone (82 ppb), and Diphacinone (1200 ppb), F049 tested positive for Bromadiolone (trace - below quantifiable detection limit), and F065 tested positive Brodifacoum and Bromadiolone (both trace - below quantifiable detection limit). Notably, the levels of AR compounds we detected were an order of magnitude lower than those reported on public lands in California (Gabriel et al. 2012). Brodifacoum and

Bromodiolone are common rodent poison baits, and were the most frequently detected AR in that study; however, Diphacinone was not reported by Gabriel et al. (2012) and may require further investigation. We will continue screening fishers for AR exposure when carcasses with sufficient tissue can be collected.

Outreach

The project team has connected with and provided information to our partners, supporters, cooperators, stakeholders, members of the scientific and conservation communities, and the public through various outreach methods. Nine new landowners enrolled in a Candidate Conservation Agreement with Assurances (CCAA) in the last year, bringing the total participation to 54 landowners who provide fisher conservation measures on 3,027,453 acres of private land. Approximately 610 people have attended release events in the Cascades, including several school and youth groups. Children have released almost every fisher to date.

Recent Presentations

- April 22, 2019 Tara Chestnut gave a presentation “Cultural competence in conservation biology: A case study by the Cascades Fisher Reintroduction Team” at the University of Washington, multi-departmental Fish and Wildlife Ecology seminar series.
- April 16, 2019, Alyssa Friesen, Conservation Linkage Associate with the Calgary Zoological Foundation (CZF), gave a presentation titled: 'Conserving Fishers in Washington' embedded in the school program of the Calgary Zoological Society (CZS)
- April 13, 2019 and March 19, 2019, Jose Luis Postigo, Conservation Research Population Ecologist (CZF) gave a presentation titled 'Reintroducing Fishers from Alberta to Washington' to CZS staff
- March 14, 2019, Jose Luis Postigo, Conservation Research Population Ecologist (CZF) gave a presentation titled: 'Conserving Fishers in Washington' embedded in the school program of the CZS.
- February 28, 2019 Jeff Lewis gave a presentation “The Cascade Fisher Reintroduction Project: Progress in the South Cascades and a New Reintroduction in the North Cascades” at the Joint Annual Meeting of the Washington Chapter of the Wildlife Society and the Society of Northwestern Vertebrate Biology in Grand Mound, WA. The abstract was published in Northwestern Naturalist 100, p. 151.
- February 26, 2019 Alyssa Friesen, Conservation Linkage Associate with the Calgary Zoological Foundation (CZF), gave a presentation titled: 'Conserving Fishers in Washington' embedded in the school program of the Calgary Zoological Society (CZS)
- January 31, 2019 Alyssa Friesen, Conservation Linkage Associate with the Calgary Zoological Foundation (CZF), gave a presentation titled: 'Conserving Fishers in Washington' embedded in the school program of the Calgary Zoological Society (CZS)
- November 13-16, 2018 Tara Chestnut gave two presentations at the 2nd IUCN International Wildlife Reintroduction Conference in Chicago, IL, a poster titled “Reintroducing fishers (*Pekania pennanti*) to their historical range in Washington State, USA: Progress in the South Cascades” and an oral presentation titled “Cultural competence in conservation biology: A case study by the Cascades Fisher Reintroduction Team”.

- May & June 2018, Tara Chestnut gave presentations to Mount Rainier National Park maintenance, interpretive, and natural and cultural resources staff on project status with key information for park visitors.

Publications/Thesis

Chestnut, T., J. I. Ransom, D. O. Werntz, J. L. Lewis, H. Anderson, K. Palmantier, H. McCloud, M. Nuetzmann, and B. Iyall. 2018. Cultural competence in conservation biology: A case study by the Washington Cascades Fisher Restoration Team. Meeting of the Society for Northwestern Vertebrate Biology and the Wildlife Society, Portland, Oregon, 13–16 February 2018. Northwestern Naturalist 99:137–138.

Lewis, J. C, P. J. Happe, K. J. Jenkins, D. O. Werntz, T. Chestnut and J. I. Ransom. 2018. Reintroducing fishers (*Pekania pennanti*) to forest ecosystems in Washington State, USA. Pages 198–203 *in* P. S. Soorae (ed.). Global re-introduction perspectives: 2018. Case-studies from around the globe. IUCN/SSC Reintroduction Specialist Group, Gland, Switzerland.

Lewis. J. C., T. Chestnut, J. I. Ransom and D. O. Werntz. 2018. Cascades fisher reintroduction project: Progress report for March 2017 to February 2018. Natural Resource Report NPS/PWR/NRR-2018/1667. National Park Service, Fort Collins, Colorado.

Lewis. J. C., T. Chestnut, J. I. Ransom and D. O. Werntz. 2017. Cascades fisher reintroduction project: Progress report for December 2017 to March 2017. Natural Resource Report NPS/PWR/NRR-2017/1486. National Park Service, Fort Collins, Colorado.

Lewis. J. C., T. Chestnut, J. I. Ransom and D. O. Werntz. 2018. Reintroducing fishers to their historical range in Washington: progress in the Southern Cascades. Meeting of the Society for Northwestern Vertebrate Biology and the Wildlife Society, Portland, Oregon, 13–16 February 2018. Northwestern Naturalist 99:157.

Parsons, M. A., J. C. Lewis, B. Gardner, T. Chestnut, J. I. Ransom, D. Werntz, and L. R. Prugh. 2019. Habitat selection and spatiotemporal interactions of a reintroduced mesocarnivore. Journal of Wildlife Management 83:1172–1184.

Parsons, M. A. 2018. Effects of forest management, prey, and predators on the habitat selection of fishers in the South Cascades of Washington. Master Thesis. University of Washington, Seattle, Washington.

Media

The Cascades Fisher Reintroduction Project was featured in a social media educational project on Twitter called March Mammal Madness (#2019MMM) which reached > 250,000 students in >3,000 classrooms in all 50 states, plus 41 countries (https://libguides.asu.edu/MarchMammalMadness).

Earthfix and Oregon Public Broadcasting (OPB) worked with project biologists to produce a video, which shares information about project activities and the goals and specific objectives of the project.

This video aired in February 2018 on the OPB's Oregon Field Guide television program and is available on YouTube at the following link: https://www.youtube.com/watch?v=ahuQ6d8EjMk

The National Park Service and Silver Fox Media worked with project biologists to produce a video that captures the events and people associated with the first fisher reintroduction at Mount Rainier National Park, on 2 December 2016. This video is available on YouTube at: https://www.youtube.com/watch?v=ahuQ6d8EjMk

The Cascades Fisher Reintroduction Project has now been featured in over 70 written, radio, and television news stories across local (e.g. Skagit Valley Herald, Yakama Herald Republic), regional (e.g. King 5 Seattle, Oregon Public Broadcasting), national (e.g. NPR, Associated Press), and international (e.g. Canada Metro News, Calgary Herald) platforms.

Fisher Project Website

With the assistance of project partners from the NPS, CNW, and CZS, Washington Department of Fish and Wildlife provides information on fisher conservation, updates on the Cascades fisher reintroduction project, photos and videos from fisher releases, planning documents and project reports, and a list of the many project cooperators and supporters, on the agency's fisher web-page. The main fisher web page can be found at: https://wdfw.wa.gov/species-habitats/species/pekania-pennanti.

Mount Rainier National Park, North Cascades National Park Service Complex, Conservation Northwest, and Calgary Zoo also host project websites that provide general and agency specific project information and provide links to the main project website hosted by WDFW. These websites are found at:

https://www.nps.gov/articles/washington-fisher-restoration.htm,
https://www.nps.gov/noca/learn/nature/washington-fisher-restoration.htm,
https://www.conservationnw.org/our-work/wildlife/fisher/, and
https://www.calgaryzoo.com/why-we-matter/conservation-programs.

Literature Cited

Bremner-Harrison, S., P. A. Prodohl, and R. W. Elwood, R.W. 2004. Behavioural trait assessment as a release criterion: boldness predicts early death in a reintroduction programme of captive-bred swift fox (*Vulpes velox*). Animal Conservation Forum 7:313–320.

Facka, A. N., J. C. Lewis, P. J. Happe, K. J. Jenkins, R. Callas, and R. A. Powell. 2016. Timing of translocation influences birth rate and population dynamics in a forest carnivore. Ecosphere 7:e01223. 10.1002/ecs2.1223.

Gabriel, M. W., L. W. Woods, R. Poppenga, R. A. Sweitzer, C. Thompson, S. M. Matthews, J. M. Higley, S. M. Keller, K. Purcell, R. H. Barrett, G. M. Wengert, B. N. Sacks, and D. L. Clifford. 2012. Anticoagulant rodenticides on our public and community lands: Spatial distribution of exposure and poisoning of a rare forest carnivore. PLoS ONE 7: e40163.

Happe, P. J., K. J. Jenkins, T. J. Kay, K. Pilgrim, M. K. Schwartz, J. C. Lewis, and K. B. Aubry. 2017. Evaluation of fisher (*Pekania pennanti*) restoration in Olympic National Park and the Olympic Recovery Area: 2016 final annual progress report. Natural Resource Report NPS/OLYM/NRR—2017/1531. National Park Service, Fort Collins, Colorado.

Hayes, G. E., and J. C. Lewis. 2006. Washington State recovery plan for the fisher. Washington Department of Fish and Wildlife, Olympia, Washington. Available online: https://wdfw.wa.gov/publications/pub.php?id=00228.

IUCN/SCC. 2013. Guidelines for reintroductions and other conservation translocations. Version 1.0. Gland, Switzerland: IUCN Species Survival Commission.

Koolhaas, J. M., S. M. Korte, S. F. De Boer, B. J. Van Der Vegt, C. G. Van Reenen, H. Hopster, I. C. De Jong, M. A. W. Ruis, and H. J. Blokhuis. 1999. Coping styles in animals: current status in behavior and stress-physiology. Neuroscience & Biobehavioral Reviews 23:925–935.

Lewis, J. C. 2013. Implementation plan for reintroducing fishers to the Cascade Mountain Range in Washington. Washington Department of Fish and Wildlife, Olympia. 29 pp. Available online: http://wdfw.wa.gov/publications/01556/.

Lewis, J. C. 2014. Post-release movements, survival and resource selection of fishers (*Pekania pennanti*) translocated to the Olympic Peninsula of Washington. Ph.D. Dissertation. University of Washington, Seattle. Available online: https://wdfw.wa.gov/publications/01655/.

Lewis, J. C., T. Chestnut, J. I. Ransom, and D. O. Werntz. 2017. Cascades fisher reintroduction project: Progress report for December 2015 to March 2017. Natural Resource Report NPS/PWR/NRR—2017/1486. National Park Service, Fort Collins, Colorado. Available online: https://www.nature.nps.gov/publications/nrpm/nrr.cfm.

Lewis, J. C., P. J. Happe, K. J. Jenkins and D. J. Manson. 2011. Olympic fisher reintroduction project: 2010 progress report. Washington Department of Fish and Wildlife, Olympia. Available online: https://wdfw.wa.gov/publications/01186/.

Lewis, J. C., and G. E. Hayes. 2004. Feasibility assessment for reintroducing fishers to Washington. Washington Department of Fish and Wildlife, Olympia. Available online: https://wdfw.wa.gov/publications/pub.php?id=00231.

Lewis, J. C., R. A. Powell and W .J. Zielinski. 2012. Carnivore translocations and conservation: Insights from population models and field data for fishers (*Martes pennanti*). PLoS ONE 7: e32726.

Lewis, J. C., and D. W. Stinson. 1998. Washington State status report for the fisher. Washington Department of Fish and Wildlife, Olympia, Washington. Available online: https://wdfw.wa.gov/publications/pub.php?id=00227.

Lofroth, E. C., C. M. Raley, J. M. Higley, R. L. Truex, J. S. Yaeger, J. C. Lewis, P. J. Happe, L. L. Finley, R. H. Naney, L. J. Hale, A. L. Krause, S. A. Livingston, A. M. Myers, and R. N. Brown. 2010. Volume I - Conservation Assessment for Fisher (*Martes pennanti*) in South-central British Columbia, Western Washington, Western Oregon, and California. USDI Bureau of Land Management, Portland, Oregon.

Mead, R. A. 1994. Reproduction in Martes. Pages 404–422 *in* S. W. Buskirk, A. S. Harestad, M. G. Raphael, and R. A. Powell (eds.). Martens, sables, and fishers: Biology and conservation. Cornell University Press, Ithaca, New York.

National Park Service. 2014. Mount Rainier National Park and North Cascades National Park Service Complex: Fisher restoration plan / environmental assessment. Available online: https://parkplanning.nps.gov/document.cfm?parkID=327&projectID=46313&documentID=61450.

Pollock, K. H., S. R Winterstein, C. M. Bunck and P. D. Curtis. 1989. Survival analysis in telemetry studies: The staggered entry design. Journal of Wildlife Management 53:7–15.

Powell, R. A. 1993. The fisher: Life history, ecology, and behavior. Second edition. University of Minnesota Press, Minneapolis, Minnesota.

Thomas, P J., K. M. Eccles, and L. J. Mundy. 2017. Spatial modelling of non-target exposure to anticoagulant rodenticides can inform mitigation options in two boreal predators inhabiting areas with intensive oil and gas development. Biological Conservation 212:111–119.

Teixeira, C. P., C. S. De Azevedo, M. Mendl, C. F. Cipreste, and R. J. Young. 2007. Revisiting translocation and reintroduction programmes: The importance of considering stress. Animal Behaviour 73:1–13.

Appendix A. List of individual fishers released in the southern portion of the Cascade Recovery Area, with capture and release dates, and last known status.

Fisher ID	Sex	Age at Release (y)*	Weight (kg)	Capture Date	Release Date	Days in Captivity	Status: Last Date Found
F001	F	1	2.71	5-Nov-2015	3-Dec-2015	28	Alive: Oct 2017
F002	F	4	3.12	17-Nov-2015	3-Dec-2015	16	Dead: Mar 2018
M003	M	0	4.36	19-Nov-2015	3-Dec-2015	14	Dead: Jul 2017
F004	F	2	2.71	20-Nov-2015	3-Dec-2015	13	Dead: May 2016
M005	M	<1	3.70	28-Nov-2015	3-Dec-2015	5	Dead: Mar 2016
F006	F	2	2.42	30-Nov-2015	3-Dec-2015	3	Dead: May 2016
M007	M	3	4.78	30-Nov-2015	3-Dec-2015	3	Dead: Feb 2017
M008	M	2	5.09	2-Dec-2015	23-Dec-2015	21	Alive: Jul 2017
M009	M	<1	2.85	7-Dec-2015	23-Dec-2015	16	Dead: Mar 2016
M010	M	2	4.46	9-Dec-2015	16-Jan-2016	38	Alive: May 2016
F011	F	<1	2.08	9-Dec-2015	23-Dec-2015	14	Alive: Oct 2017
M012	M	<1	3.34	12-Dec-2015	23-Dec-2015	11	Alive: Oct 2017
F013	F	4	2.68	12-Dec-2015	16-Jan-2016	35	Alive: Jun 2017
M016	M	6	4.97	24-Dec-2015	16-Jan-2016	23	Dead: Mar 2016
F017	F	<1	2.32	24-Dec-2015	16-Jan-2016	23	Alive: Dec 2017
M019	M	2	4.90	8-Jan-2016	16-Jan-2016	8	Alive: May 2017
M020	M	<1	3.68	11-Jan-2016	16-Jan-2016	5	Alive: Jul 2016
F021	F	2	3.19	14-Jan-2016	6-Feb-2016	23	Dead: Mar 2017
F023	F	<1	2.43	17-Jan-2016	6-Feb-2016	20	Alive: Sep 2017
M024	M	unknown	4.02	22-Jan-2016	6-Feb-2016	15	Alive: Oct 2017
F025	F	<1	2.61	23-Jan-2016	6-Feb-2016	14	Alive: Oct 2017

*Age as determined by dental cementum analysis

[a] Veterinary assessment of age class, no dental analysis performed

[b] Date of release: no radio-transmitter implanted.

Appendix A (continued). List of individual fishers released in the southern portion of the Cascade Recovery Area, with capture and release dates, and last known status.

Fisher ID	Sex	Age at Release (y)*	Weight (kg)	Capture Date	Release Date	Days in Captivity	Status: Last Date Found
M026	M	<1	3.98	28-Jan-2016	6-Feb-2016	9	Dead: Jun 2017
F028	F	unknown	2.76	31-Jan-2016	6-Feb-2016	6	Alive: Oct 2017
M029	M	<1	3.68	13-Nov-2016	2-Dec-2016	19	Dead: Jul 2018
M030	M	1	4.55	14-Nov-2016	2-Dec-2016	18	Alive: Dec 2017
F031	F	2	2.87	5-Nov-2016	2-Dec-2016	27	Alive: Oct 2017
F032	F	1	2.38	17-Nov-2016	2-Dec-2016	15	Dead: Sep 2017
F034	F	2	3.22	17-Nov-2016	2-Dec-2016	15	Alive: Aug 2017
M035	M	<1	3.83	21-Nov-2016	2-Dec-2016	11	Dead: Oct 2017
M036	M	<1	3.63	24-Nov-2016	2-Dec-2016	8	Dead: Sep 2017
M037	M	<1	3.50	25-Nov-2016	2-Dec-2016	7	Alive: Jul 2018
F038	F	<1	2.23	25-Nov-2016	2-Dec-2016	7	Alive: Jul 2018
M039	M	5	5.02	27-Nov-2016	2-Dec-2016	5	Alive: Dec 2016
M040	M	<1	3.79	27-Nov-2016	10-Dec-2016	13	Alive: Jul 2018
F041	F	2	2.69	27-Nov-2016	10-Dec-2016	13	Alive: Oct 2017
F042	F	<1	2.55	28-Nov-2016	10-Dec-2016	12	Alive: Sep 2018
M043	M	<1	3.58	30-Nov-2016	10-Dec-2016	10	Alive: Jul 2018
M044	M	<1	3.06	1-Dec-2016	10-Dec-2016	9	Alive: Oct 2017
F045	F	<1	2.54	3-Dec-2016	10-Dec-2016	7	Dead: Apr 2017
M046	M	4	5.08	5-Dec-2016	10-Dec-2016	5	Dead: Sep 2017
F047	F	2	2.47	6-Dec-2016	10-Dec-2016	4	Dead: Jun 2017
M048	M	<1	3.76	6-Dec-2016	17-Dec-2016	11	Alive: Jul 2018
F049	F	1	2.53	7-Dec-2016	17-Dec-2016	10	Dead: Dec 2018

*Age as determined by dental cementum analysis

[a] Veterinary assessment of age class, no dental analysis performed

[b] Date of release: no radio-transmitter implanted.

Appendix A (continued). List of individual fishers released in the southern portion of the Cascade Recovery Area, with capture and release dates, and last known status.

Fisher ID	Sex	Age at Release (y)*	Weight (kg)	Capture Date	Release Date	Days in Captivity	Status: Last Date Found
F050	F	1	2.38	7-Dec-2016	17-Dec-2016	10	Alive: Jul 2017
F051	F	1	2.74	7-Dec-2016	17-Dec-2016	10	Dead: May 2018
F052	F	unknown	2.56	10-Dec-2016	17-Dec-2016	7	Dead: Oct 2017
M054	M	1	3.76	11-Dec-2016	17-Dec-2016	6	Alive: Sep 2018
M056	M	<1	3.17	22-Dec-2016	31-Dec-2016	9	Alive: Sep 2018
F057	M	<1	2.22	22-Dec-2016	31-Dec-2016	9	Alive: Dec 2017
M058	M	<1	3.70	22-Dec-2016	31-Dec-2016	9	Alive: Sep 2018
F059	F	<1	1.95	23-Dec-2016	31-Dec-2016	8	Alive: Jul 2018
F060	F	2	2.66	24-Dec-2016	13-Jan-2017	20	Alive: Feb 2018
M061	M	<1	3.93	24-Dec-2016	13-Jan-2017	20	Alive: Jul 2018
M062	M	<1	3.82	24-Dec-2016	13-Jan-2017	20	Alive: Apr 2018
M063	M	<1	3.81	26-Dec-2016	31-Dec-2016	5	Alive: Feb 2018
M064	M	<1	3.46	26-Dec-2016	31-Dec-2016	5	Alive: Sep 2018
F065	F	3	2.71	1-Jan-2017	13-Jan-2017	12	Dead: Jun 2017
M066	M	<1	3.70	1-Jan-2017	13-Jan-2017	12	Alive: Oct 2017
F067	F	<1	2.94	4-Jan-2017	13-Jan-2017	9	Dead: Jun 2018
F070	F	<1	2.58	6-Jan-2017	13-Jan-2017	7	Dead: Jul 2017
F072	F	<1	2.40	11-Jan-2017	3-Feb-2017	23	Alive: May 2017
F073	F	1	2.83	14-Jan-2017	3-Feb-2017	20	Alive: Sep 2018
F075	F	<1	2.25	17-Jan-2017	3-Feb-2017	17	Alive: Jul 2018
F080	F	1	2.44	30-Jan-2017	3-Feb-2017	4	Alive: May 2018
F082	F	<1	2.79	2-Feb-2017	20-Feb-2017	18	Alive: Sep 2018

*Age as determined by dental cementum analysis

[a] Veterinary assessment of age class, no dental analysis performed

[b] Date of release: no radio-transmitter implanted.

Appendix A (continued). List of individual fishers released in the southern portion of the Cascade Recovery Area, with capture and release dates, and last known status.

Fisher ID	Sex	Age at Release (y)*	Weight (kg)	Capture Date	Release Date	Days in Captivity	Status: Last Date Found
F084	F	<1	3.22	4-Feb-2017	20-Feb-2017	16	Alive: Sep 2017
F085	F	<1	2.19	6-Feb-2017	20-Feb-2017	14	Dead: Sep 2017
F086	F	2	2.61	13-Feb-2017	20-Feb-2017	7	Dead: Oct 2017
F088	F	3	2.90	15-Feb-2017	20-Feb-2017	5	Dead: Jun 2017
M089	M	Juvenile[a]	4.35	15-Oct-2018	27-Oct-2018	12	Alive: Oct 2018[b]
F090	F	Adult[a]	3.03	15-Oct-2018	27-Oct-2018	12	Alive: Oct 2018[b]
F091	F	Subadult[a]	2.96	17-Oct-2018	27-Oct-2018	10	Alive: Oct 2018[b]
F092	F	Juvenile[a]	2.58	21-Oct-2018	27-Oct-2018	6	Alive: Oct 2018[b]

*Age as determined by dental cementum analysis

[a] Veterinary assessment of age class, no dental analysis performed

[b] Date of release: no radio-transmitter implanted.

Appendix B. List of fishers released in the northern portion of the Cascade Recovery Area, and associated morphology, age and release data.

Fisher ID	Sex	Age at Release	Weight (kg)	Capture Date	Release Date	Days in Captivity	Status: Last Date Found
F093	F	1	2.90	26-Oct-2018	5-Dec-2018	40	Dead: Jan 2019
M095	M	1	5.08	28-Oct-2018	5-Dec-2018	38	Alive: Dec 2018
F096	F	<1	3.04	18-Nov-2018	5-Dec-2018	17	Alive: Mar 2019
F097	F	<1	2.40	18-Nov-2018	5-Dec-2018	17	Alive: Mar 2019
F098	F	1	2.86	20-Nov-2018	5-Dec-2018	15	Alive: Mar 2019
F101	F	<1	2.80	26-Nov-2018	5-Dec-2018	9	Alive: Mar 2019
M102	M	<1	4.46	27-Nov-2018	13-Dec-2018	16	Alive: Mar 2019
M103	M	<1	3.93	23-Nov-2018	13-Dec-2018	20	Dead: Feb 2019
M104	M	1	4.03	24-Nov-2018	13-Dec-2018	19	Alive: Dec 2018
F105	F	2	3.15	29-Nov-2018	13-Dec-2018	14	Alive: Mar 2019
F106	F	5	2.80	30-Nov-2018	13-Dec-2018	13	Alive: Feb 2019
M107	M	1	4.52	1-Dec-2018	13-Dec-2018	12	Dead: Mar 2019
F109	F	<1	2.51	15-Dec-2018	17-Jan-2019	33	Alive: Mar 2019
F110	F	<1	2.07	15-Dec-2018	17-Jan-2019	33	Alive: Jan 2019
F111	F	<1	2.59	16-Dec-2018	17-Jan-2019	32	Alive: Mar 2019
M112	M	<1	4.27	18-Dec-2018	17-Jan-2019	30	Dead: Jan 2019
M113	M	1	4.88	20-Dec-2018	17-Jan-2019	28	Alive: Feb 2019
F116	F	<1	2.35	22-Dec-2018	17-Jan-2019	26	Dead: Mar 2019
F118	F	<1	2.56	10-Jan-2019	6-Feb-2019	27	Alive: Mar 2019
M119	M	<1	4.36	14-Jan-2019	6-Feb-2019	23	Alive: Feb 2019
M120	M	1	4.86	15-Jan-2019	6-Feb-2019	22	Alive: Feb 2019
M121	M	<1	4.56	18-Jan-2019	6-Feb-2019	19	Dead: Feb 2019
F122	F	<1	2.88	19-Jan-2019	6-Feb-2019	18	Alive: Feb 2019

Appendix B (continued). List of fishers released in the northern portion of the Cascade Recovery Area, and associated morphology, age and release data.

Fisher ID	Sex	Age at Release	Weight (kg)	Capture Date	Release Date	Days in Captivity	Status: Last Date Found
M123	M	1	5.00	23-Jan-2019	6-Feb-2019	14	Alive: Mar 2019
M124	M	<1	4.80	14-Feb-2019	7-Mar-2019	21	Alive: Mar 2019
F125	F	<1	2.50	17-Feb-2019	7-Mar-2019	18	Alive: Mar 2019

NPS 963/160125, August 2019

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

EXPERIENCE YOUR AMERICA ™