Evaluation of Fisher Restoration in Olympic National Park and the Olympic Recovery Area: 2013 Annual Progress Report

By Patricia J. Happe, National Park Service; Kurt J. Jenkins, U.S. Geological Survey; Michael K. Schwartz, U.S. Forest Service; Jeffrey C. Lewis, Washington Department of Fish and Wildlife; Keith B. Aubry, U.S. Forest Service

Administrative Report

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This progress report compiles research activities occurring during the years under report. The information is preliminary in nature. Users are cautioned to consider carefully the provisional nature of the information, and note that additional data collection and analyses are needed to properly assess all preliminary data reported.

Cover Photo: Fisher visiting remote camera station in Olympic National Park, National Park Service.

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)

SI to Inch/Pound

Multiply	By	To obtain
	Length	
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
	Area	
square kilometer (km^2)	247.1	acre
square kilometer (km^2)	0.3861	square mile (mi^2)
	Mass	
gram (g)	0.03527	ounce (oz)

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By Patricia J. Happe[1], Kurt J. Jenkins[2], Michael K. Schwartz[3], Jeffrey C. Lewis[4], and Keith B. Aubry[5]

Executive Summary

With the translocation and release of 90 fishers [*Pekania pennanti* (formerly *Martes pennanti*)] from British Columbia to Olympic National Park during 2008–2010, the National Park Service and Washington Department of Fish and Wildlife accomplished the first phase of fisher restoration in Washington State. Beginning in 2013, we initiated a new research project to determine the current status of fishers on Washington's Olympic Peninsula 3–5 years after the releases and evaluate the short-term success of the restoration program. Objectives of the study are to determine the current distribution of fishers and proportion of the recovery area that is currently occupied by fishers, determine several genetic characteristics of the reintroduced population, and determine reproductive success of the founding animals through genetic studies.

During 2013, we assembled a broad coalition of cooperating agencies and Tribes to assist in conducting fisher surveys, and initiated field studies of fisher detections and genetic (hair) sampling. The sampling frame consists of 157 24-square-kilometer hexagons distributed across all major land ownerships on the Olympic Peninsula. During 2013, Federal, State, and Tribal biologists established three baited motion-sensing camera stations, paired with hair snaring devices, in 52 (33 percent) of the hexagons within the targeted study area. Each paired camera/hair station was left in place for approximately 6 weeks, with three checks on 2-week intervals. We documented fisher presence in 9 of the 52 hexagons (17 percent), and identified 10 different fishers through a combination of microsatellite DNA analyses and camera detections. These 10 individuals, including 4 of the original founding population of 90, and 5 new recruits to the population (1 individual was not identified) provide indicators of both long-term survival of translocated fishers and successful reproduction of fishers in the Olympic Recovery Area. We documented fisher occurrence on Federal, State, private, and Tribal lands. Additionally, we identified more than 40 other species of wildlife at the baited camera stations. We also obtained eight incidental fisher observations on the Olympic Peninsula through photographs, carcass retrieval, or the incidental capture (and safe release) of fishers in box traps set for bobcats.

[1] Olympic National Park, 600 E. Park Ave., Port Angeles, WA 98362, patti_happe@nps.gov
[2] U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, 600 E. Park Ave., Port Angeles, WA 98362, kurt_jenkins@usgs.gov
[3] U.S.D.A. Forest Service, Rocky Mountain Research Station, 800 Block East Beckwoith, Missoula, MT 59801
[4] Washington Department of Fish and Wildlife, 600 Capital Way N., Olympia, WA 98501
[5] U.S.D.A. Forest Service, Pacific Northwest Research Station, 3625 93rd Ave. SW, Olympia WA 98512

During 2014, we plan to sample 45–50 additional hexagons in Olympic National Park and National Forest and lend support to partners working on non-federal lands. We anticipate continued broad participation of collaborators in the year ahead, and hope to add new partners allowing us to expand sampling outside the initial study area. In 2014, we will expand to include an interpretive component of the study and begin estimating occupancy patterns and genetic indicators of fisher population status.

Background and Study Objectives

The fisher, *Pekania pennanti* (formerly *Martes pennanti;* Sato and others, 2012), once occupied coniferous forests at low to middle elevations throughout much of the Western United States, but was extirpated from Washington State during the last century. It was listed as a State endangered species in October 1998, and the West Coast Distinct Population Segment of fishers was listed as a Federal candidate in 2004. Federal listing was deemed warranted but precluded by higher priority actions (U.S. Fish and Wildlife Service, 2004), but federal listing is currently under additional review (U.S. Fish and Wildlife Service, 2013). In 2006, Washington State developed a Fisher Recovery Plan, with a goal of establishing multiple self-sustaining fisher populations in Washington (Hayes and Lewis, 2006).

In 2007, the National Park Service (NPS) and Washington Department of Fish and Wildlife (WDFW) completed a Fisher Reintroduction Plan and Environmental Assessment for Olympic National Park (National Park Service, 2007). The goals of that effort were to restore fishers to Olympic National Park (ONP) and Washington State. The project was designed to take 10 years to complete, and to be conducted in two phases. In Phase 1, 90 fishers were translocated from central British Columbia to the Olympic Peninsula from 2008 to 2010, and the initial success of the reintroduction was monitored by radio-tracking translocated fishers (2008–2011). Data were collected on post-release survival, movements, home-range establishment, and reproduction. Initial findings indicate that survival was highly variable among release years (Lewis and others, 2011). In addition, wilderness constraints prevented the reliable determination of breeding success for most of the released females, creating additional uncertainties about the current status of reintroduced fishers in the Olympic Recovery Area.

The need for a second monitoring phase, consisting of non-invasive surveys of fisher distribution, was identified in both the State and Federal fisher recovery planning efforts (Lewis, 2006; National Park Service, 2007). The goal of Phase 2 of the fisher monitoring in the Olympic Recovery Area is to evaluate the current status of reintroduced fishers on the Olympic Peninsula (that is, 2013–2016). Specific objectives are to:

1. Determine the proportion of potential habitat occupied by fishers in the Olympic Recovery Area,
2. Determine the genetic diversity and effective population size of the reintroduced fisher population,
3. Determine the minimum number of fishers known to be alive in the Olympic Recovery Area,
4. Estimate the reproductive success of the released fishers, and
5. Determine if the population has experienced a genetic bottleneck.

Research Accomplishments, 2013

Sampling design and methods followed those contained in the protocol developed during Phase 1 and finalized in 2013 (Jenkins and Happe, 2013). Prior to the start of field season, we polled wildlife biologists working for State, Federal and Tribal agencies on the Olympic Peninsula to determine who would be interested in participating in the project. Biologists from Olympic National Forest (ONF), WDFW, Washington Department of Natural Resources (WDNR), Makah Tribe, Quileute Tribe, Lower Elwha Klallam Tribe, Point no Point Treaty Tribes, and Skokomish Tribe indicated that they would like to participate in the field sampling effort. We held two office and two field training sessions, coordinated sampling efforts, provided most of the equipment (with the exception of bait and batteries), collated and processed data, and processed all samples.

Study Area

The target survey area includes accessible lands less than 4,700 ft (1,435 m) in elevation on Washington's Olympic Peninsula, excluding the Quimper Peninsula in the northeast and areas south of the USFS boundary (fig. 1). In this study, "accessible" is defined as lands that can be safely accessed, as well as private and Tribal lands where access is permitted by the landowner. Fishers may have colonized areas south of the Olympic National Forest and east of the target area, but logistical constraints prevent us from sampling fishers outside this area. As funding and logistical considerations permit, we will monitor sites south and east of the target area to determine if there is evidence of population expansion beyond the study area boundaries.

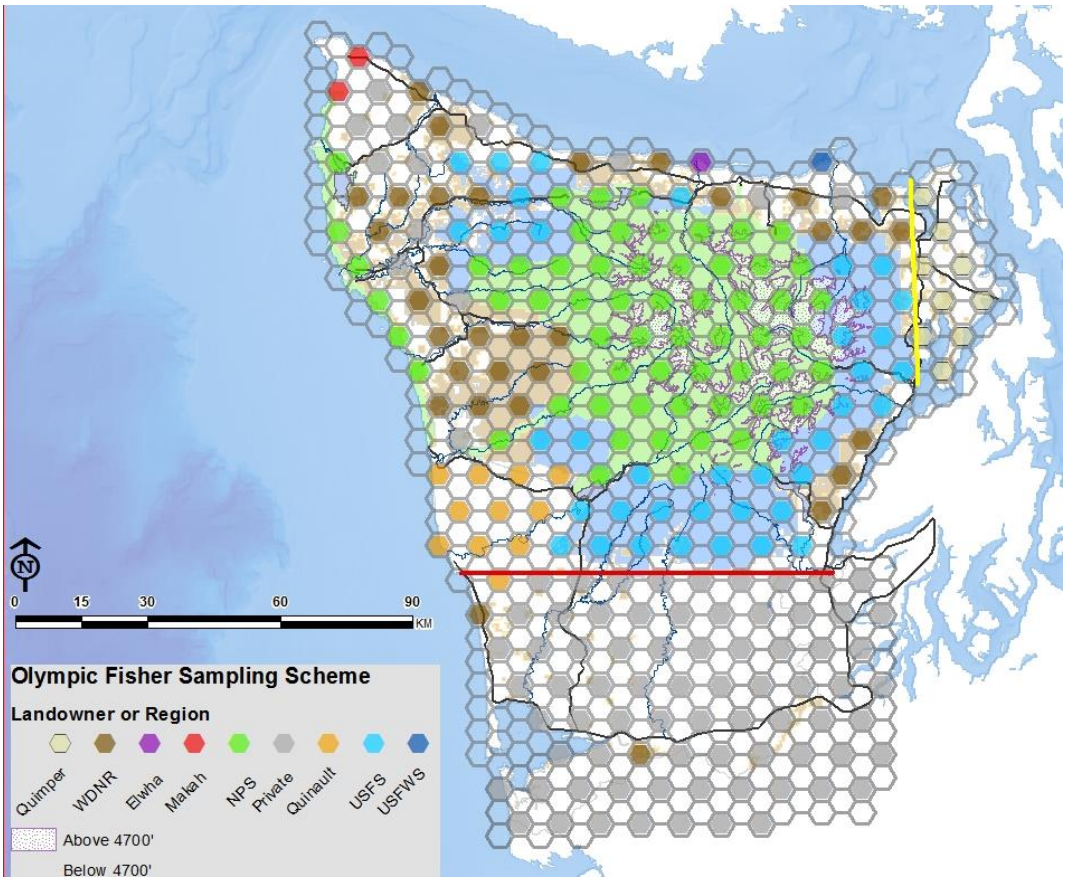

Figure 1. Sampling frame depicting 24-km^2 hexagons where fisher occupancy and genetics will be sampled on the Olympic Peninsula. The target survey area includes the Olympic Peninsula (lands north of the horizontal red line) and excludes the Quimper Peninsula on the northeast (lands east of the vertical yellow line).

The primary sampling units are 24-km^2 hexagonal cells (hexes) (approximately the size of a core area used by female fishers in the study area (J. Lewis and others, Washington Department of Fish and Wildlife, unpub. data, 2013). Using a randomly selected starting point, we selected every other hex, resulting in 241 hexes out of 775 selected for sampling; 157 selected hexes are in the target area, 75 are south of the target area, and 9 on the Quimper Peninsula (fig. 1). Within the target area, hexes occur entirely or predominantly on lands managed by ONP (n=60), ONF (n=39), Washington State (n=30), Native American Tribes (n=14), private landowners (n=13), and the U.S. Fish and Wildlife Service (n=1).

We used a Generalized Random Tesselation Stratified (GRTS) sampling scheme to assign a random firing order for each hex (U.S. Environmental Protection Agency, 2011). Each partner selected the grouping of hexes in their area that they would try to sample over the next 3 years. Following that selection, each partner was given the firing order for their hexes, based on the random firing order assigned to that hex by GRTS.

Methods

Within each hex we established three sampling stations in suitable fisher habitat (Jenkins and Happe, 2013), with each station preferably at least 1 km apart (fig. 2). Suitable fisher habitat was defined as mid- to late-seral forests, or forested stands that most closely matched those conditions within each hex. Each station contained a motion-sensing camera and a hair-snaring device for collecting DNA. Our primary camera was the Bushnell® Trophy Cam HD, with a black LED flash. The hair snaring device was a triangular cubby box baited with a chicken drumstick and equipped with six gun-brushes attached to the inside walls, three near each entrance. The camera was focused on both the chicken bait affixed to a tree and the triangular cubby box (fig. 3). Following set up, each station was visited three times, with 14-day intervals between visits, resulting in it taking 6 weeks for a full hex sampling session. This design resulted in a hex being sampled for nine, 14-day intervals (that is, three intervals for all three stations or nine station/visit events total for each hex). The study design allows for three 6-week sampling sessions (spring, summer, and fall) between May 28 and October 30, 2013.

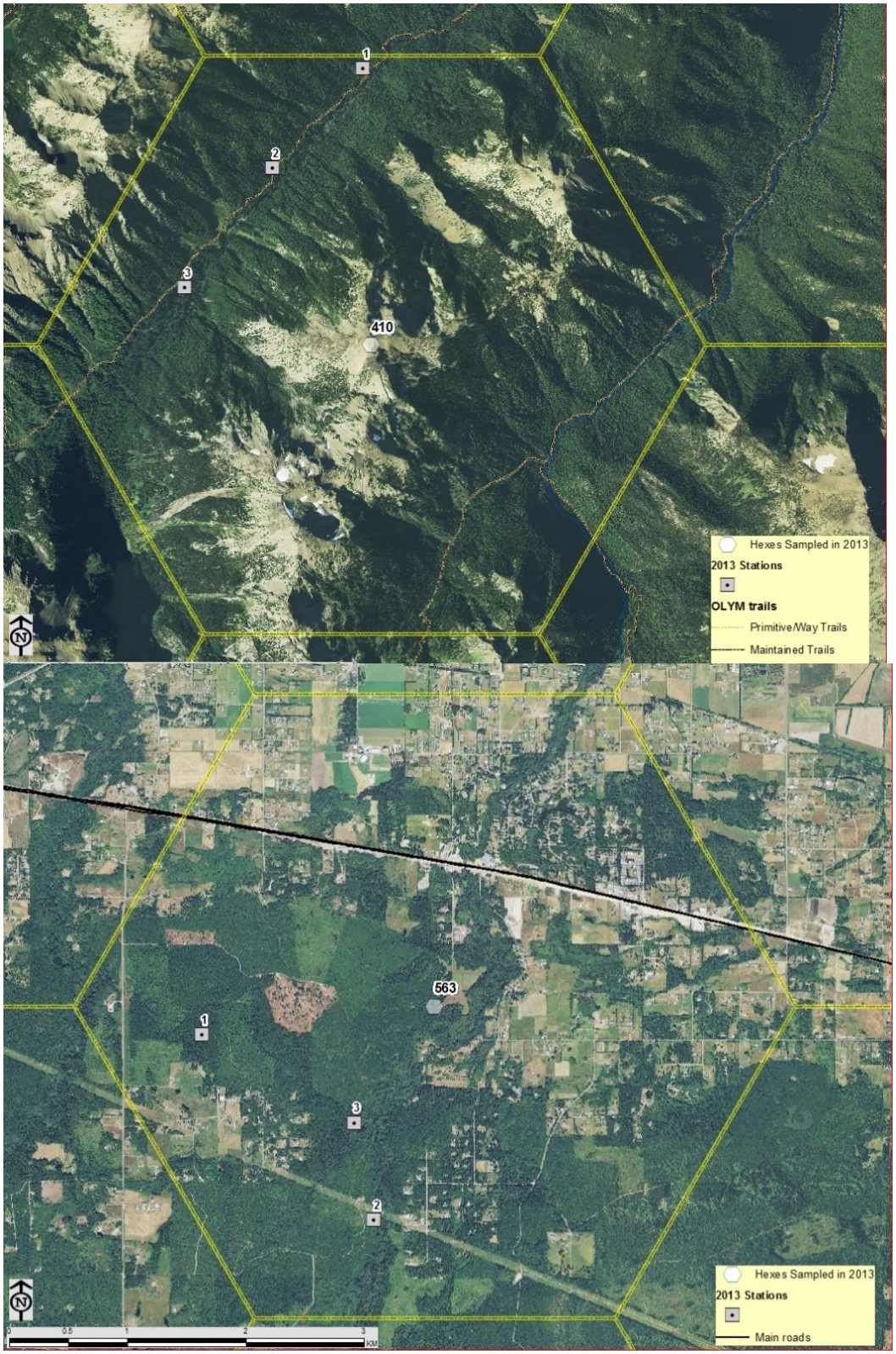

Figure 2. Examples of locations of stations in a hex. Fishers were detected in both hexes in 2013.

Figure 3. Members of a field crew setting up a station within Olympic National Park (Hex 239). Note camera (circled in red) on left of frame is pointing to tree bait (yellow circle) and baited cubby (blue circle) box on the right of the frame.

Sampling Effort

We sampled 52 out of the 157 hexes in the target area in 2013 (fig. 4). Landownership of sampled hexes varied: 44 percent were on Federal lands, 25 percent on State lands, 6 percent on Tribal lands, and 25 percent on lands with mixed ownership, including private (table 1).

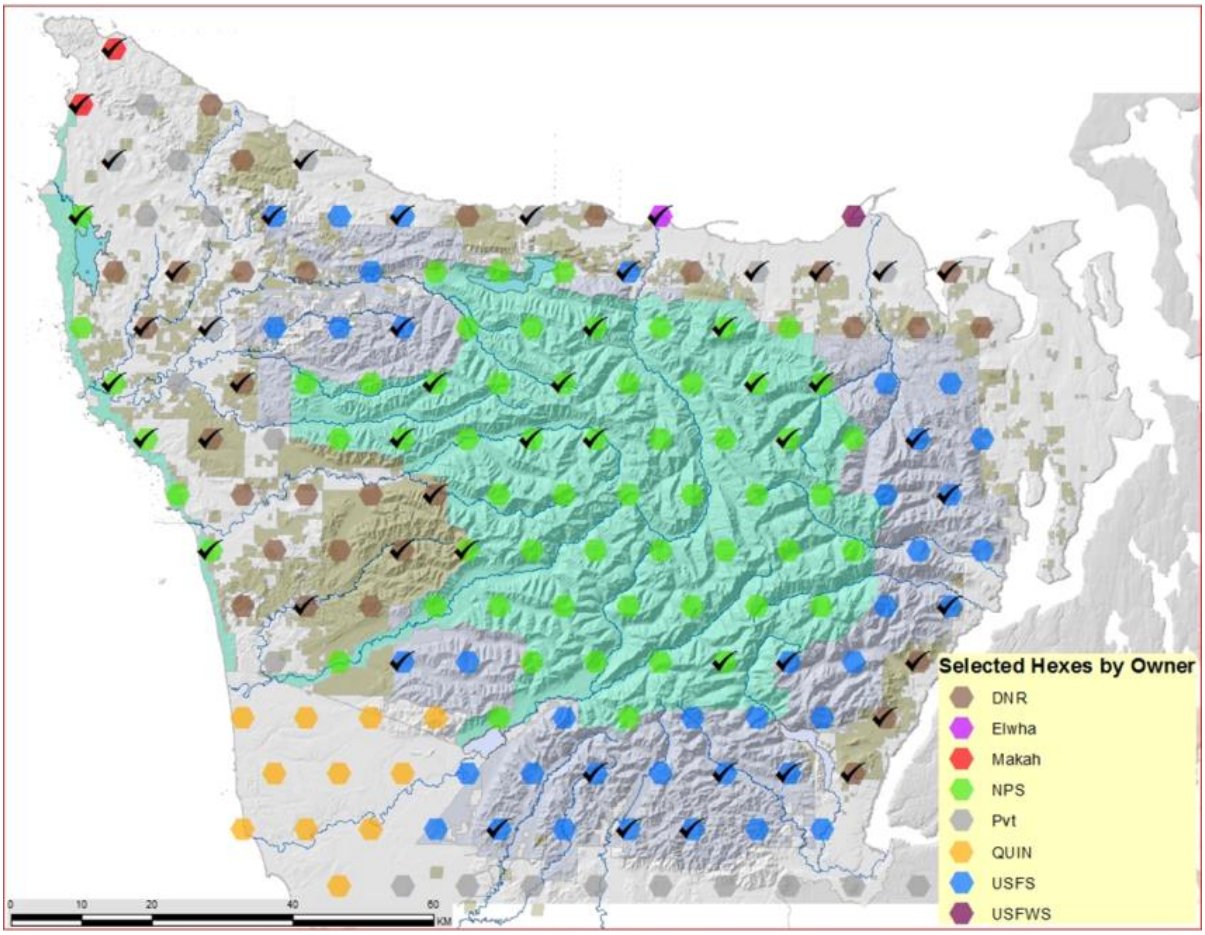

Figure 4. Location of hexes sampled in 2013 (check marks) by landowner.

Table 1. Landownership of hexes sampled in 2013.

Hex primary landownership	Number of hexes sampled
National Park Service (NPS)	10
NPS and Olympic National Forest (ONF)	2
NPS and Washington Department of Natural Resources (WDNR)	1
NPS and Private	3
ONF	11
ONF and WDNR	1
ONF and private	2
WDNR	12
WDNR and private	6
Tribal	3
State Parks	1

In 2013, one-half of the hexes sampled were sampled by project partners; the remaining hexes were sampled by NPS crews (table 2).

Table 2. Lead agencies and number of hexes they sampled, 2013.

Hex lead	Number of hexes sampled
National Park Service	26
Lower Elwha Klallam Tribe	5
Makah Tribe	3
Olympic National Forest	2
Quileute Tribe	6
Skokomish Tribe	4
Washington Department of Fish and Wildlife and Point no Point Treaty Tribes	3
Washington Department of Natural Resources	3

Our sampling protocol specified a 14-day interval between sampling visits. Thus, with 52 hexes sampled, the total sampling effort should have been 468 station/visit events (52 hexes * 3 stations/hex * 3 visits/station). In 2013, we ended up with 470 sampling events (table 3); the extra sampling events were due to some stations being sampled for a 4th time to compensate for camera malfunction, camera destruction, or early bait loss.

Table 3. Station sampling intervals (days) for the 52 hexes sampled in 2013.

[Intervals reported for visits indicate the number of days between station checks. Intervals for camera, bait, and hair snare represent the number of days each device (or bait) was functional, if known, based on date stamps on camera images]

Station Sampling Event Intervals, in days (n=470):				
	Visit	**Camera**	**Bait**	**Snare**
Mean	14.6	14.0	12.6	12.9
Max	34	34	22	24
Min	0	0	0	0
Between 13 and 16 days	87%	83%	69%	71%

We averaged 14.6 days between station visits (table 3). Although 87 percent of the sampling intervals were in our target range of 13–16 days, we did have some outliers. The minimum of 0 days was due to camera theft (two were stolen) and the station being removed from sampling. Intervals greater than or equal to 16 days were due to the Federal government shutdown or illness among the sampling crew. The government shut-down occurred in the middle of the second round of sampling in October, and we had to leave the stations unattended for 18–34 days. Although the protocol called for fieldwork to end in October, we had to extend sampling into early November to complete three full rounds of sampling.

The average sampling interval for remote cameras was 14.0 working days per station/visit; 83 percent of the cameras were functional within our target range of 13–16 days. Twenty cameras were functional for no days due to either theft (4), camera destruction by a bear (1), or malfunctioning for the entire interval. Malfunctioning cameras were either not turned on (2), batteries died (2), or unexplained malfunctions (11). The majority of the unexplained malfunctions (10) were with older cameras.

Tree baits were functional for an average of 12.6 days; only 69 percent were functional for 13–16 days. At 25 percent of the sites, bait functionality was shortened due to consumption by black bears (*Ursus americanus*), spotted skunks (*Spilogale gracilis*), ravens (*Corvus corax*), turkey vultures (*Carthartes aura*), coyotes (*Canis latrans*), or fishers before the sampling interval was complete. In some cases, where a station had repeated visits by bears or ravens, we moved the station; in some situations, however, it was not possible to move a station.

Hair snares were functional for an average of 12.9 days; only 71 percent were functional for 13–16 days (however, at 31 intervals snare functionality was unknown due to either camera malfunction or unclear pictures). At 22 percent of the sites, snare functionality was shortened due to either destruction of the cubby box by bears or consumption of the bait in cubbies by bears, spotted skunk, or fishers before the sampling interval was complete.

In the majority of hexes, cameras, tree baits, and cubbies were functional for greater than 75 percent of the sampling intervals. However, 4 hexes were functional for less than 66 percent of the time. Three of these hexes will be resampled. The fourth hex will not be resampled because it occurs in an urban area and there is insufficient habitat for establishing three secure areas in which to place cameras.

Fisher Detections

Remote Cameras

We detected fishers on cameras in seven hexes (table 4, fig. 5). Fishers with radio-collars (presumably founders released between 2008 and 2010) were observed in three hexes. In one hex, two fishers were detected, one with a collar and one without. In three hexes, fishers were detected at two stations, and in three hexes, fishers were detected on every visit. One fisher was detected five times (including detections at two stations on two visits). Three fishers, however, were detected only once—during the last visit and at only one station (indicating the value of sampling throughout the complete nine station/visit event cycle).

Table 4. Fishers detected by cameras and DNA analysis, 2013.

Hex Number	Fisher on Camera	Hair Collected	DNA Amplified	Fisher ID	Gender	Founder	Collar Visible	Number Stations[1]	Number Station/ Visits[2]	First Visit[3]
563	yes	yes	yes	OPF0301	Male	No	No	2	3	1
410	yes	yes	yes	OPF0678	Male	No	No	2	3	1
511	yes	yes	yes	OPF0728	Male	No	No	1	1	3
560	yes	yes	yes	F006	Female	Yes	Yes	1	3	1
630	yes	yes	NO	Unk	Unknown	Yes	Yes	1	*	1
455	yes	yes	yes	M035	Male	Yes	No	1	1	3
309	yes	yes	yes	M079	Male	Yes	Yes	1	1	3
309	yes	yes	NO	Unk	Unknown	Unknown	No	2	5	1
172	NO	yes	yes	OPF0005	Male	No	*n/a*	1	1	1
645	NO	yes	yes	OPF0077	Female	No	*n/a*	1	1	1

1: Number of stations a fisher was detected (maximum=3).
2: Number of station (3) and visit (3) combinations a fisher was detected (maximum=9).
3: Visit number a fisher was first detected.
*: Stations were pulled early due to crew scheduling challenges.

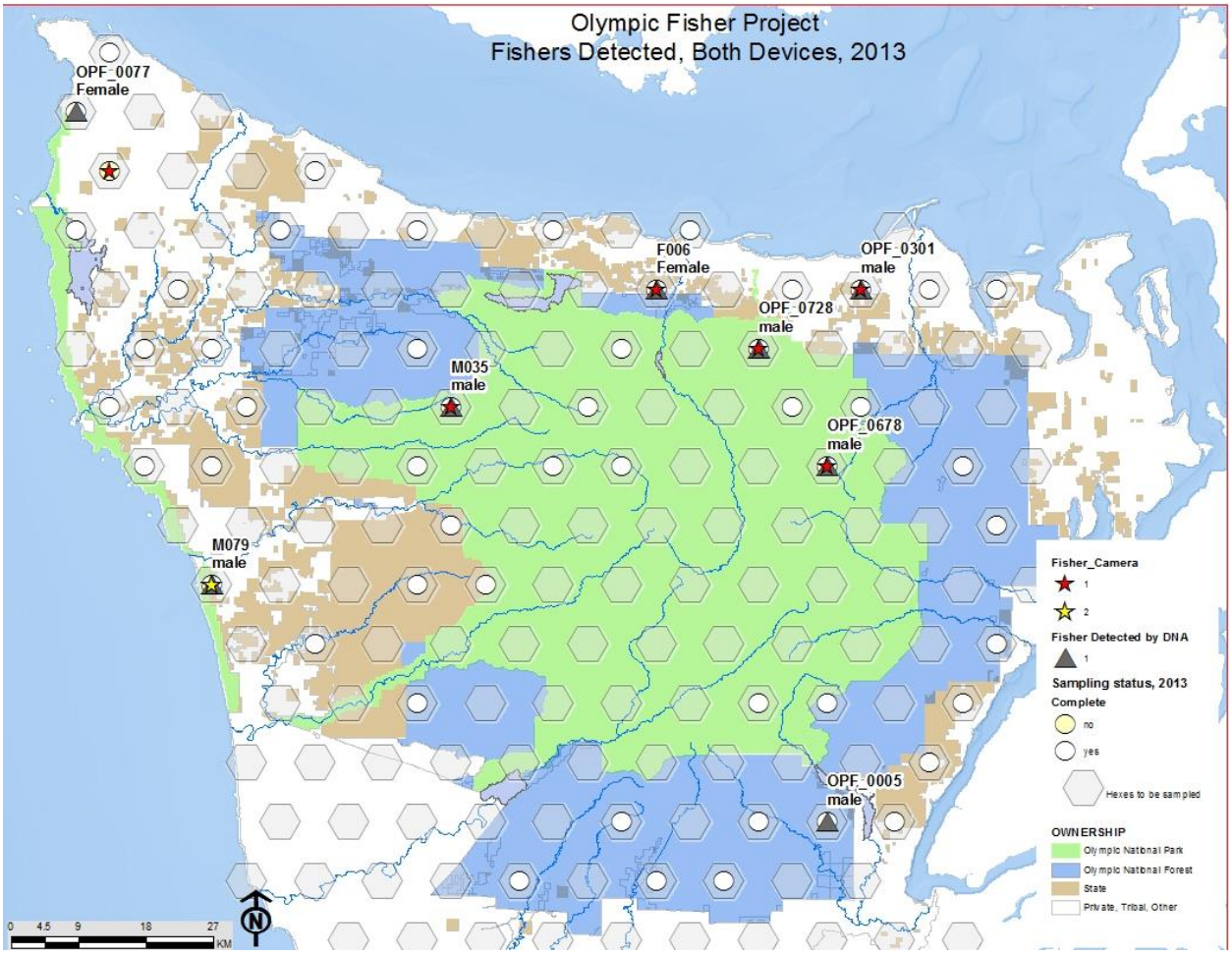

Figure 5. Location of fisher detections by either cameras (stars) or DNA from hair snares (dark gray triangles) in hexes sampled in 2013 (white dots). In one hex (yellow star), two fishers were detected with the camera. Labels by the fisher detected with DNA are the animal ID number and gender. ID numbers that start with "OPF" are recruits to the population.

DNA Analysis

Seventy-three hair samples were collected and sent to the laboratory for DNA analysis. The samples came from 27 station/visit events (1–6 samples per cubby) distributed among 12 different hexes. Ten events were from intervals in which the camera was not fully functional (six hexes) and no fisher pictures were taken; the samples were sent in for analysis in the event that a fisher was present but was undetected by the camera. Seventeen events were from stations and intervals in the seven hexes where we did detect fishers with the cameras.

We attempted to identify individual fishers using microsatellite DNA analysis. Samples that did not contain DNA for this analysis ("no amplification") were either hair from another species, or an inadequate sample from a fisher. To reduce costs, we did not analyze additional samples at some stations that produced positive results.

Eight individual fishers from eight hexes were identified through DNA analysis (fig. 5). Two fishers were detected at stations that had malfunctioning cameras for part of the sampling interval (table 4). We detected fishers in 9 of the 52 hexes sampled (17.3 percent) with either remote cameras or DNA analysis (fig. 5). DNA from two fishers captured on the cameras did not amplify: (1) a large fisher in the northwest that had a visible radio-collar, and (2) an un-collared fisher detected in the hex where two different individuals were detected on remote cameras (fig. 5, table 4). The un-collared fisher was present at five station/visit combinations but only left hair behind on three events, and all three hair samples were small.

We detected five new fishers (recruits to the population), four founders (including M035 who had shed his radio collar), and one unknown (no collar seen and its DNA did not amplify). The age for the founders detected was 5–7 years old (appendix A). All new recruits detected had paternal DNA from males released in 2010 and females released in either 2008 or 2010 (table 5). None of the recruits were born prior to 2011 (appendix B).

Table 5. Maternal and paternal assignments for new recruits detected through DNA analysis, 2013.

Individual	Gender	Maternal			Paternal			Distance to maternal home range	Earliest possible birth year
		Match	Release Year	Release age	Match	Release year	Release age		
OPF0301	Male	F072	2010	2	M061	2010	0	Unknown	2011
OPF0728	Male	F007	2008	2	M075	2010	0	5 km	2012
OPF0005	Male	F006	2008	1	M058	2010	1	70 km	2011
OPF0077	Female	F080	2010	4	M077	2010	0	Unknown	2011
OPF0678	Male	F057	2010	0	M082	2010	0	77 km	2011

Fishers were detected on multiple landownerships (table 6). Most were detected in hexes comprised of mixed landownerships.

Table 6. Landownerships where fishers were detected in 2013.

Hex primary landownership	Number hexes sampled	Number fishers detected
National Park Service (NPS)	10	2
NPS & Olympic National Forest (ONF)	2	1
NPS &Washington Department of Natural Resources (WDNR)	1	
NPS & Private	3	2
ONF	11	1
ONF &WDNR	1	1
ONF & private	2	
WDNR	12	1
WDNR & private	6	1
Tribal	3	1
State Parks	1	

Other Species Detected

We collected more than 37,000 digital photographs of 40 wildlife species. Black bears were the most frequently detected species, and the most frequently detected carnivore; they were detected in 38 (73 percent) hexes and in 95 (20 percent) station/visit events (table 7). Coyotes and spotted skunks were the next most frequently detected carnivores; both were detected at 21 hexes, but spotted skunks were detected at more station/visit events. We also obtained detections of potential fisher prey with remote cameras; Douglas squirrels (*Tamiasciurus douglasii*) and snowshoe hares (*Lepus americanus*) were detected most frequently.

Table 7. Number of times a species or species group was detected with remote cameras in 2013, by station/visit events and by hex. n=52 hexes and 470 station/visits

Station/ visits	Hexes	Species		Station/ visits	Hexes	Species
Carnivores				**Ungulates**		
95	38	Black Bear (*Ursus americanus*)		83	35	Black-tailed Deer (*Odocoileus hemionus columbianus*)
43	21	Coyote (*Canis latrans*)		17	8	Elk (*Cervus elaphus*)
82	21	Spotted Skunk (*Spilogale gracilis*)		**Rodents and Lagomorphs**		
26	19	Bobcat (*Lynx rufus*)		85	31	Douglas Squirrel (*Tamiasciurus douglasii*)
9	8	Cougar (*Puma concolor*)		34	20	Snowshoe Hare (*Lepus americanus*)
14	8	Raccoon (*Procyon lotor*)		31	17	Mouse[7]
11	7	Domestic Dog		23	15	Flying Squirrel (*Glaucomys sabrinus*)
18	7	**Fisher *(Pekania pennanti)***		17	12	Chipmunk (*Tamias* sp.)
9	8	Weasel[1] (*Mustela* spp.)		6	5	Mountain Beaver (*Aplodontia rufa*)
2	1	Domestic Cat		2	2	Bush-tailed Woodrat (*Neotoma cinerea*)
Birds				**Miscellaneous**		
79	29	Passerine[2]		11	9	Human
31	18	Jays or Crows[3]		**Unidentifiable:**		
25	10	Raven (*Corvus corax*)		37	20	Small mammal
13	6	Turkey vulture (*Cathartes aura*)		4	4	Medium mammal
6	4	Grouse[4]		3	3	Large mammal
3	3	Woodpecker[5]		4	4	Animal
3	2	Owl[6]				
1	1	Hawk				

1: Short-tailed weasel (*Mustela eminea*), Long-tailed weasel (*Mustela frenata*), or unidentifiable weasel (*Mustela* sp.).
2: Black-headed Grosbeak (*Pheucticus melanocephalus*), Chestnut-backed Chickadee (*Poecile rufescens*), hummingbird, Dark-eyed Junco (*Junco hyemalis*), Hermit Thrush (*Catharus guttatus*), Varied Thrush (*Ixoreus naevius*), American Robin (*Turdus migratorius*), or unidentifiable bird.
3: Crow (*Corvus* sp.), Gray Jay (*Perisoreus canadensis*), or Steller's Jay (*Cyanocitta stelleri*).
4: Sooty Grouse (*Dendragapus fuliginosus*),Rruffed Grouse (*Bonasa umbellus*), or unidentifiable grouse.
5: Hairy Woodpecker (*Picoides villosus*) or Northern Flicker (*Colaptes auratus*).
6: Western Screech Owl (*Megascops kennicottii*) or Barred Owl (*Strix varia*).
7. Principally *Peromyscus* sp, or *Zapus* sp.

Other Fisher Detections

In addition to fishers detected in the Olympic Recovery Area during this study, eight other fisher detections were obtained in 2013 (table 7, fig. 6). Two fishers were detected on non-project cameras (NB-2 and ONF-1), four fisher carcasses were collected along roadsides (F102, F103, F104, M023), and two fishers were live trapped by licensed trappers and later released (F105, F106). It is notable that three of the fisher detections (F104, F105, F106) were outside of the target area (fig. 6).

Table 8. Other fishers detected on the Olympic Peninsula, 2013.

Fisher number	Date collected	How detected	DNA amplified	Fisher ID	Gender	Founder	Collar visible	Cause of death
F102	3/31/2013	Carcass	Yes	F102	Female	No	No	Trauma and anticoagulant toxicosis
F103	5/21/2013	Carcass	Yes	F103	Female	No	No	Suspect trauma and parasitic enteritis
F104	12/10/2013	Carcass	Yes	Unknown	Female	Unknown	No	Malnutrition
M023	12/14/2013	Carcass	Not collected	M023	Male	Yes	Yes	Trauma
F105	12/15/2013	Live Trap	Not collected	Unknown	Unknown	Unknown	No	n/a
F106	12/17/2013	Live Trap	Not collected	Unknown	Unknown	Unknown	No	n/a
ONF-1	3/18/2013	Camera	Not collected	Unknown	Unknown	Unknown	No	n/a
NB-2	8/30/2013	Camera	Not collected	Unknown	Unknown	Unknown	No	n/a

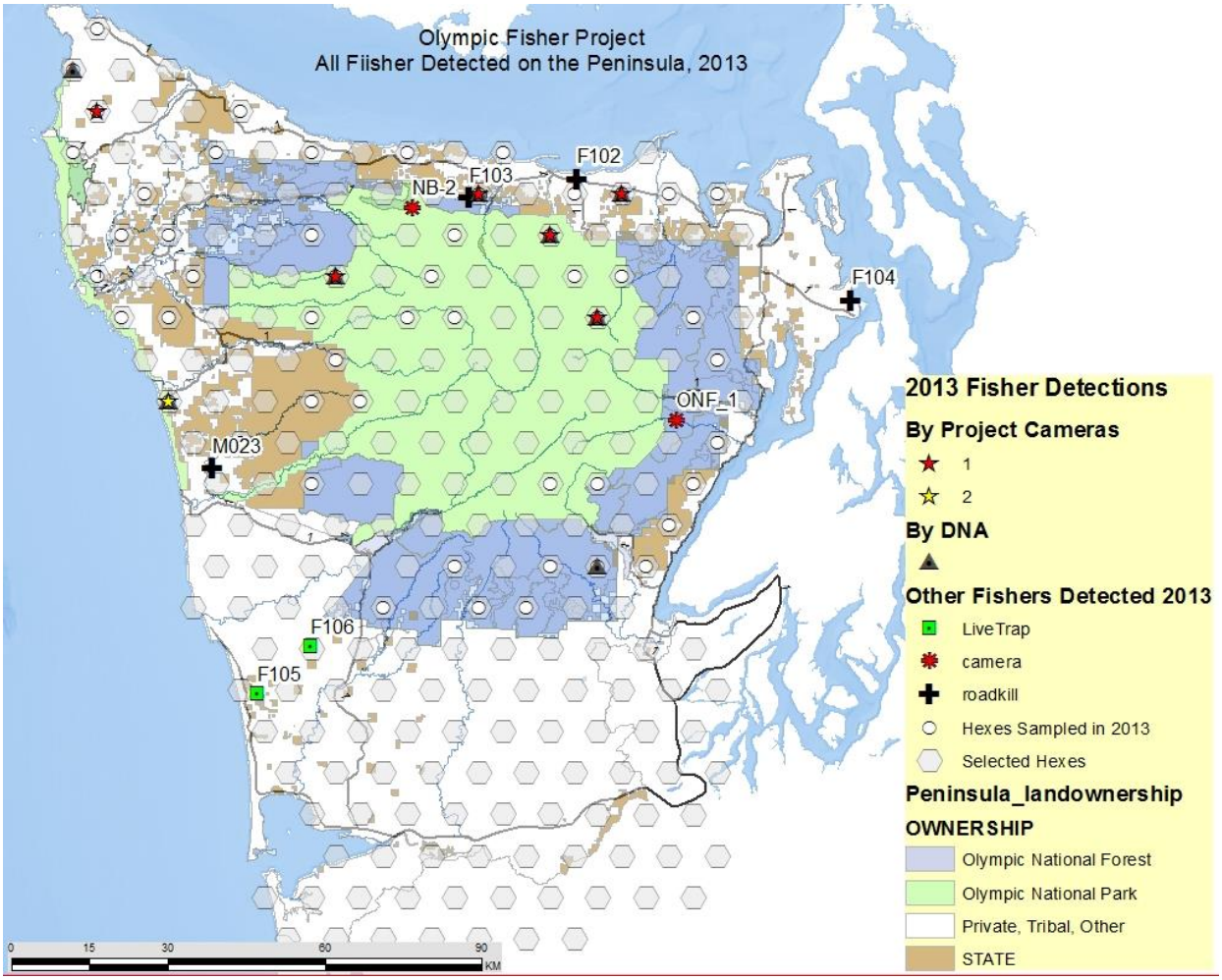

Figure 6. Location of all fisher detections on the Olympic Peninsula, 2013, including fishers not detected in the project.

The identity and gender of fishers that were either detected on non-project cameras or trapped are unknown; DNA samples were not collected, however, no radio-collars were visible on any of these animals. Three of the four fishers that were recovered on roadsides had tissue submitted for DNA analysis; M023 was identified by his microchip. Results are still pending on the DNA analysis for F104, but F102 and F103 were female fishers new to the population, and were the offspring of F004 and M009 (appendix A). M023 was a male released in 2009 at 0 months of age and was 5 ½ years old at death. Teeth from F102, F103, and F104 have been be submitted for age determination, and the results are anticipated in 2014.

All recovered carcass were submitted to the National Park Service Biological Resources Management Division for necropsy. F102 was recovered along U.S. Highway 101 adjacent to a residential area and her mother's home range. She was a young female in very good condition and no signs of current or past pregnancy. She had severe head trauma, presumably from a vehicle strike, but also had anticoagulant exposure. F103 was recovered along U.S. Highway 101 adjacent to managed forestlands and 21 km from her mother's home range. She was an adult female, in fair-good condition, actively lactating, had 4 placental scars and signs of significant trauma. F104 was recovered in a ditch along a rural residential road. She was in very poor condition and had no sign of past pregnancies or trauma; the final determination was death from malnutrition. M023 was observed being struck by a vehicle on a paved logging road. He was in very good body condition and the final determination was death from severe trauma. See appendix C for details of the necropsies.

Plans for 2014

2014 will be year 2 of what is now a 4-year study. We anticipate receiving full funding in 2014 from the NPS. This support, in addition to the funding already in place from the USFS and the USFWS Recovery Program initiated in 2013, will allow us to fully implement our monitoring protocol in 2014. With these funds, we will hire a crew lead and 4–6 crew members who will sample 45 to 50 hexes on ONP and ONF and lend support to partners on non-federal lands.

We anticipate having all project partners participate again in 2014, and will seek to add new partners and expand our sampling beyond the target area boundary in response to the three fishers recovered outside of the target area in 2013.

We will start the interpretive component of the study in 2014, with the development of a fisher project webpage on the NPS website and classroom curricula.

Lastly, we will begin developing models of detection probability and occupancy patterns of fishers in the Olympic Recovery Area. Final occupancy estimates will not be available until sampling in all target hexes has been completed, but preliminary estimates will be calculated from the partial data set.

Publications and Public Outreach Activities (2013)

Jenkins, K., and Happe, P. 2013, Sampling design and field protocols for non-invasive fisher surveys on the Olympic Peninsula, Washington: U.S. Geological Survey Administrative Report to Olympic National Park (on file at USGS and Olympic National Park, Port Angeles, Washington), 41p.

Funding

This project received $30,000 in funding from NPS-NRPP, $20,000 from Olympic National Forest, and $11,610 from NPS base. In addition, the USFS-ONF and USGS-Forest and Rangeland Ecosystem Science Center purchased 7 and 48 cameras, respectively, for this study. Finally, a grant of $77,265 from USFWS Recovery Program to USGS supported the DNA analysis, and will continue to support DNA analyses, equipment needs, and field crew costs in FY2014.

Acknowledgments

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This project would not have started, nor been as successful in 2013, without the help of many people. We were scheduled to begin in May 2013 with $129,932 in funding from NPS-NRPP. However the funding was delayed and eventually cancelled due to the Federal Sequester budget cuts. Only through the hard work of Jay Goldsmith (NPS) and the kindness of staff from Hawaii Volcanos National Park, who deferred some of their funding until 2014, was the project able to start in 2013. With reduced federal funding, very little would have been accomplished without the generous donation of staff time and resources from the many project partners; one-half of the sampling in 2013 and one-half of the fisher detections were from project partners. We want to thank (in no particular order) S. Murphie, R. McCoy, and J. Johnson from the Makah Tribe; B. Tropp, S. Miller, and R. Lumper from the Skokomish Tribe; A. McMillan, and S. Ament from WDFW; T. Cullinan from Point no Point Treaty Tribes; S. Horton from WDNR; B. Howell, and D. Kelso from ONF; Z. Radmer from USFWS; G. Rasmussen and N. Jacobson from the Quillieute Tribe; K. Sager-Fradkin, D. Manson, R. Paradis, K. Kaufman, K. Turrey, and G. Younger from the Lower Elwha S'Klallam Tribe; T. Kay, E. Gordon, A. Hokit, J.D. Herndon, J. Hower, J. Busiek, D. Victor, S. Gremel, K. Jenkins, and S. Scranton from the NPS crew and volunteers. We would like to thank Jody Tucker, USFS Rocky Mountain Research Station (RMRS), for consulting on several aspects of this study and Kristy Pilgrim, also from USFS RMRS, for supervising the genetic analyses of fisher hairs at the Carnivore Genetics Lab. We would also like to thank the staff at NPS Diagnostics, and John Bryan in particular for performing necropsies on recovered fishers. Lastly, we would also like to thank the communications and ranger staffs at Olympic National Park for providing so many necessary logistical and safety supports of our field operations.

References Cited

Hayes, G.E., and Lewis, J.C., 2006, Washington state recovery plan for the fisher: Washington Department of Fish and Wildlife, Olympia, Washington, 69 p., *http://wdfw.wa.gov/wlm/diversty/soc/fisher/reintro.htm*.

Jenkins, K.J., and Happe, P.J., 2013, Sampling design and field protocols for non-invasive fisher surveys on the Olympic Peninsula, Washington (Version 2013—1.0): Administrative Report to Olympic National Park, May 2013, 41 p.

Lewis, J.C., 2006, Implementation plan for reintroducing fishers to Olympic National Park: Washington Department of Fish and Wildlife, Olympia, Washington, *http://wdfw.wa.gov/wlm/diversty/soc/fisher/reintro.htm*.

Lewis, J.C., Happe, P.J., Jenkins, K.J., and Manson, D.M., 2011, Olympic fisher reintroduction project—2010 progress report: Washington Department of Fish and Wildlife, Olympia, Washington, 24 p.

National Park Service, 2007, Olympic National Park fisher reintroduction plan/environmental assessment: Olympic National Park, Port Angeles, Washington, *http://wdfw.wa.gov/wlm/diversty/soc/fisher/reintro.htm*.

Sato, J.J., Wolsan, M., Prevosti, F.J., D'Elía, G., Begg, C., Begg, K., Hosoda, T., Campbell, K.L., and Suzuki, H., 2012, Evolutionary and biogeographic history of weasel-like carnivorans (Musteloidea): Molecular Phylogenetics and Evolution, v. 63, no. 3, p. 745–757.

U.S. Environmental Protection Agency, 2011, Aquatic resources monitoring—Specific design information—Illustrative examples: Website, accessed March 19, 2014, at *http://www.epa.gov/nheerl/arm/designing/design_intro.htm*.

U.S. Fish and Wildlife Service, 2004, 12-month finding for a petition to list the west coast distinct population segment of the fisher (*Martes pennanti*): Federal Register, v. 69, no. 68, p. 18770–18792.

U.S. Fish and Wildlife Service, 2013, Status review of the West Coast distinct population segment of the fisher as endangered or threatened: Federal Register, v. 78, no. 53, p. 16828–16829.

Appendix A. Founders Detected in 2013

Animal ID	How Detected	Where	Release date	Age at Release	Age in 2013	Gender
F006	Camera and DNA	Hex 560, Station 1	Jan 27, 2008	1	7	Female
M023	Carcass		Dec 21, 2008	0	5	Male
M035	Camera and DNA	Hex 455, Station 3	Dec 21, 2008	0	5	Male
M079	Camera and DNA	Hex 309, Station 1	Jan 21, 2010	3	6	Male

F006 was captured in British Columbia on January 6, 2008 and released on January 27, 2008 in the Elwha Valley at Altair campground. She was the first animal released at the first public release event of the project. F006 was 1 year old at the time of her release. She was one of the animals that we followed the longest: she was radio-tracked for 2½ years. Shortly after release F006 left the Elwha Valley and was located in several drainages in the northeastern portion of the Olympic Peninsula (fig. A1). She settled down in the upper Dosewallips drainage in the summer of 2008 and remained there until March 2009. After 2 months of wandering around in the southeastern Olympics, she moved back to the lower Elwha near her release area. She stayed in the lower Elwha from June 2009 through June 2010. Her last location was on June 14, 2014, and after that we lost contact due to what was presumed to be dead batteries (they were at the end of their expected life). Due to the distances she traveled during the denning seasons of 2008 and 2009, we do not suspect that F006 denned in either of those years. We were unable to confirm her denning status in 2010.

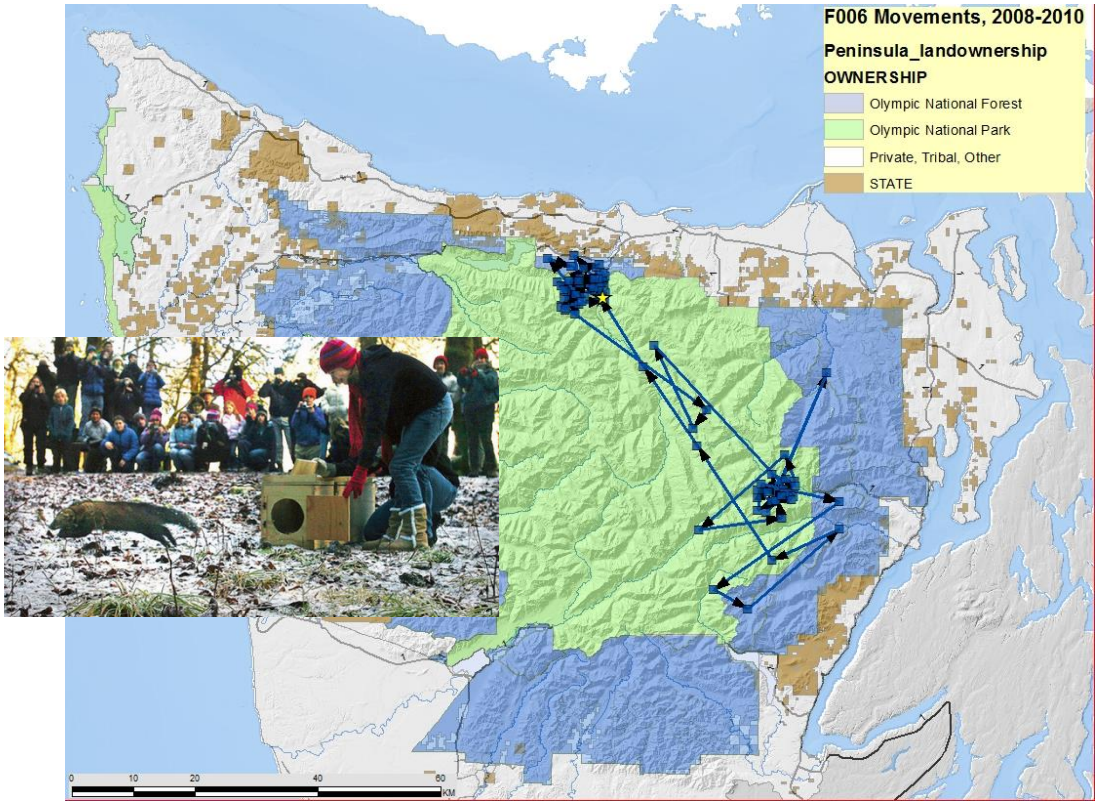

Figure A1. Release site (yellow star), movement, and release picture of F006.

In 2013, F006 was detected only at one station (Station 1) in hex 560.The station location is within the range of her radio locations in 2009 and 2010 (fig. A2).

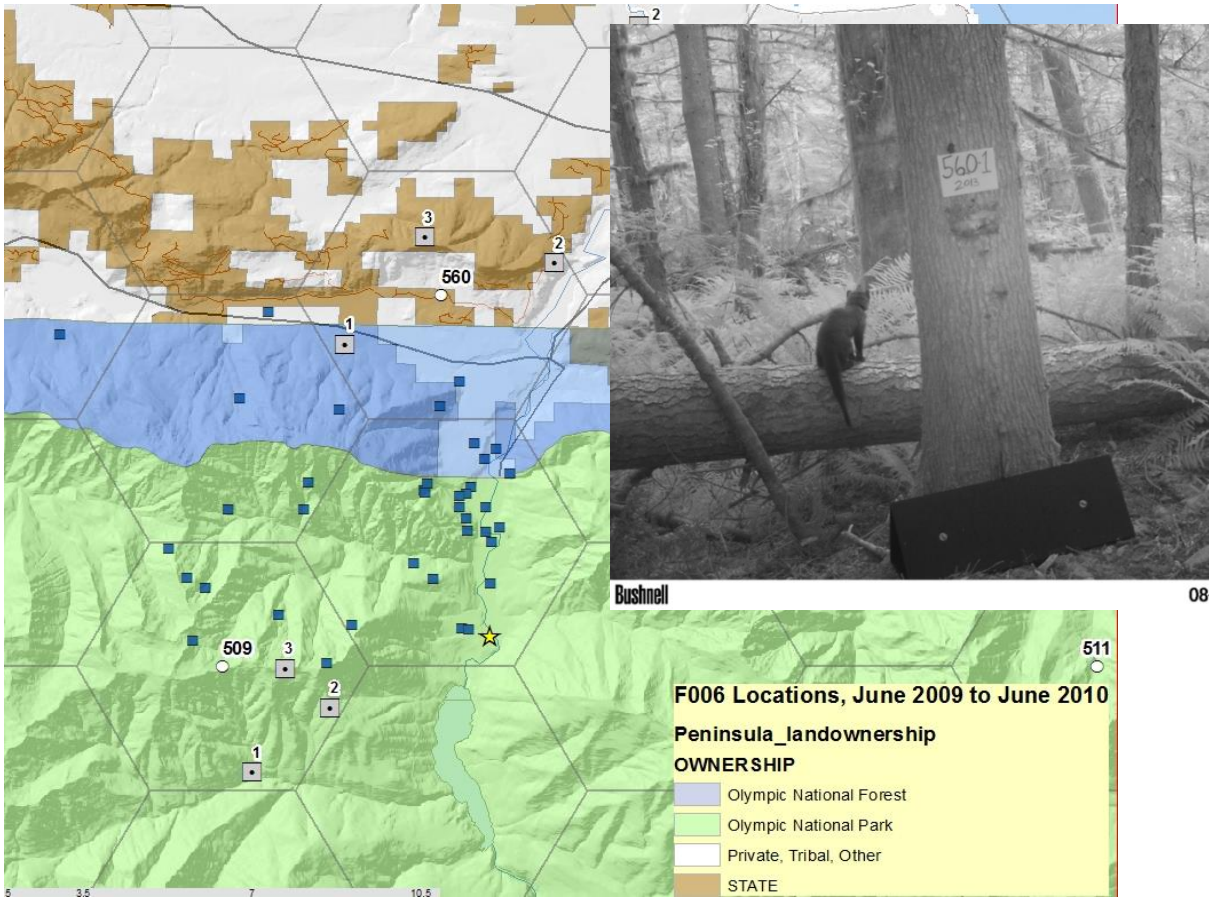

Figure A2. Locations of F006 from June 2009 through June 2010, location of Hex and Station where she was detected in 2013 (hex 560, Station 1), and one of the images captured at that station.

M023 was captured in British Columbia on November 29, 2008, and released on December 21, 2008, in the Sol Duc Valley near the North Fork Trailhead. He was 8 months old at the time of his release, and was radio-tracked for almost 2 years. Soon after his release M023 settled down in the Sol Duc, but then moved around during April, and eventually settled down in the western Olympics in between the Bogachiel and Hoh Rivers (fig. A3). His last location was in this area on October 4, 2010, after which we lost contact due to what was presumed to be dead batteries. He was recovered as a road-kill on December 14, 2013, in the lower Clearwater Valley.

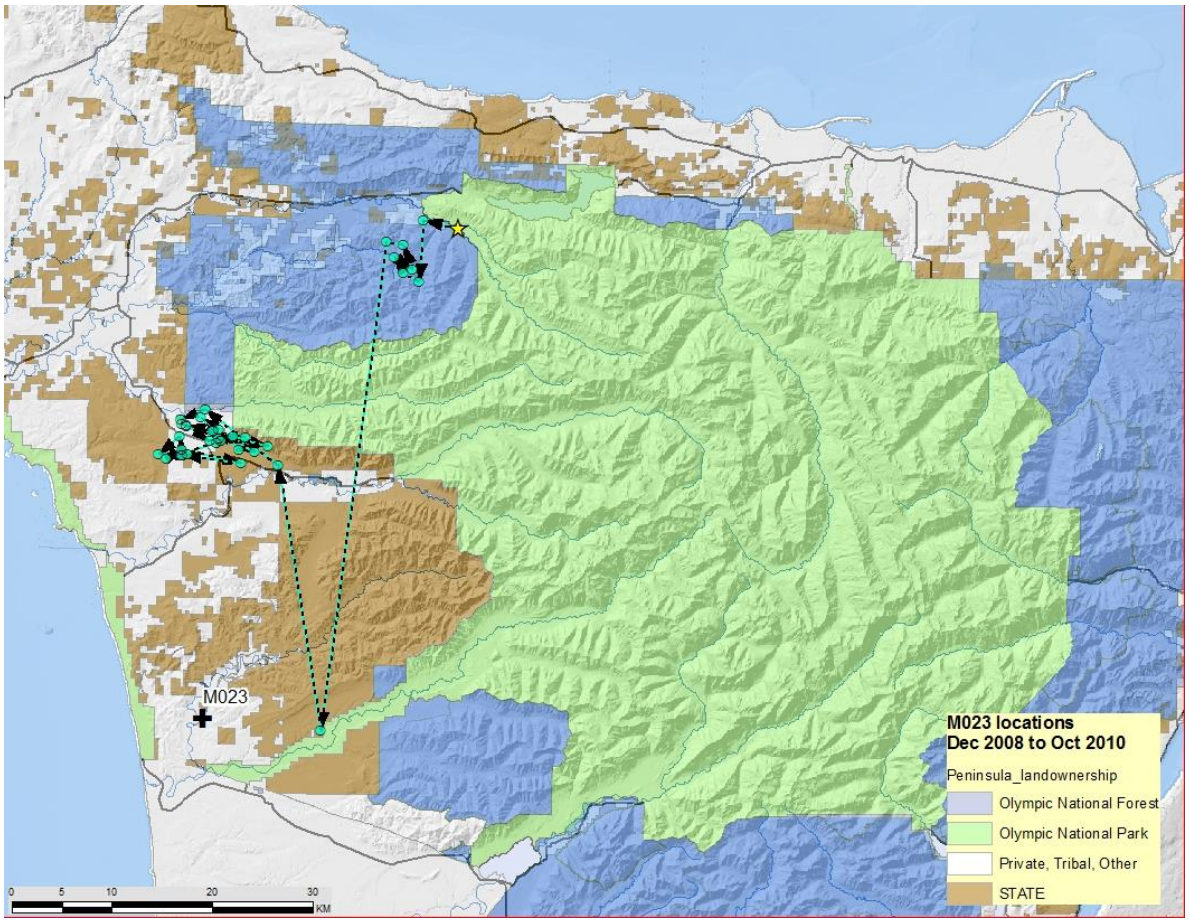

Figure A3. Release location (yellow star) and movements of M023 from his release in 2008 through October 2010. The black cross indicates where his carcass was recovered.

M035 was captured in British Columbia on December 18, 2008, and released on December 21, 2008, in the Sol Duc Valley at the Aurora trailhead. He was 8 months old at the time of release. He did not move extensively following his release, and set up a home range in the Sol Duc area. We obtained 40 locations on him until we received a mortality signal on April 12, 2010. Upon investigation, all that was found was a shed collar; it was presumed at the time that he had not died, and this study now confirms that assumption. He was detected in this study at age 5, in close proximity to where he was frequently located in 2009–2010, in hex 455. He was detected only once, on the third visit and at Station 3.

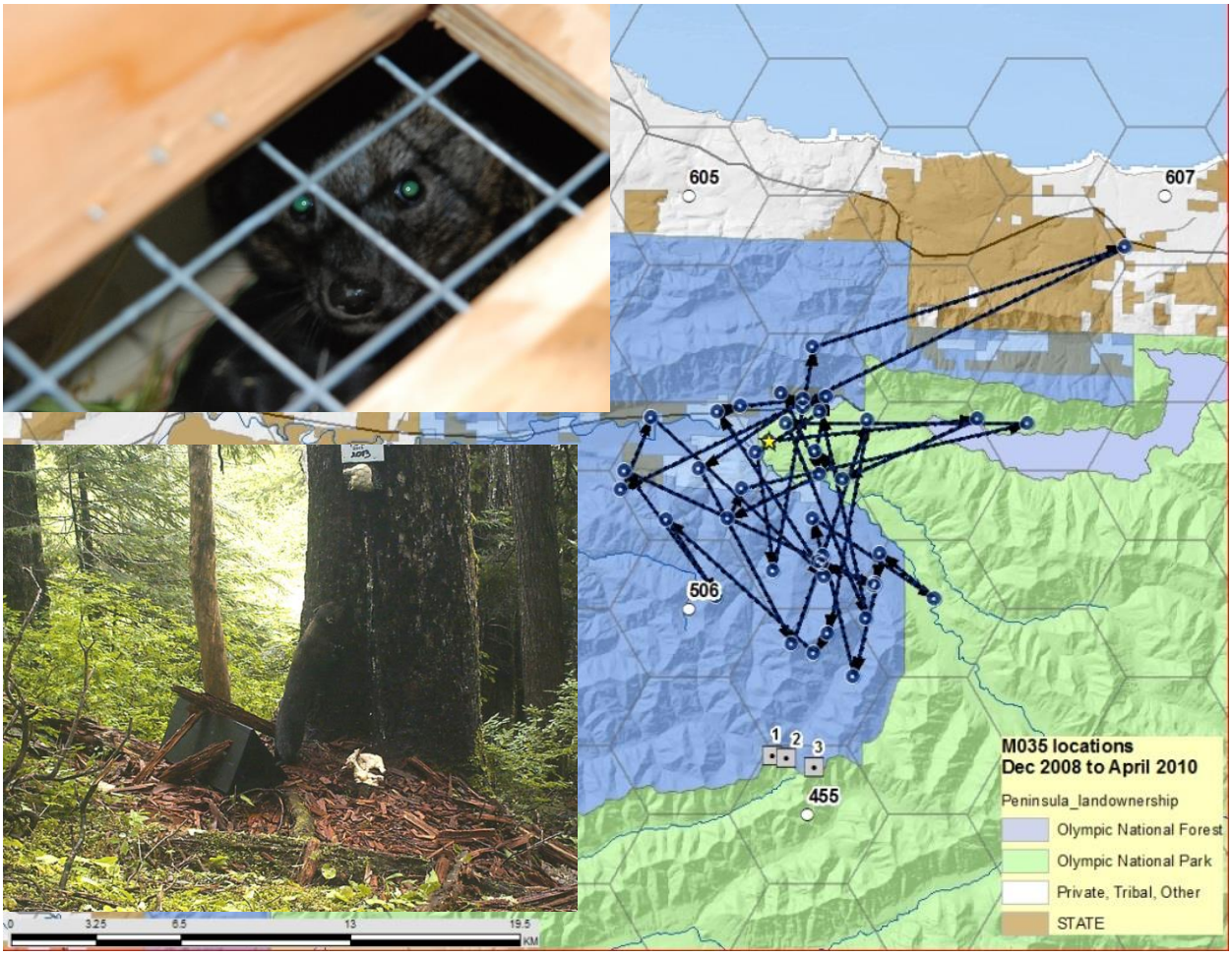

Figure A4. Release location (yellow star) and movements of M035 from December 2008 until his collar was shed in April 2010. Also shown is M035 in his transport box just prior to release, and the image M035 captured in 2013 on station 3 in hex 455.

M079 was captured in British Columbia on January 2, 2010, and released on January 21, 2010, in the Quinault Valley at Graves Creek. He was 3 years old at the time of release. He was equipped with an Argos collar that failed after only 3 months, so we had no idea where he moved, whether he established a home range, or what his fate was. He was detected in this study only once, on the third visit and only at one station.

Figure A5. Image of M079 captured in 2013 at Station 1 in Hex 309.

Appendix B. Parentage of Recruits Identified by DNA in 2013

1) OPF0301 Male		
Parental identification	Maternal: F072	Paternal: M061
Release year	2010	2010
Capture site separation	106 km	
Release age	2	0
Release site	Elwha	Deer Park
Last heard	12/10/2010	04/19/2011
Fate	Unknown	Presumed dead
Home range determined	No	Yes
Home range area		Upper Dosewallips

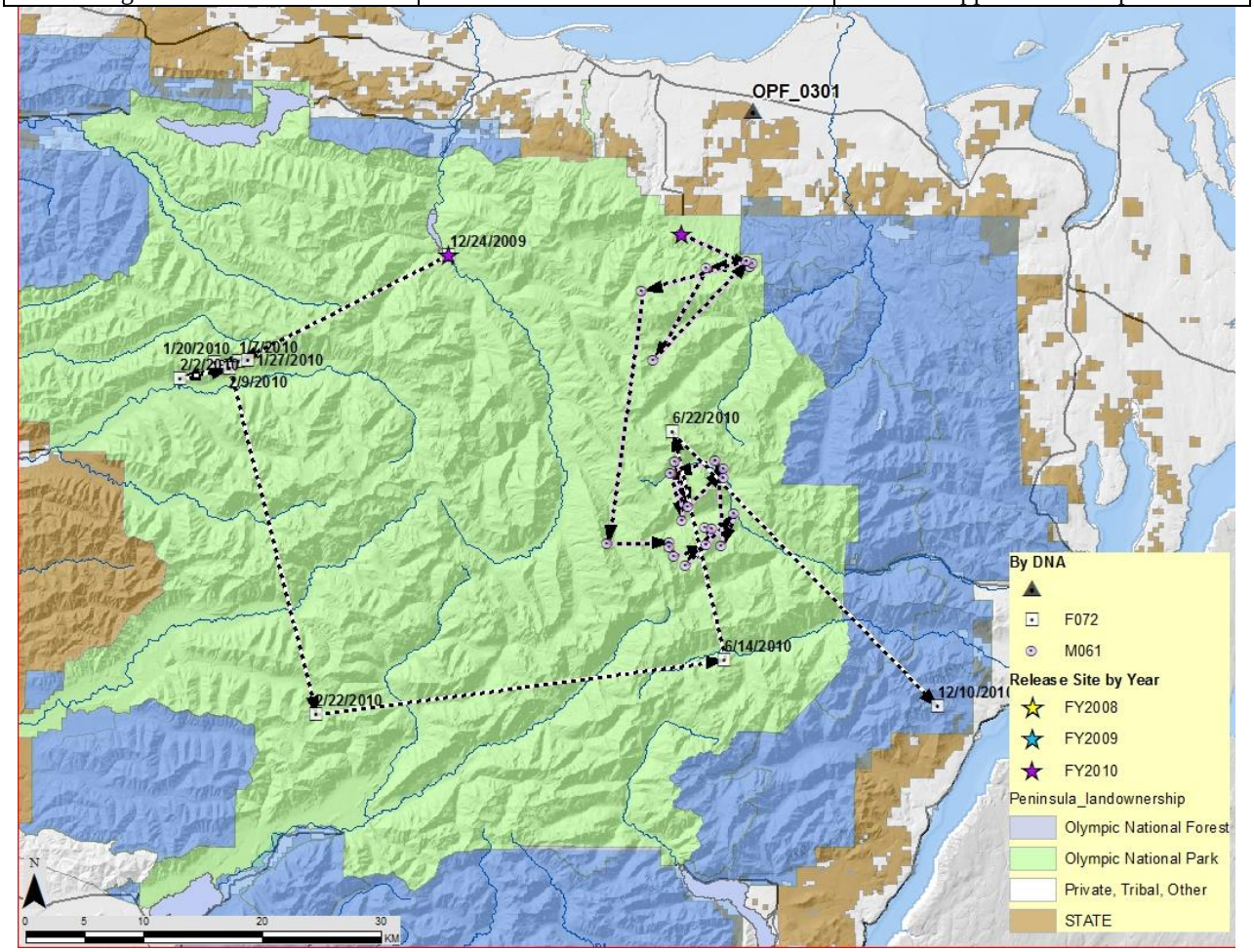

Figure B1. Release sites and movements of F072 and M061, December 2010 until contact was lost. Also shown is the hex center where OPF_0301 was detected (black triangle).

F072 was released in 2010 at age 2 in the Elwha Valley (fig. B1). M061 was also released in 2010, but at Deer Park and at age 0 (fig. B1). So, although F072 may have been pregnant at the time of her release, M061 was not the father, because he was not born when she would have been bred in British Columbia. In addition, their capture sites in British Columbia were 106 km apart.

We had a hard time locating F072 following her release in 2010. Following release, she moved west to the Hoh Valley and then South more than 30 km to the Skyline Ridge area in February 2010 (fig. B1). She was missing until June 2010 when she was found east in the Duckabush Valley and then later north in the upper Greywolf. Given these movement patterns, it is unlikely that she successfully denned in 2010. She was missing again until December 2010 when she was found outside the park south of the Duckabush River. Despite intensive searches, that was her last location.

M061 was released in Deer Park, traveled in the northeastern portion of the park, and settled in the upper Dosewallips Valley in April 2010 (fig. B1). We received a mortality signal on an aerial flight on April 19, 2011, but were not able to retrieve a carcass; he either died or shed his radio-collar.

It is possible, but unlikely that these two bred in 2010, given their movement patterns. It is more likely that they bred in 2011 or later; M061 could have lived past April 2011 but with a shed collar, as we had several males lose their collars around the time of breeding season. In any event, the genetic results indicate that F072 lived past 2010.

2) OPF0728 Male		
Parental identification	Maternal: F007	Paternal: M075
Release year	2008	2010
Capture site separation	24 km	
Release age	2	0
Release site	Elwha	Graves Creek
Last heard	04/19/2010	01/11/2011
Fate	Shed Collar	unknown
Home range determined	Yes	No
Home range area	NE: Maiden Creek	South: Wynoochee

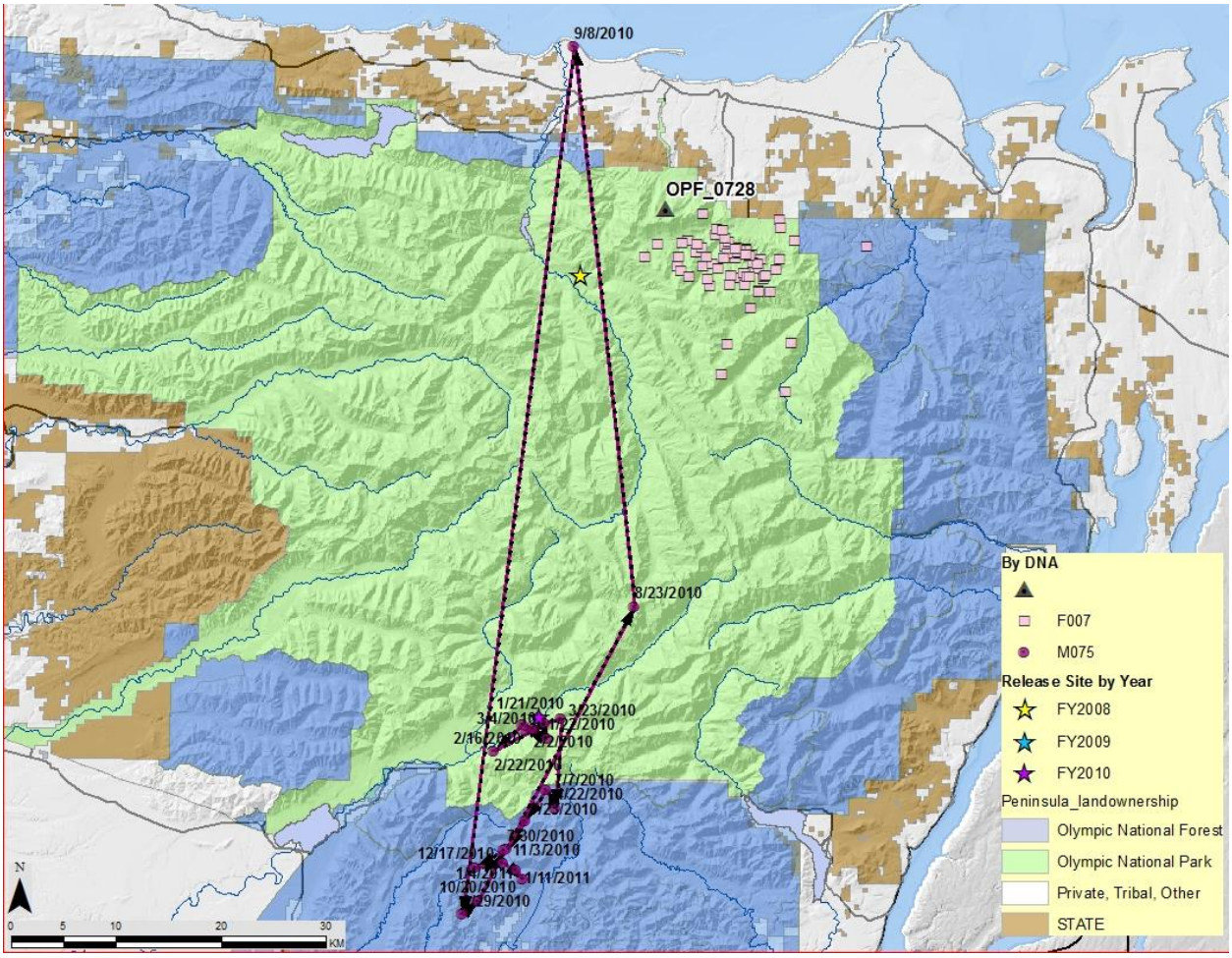

Figure B2. Release sites and locations for F007 (2008–2010) and M075 (2010–2011), and the detection location of OPF_0728 (2013; black triangle). Locations for F007 are from June 2008 through April 2010. All locations and movement patterns for M075 are shown, with the date of the location indicated by each point.

F007 was released in 2008 at age 2 in the lower Elwha Valley (fig. B2). We monitored her for 2.25 years and have extensive data on her movement patterns. She quickly established a home range just 10 km northeast of her release site in the Morse and Maiden Creek drainages. We were unable to confirm denning in 2008, and due to the timing of the occasional forays outside of her home range, we suspect that she did not den that year. However, we confirmed that F007 denned in 2009, when she was captured on camera while moving four kits from the den tree. We received a mortality signal from F007 on April 19, 2010, and upon investigation (on 6/18/2010) found a shed collar inside what we strongly suspect was a den tree due to the copious amount of scat found at the site.

M075 was released in 2010 at Graves Creek in the Quinault drainage (fig. B2). He moved south after the release and appeared to be settling in the Wynoochee drainage. However, we aerially located him north of that area in the upper Quinault Valley on August 23, 2010, followed by a location further north outside Port Angeles on September 8, 2010. We later found M075 back in the Wynoochee area on September 29, 2010. His last location was on January 11, 2011, in the Wynoochee area, after which we lost contact with him.

We detected OPF_0728 on camera adjacent to F007's home range. Given M075's release date (2010) and movement patterns, it is unlikely that F007 and M075 bred prior to the 2011 breeding season. It is possible that M075 shifted his home range north in 2011 and we were not able to pick that up due to a failed radio-collar; we observed other fishers shifting home ranges between year 1 and year 2 after release. (Like other males that shifted their home ranges, there were no known female fishers in the Wynoochee area in 2010 or 2011). It is likely that OPF_0728 comes from at least the 3rd litter that F007 had, and that he was born in 2012 or 2013.

3) OPF0005 Male		
Parental identification	Maternal: F006	Paternal: M058
Release year	2008	2010
Capture site separation	21 km	
Release age	1	1
Release site	Elwha (Altair)	Sol Duc
Last heard	06/14/2010; 2013	02/01/2011
Fate	Alive as of 2013	Unknown
Home range determined	Yes	No
Home range area	Lower Elwha (Hughes Crk)	Striped Peak

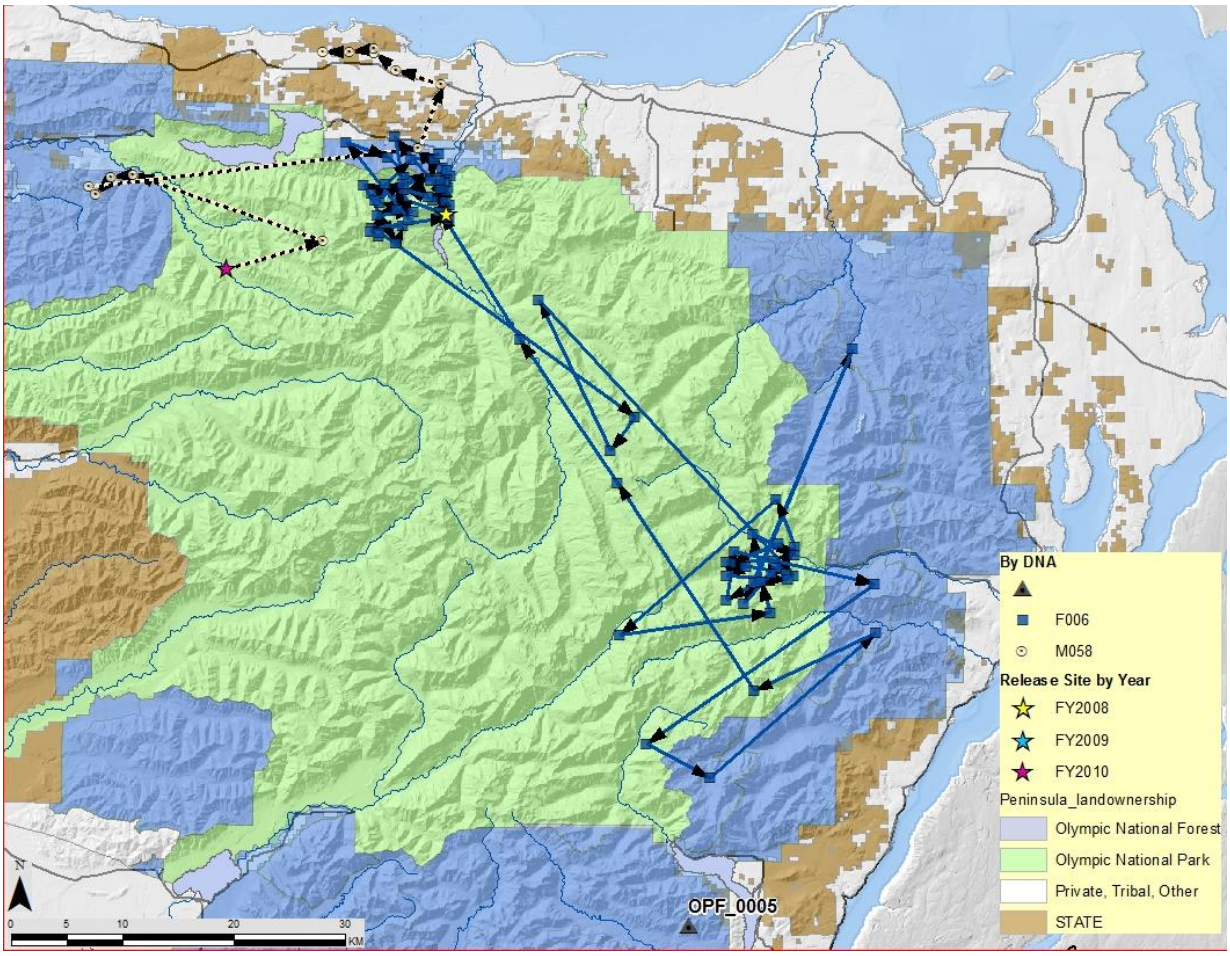

Figure B3. Release locations and movements of F006 (2008–2010) and M058 (2010–2011), and location of detection of OPF_0005 (2013, black triangle).

F006 was released in the lower Elwha in 2008 at age 1. We were able to monitor her movements for 2.25 years. Details of her movement patterns are in appendix A. She was detected by a camera and hair snare in her previously documented home range in the summer of 2013, so it is likely that she has remained in this area from 2009 to 2013.

M058 was released in 2010 at age 1 on the northern side of the park in the Sol Duc Valley (fig. B3). His radio collar did not have a strong signal, and consequently he was hard to track. We did record him moving generally north following his release, and he was occasionally found in the Striped Peak area north of the park. His last location was in that area on February 1, 2011.

Because M058 was released near F006's home range in 2010, had a telemetry location in her home range in late February 2010, was detected via hair snares in April 2010 (see report dated 10/9/2012) near F006, and was 2 years old during the 2010 breeding season, it is possible that they bred as early as 2010, and OPF0005 was born as long ago as 2011. Fisher OPF_0005 was detected more than 70 km from F006's home range.

4) OPF0077 Female		
Parental identification	Maternal: F080	Paternal: M077
Release year	2010	2010
Capture site separation	105 km	
Release age	4	0 (estimated)
Release site	Graves Creek (Quinault)	Graves Creek (Quinault)
Last heard	11/19/2010	08/04/2011
Fate	Presumed dead	Unknown
Home range determined	Yes	Yes
Home range area	Upper Cameron	East of Aberdeen

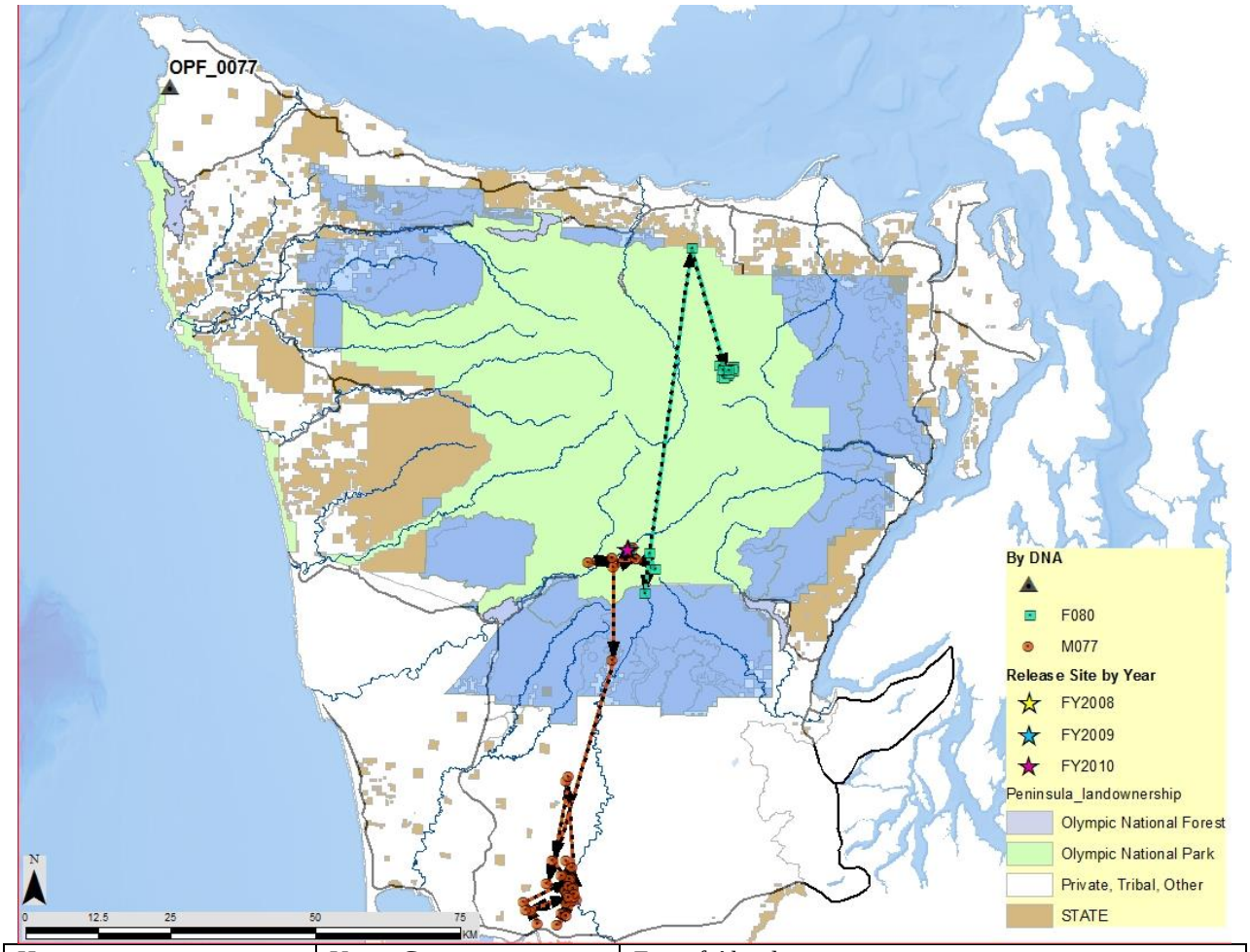

Figure B4. Release sites, locations, and movement patterns of F080 (2010) and M077 (2010–2011) and the detection location of OPF_0077 (black triangle).

F080 was released in 2010 on the southern side of the park in Graves Creek in the Quinault Valley at age 4 (fig. B4). She was pregnant at the time of release, and immediately moved north and settled down in the upper Cameron Basin, where she was confirmed to have at least one kit. She was last detected on November 19, 2010, when we received a mortality signal from her radio-collar. Due to the remote location and time of year, we did not investigate the mortality site and she was listed as presumed dead, but she could have shed her collar.

M077 was also released in 2010 at Graves Creek (fig. B4), and was estimated to be a juvenile (age 8 months, but the tooth analysis was inconclusive). Soon after release, he started moving south (but was missing from March 23 until June 7, 2010) and settled along the lower Wynoochee River east of Aberdeen. He appeared to stay in this area during the 2011 breeding season, and was last located on August 4, 2011.

There are several points of evidence that indicate that it is unlikely that OPF0077 is part of F080's litter born in the upper Cameron in 2010. First, M077 and F080's capture sites in British Columbia were 105 km apart. Second, M077 was estimated to be 8 months old at the time of his release and if this estimation was correct, he was not born when F080 was bred in 2009 in British Columbia. The age determination via tooth section was inconclusive; however, our ocular estimation of age for male juveniles was correct 13 of 14 times when tooth sectioning was performed (National Park Service, unpub. Data, 2014). The one incorrect age determination was for a male that was 1 year old. If we underestimated M077s age by 1 year he would have been 1 year old during the breeding season in British Columbia, and research indicates that juvenile males are not effective breeders (Strickland and others, 1982; Powell, 1993).

Given their movement patterns in the breeding season of 2010, it is possible that F080 and M077 bred in 2010; M077 was missing from March 23 to June 7, 2010. It is also possible that F080 moved south in 2011 near where M077 was. In either case, it does not appear that F080 died in 2010.

5) OPF0678 Male		
Parental identification	Maternal: F057	Paternal: M082
Release year	2010	2010
Capture site separation	230 km	
Release age	0	0
Release site	Sol Duc	Bogacheil
Last heard	01/19/2011	09/02/2011
Fate	Unknown	Unknown
Home range determined	Yes	Yes
Home range area	Lower Queets	Coast (Kalakoch)

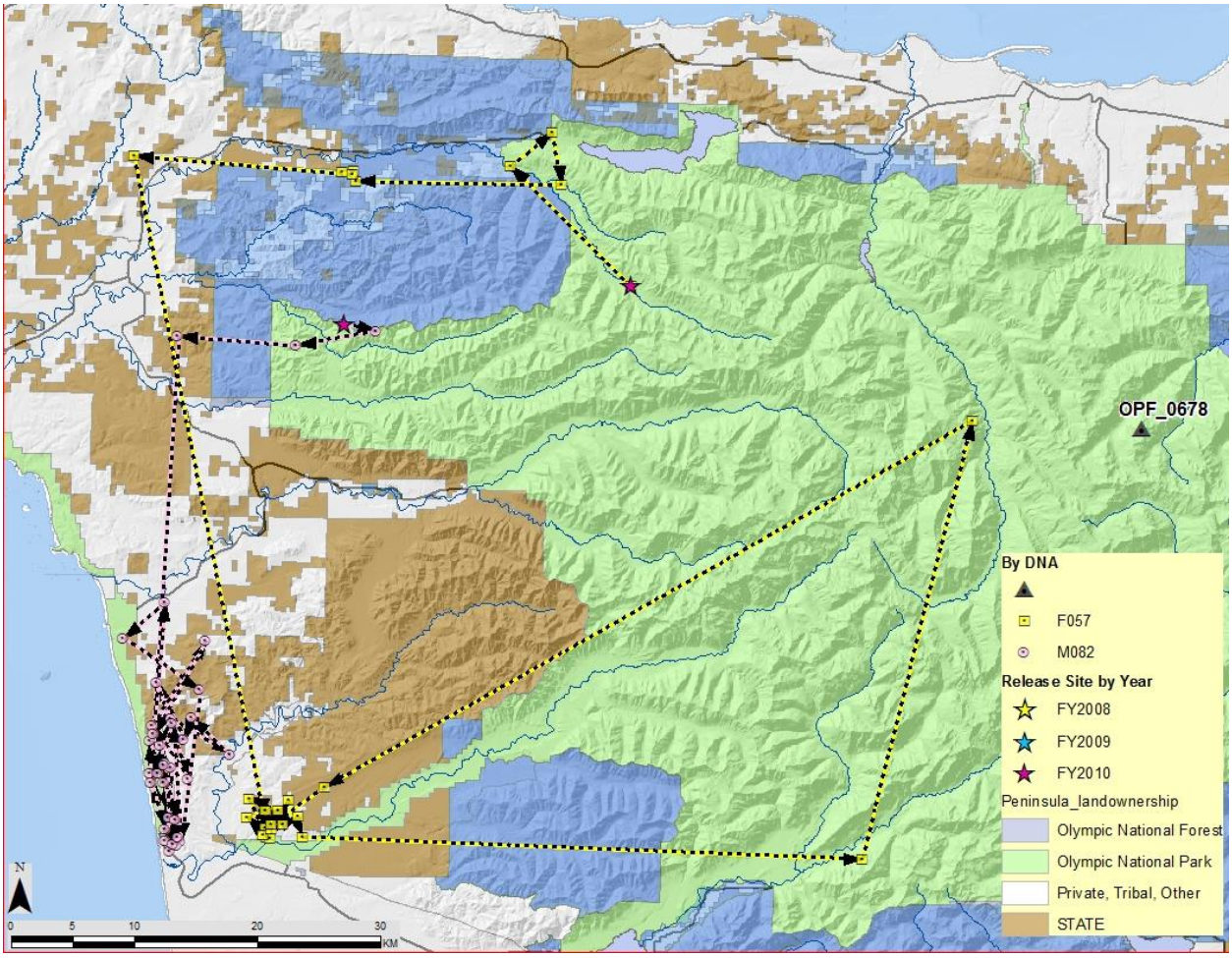

Figure B5. Release sites, locations, and movement patterns of F057 (2010–2011) and M082 (2010–2011) and the detection location of OPF_0678 (black triangle).

F057 was released in 2010 in the Sol Duc drainage at age 0 (fig. B5). Soon after release, she settled down in the lower Queets Valley. She did make a foray out of her home range in the fall of 2010, but returned to the area by January 2011. We lost contact with her in late January 2011, and were never sure if that was due to her moving to an area where we were unable to find her, or due to the failure of her radio collar.

M082 was also released at age 0 in 2010, but his release site was farther west in the Bogacheil drainage (fig. B5). Soon after release, he settled down along the coast in the Kalaloch area. We tracked him until September 2, 2011, near the end of the radio-telemetry phase of our study.

OPF0678 is the offspring of these two fishers that set up home ranges as juveniles in close proximity to each other. They could have bred in 2010 at the earliest, but a later date is more likely due to M082s age at that time (1 year). Fisher OPF_0678 was detected 77 km from F057's home range.

References

Powell, R.A., 1993, The fisher—Life history, ecology, and behavior (2d ed.): Minneapolis, Minn., University of Minnesota Press, 237 p.

Strickland, M.A., Douglas, C.W., Novak, M., and Hunzinger, N.P, 1982, Fisher (*Martes pennanti*), *in* Chapman, J.A., and Feldhamer, G.A., eds., Wild mammals of North America—Biology, management, and economics: Baltimore, Md., The Johns Hopkins University Press, p. 586–598.

Appendix C. Genetic Analyses of Dead Fishers Recovered in 2013

We conducted microsatellite DNA analyses of two fishers recovered as mortalities in 2013. The necropsy reports of both fishers comprise appendix D. The purpose of the microsatellite analyses was to determine the identity of both animals, whether they were founders released in the park between 2008 and 2010, or whether they were born into the population, and who their parents were.

F102 was a young female recovered along U.S. Highway 101 in early April 2013. See appendix D for the necropsy details.

OPF_0683T F102 Female		
Parental identification	Maternal: F004	Paternal: M009
Release year	2008	2008
Capture site separation	16	
Release age	2	0
Release site	Elwha (Hot Springs Road)	Elwha (Altair)
Last heard	05/28/2010 (seen in July 2010)	09/17/2008
Fate	Unknown (collar at end of life)	Unknown (implant failure)
Home range determined	Yes	Yes
Home range area	Morse Creek (lower)	Morse Creek (upper)

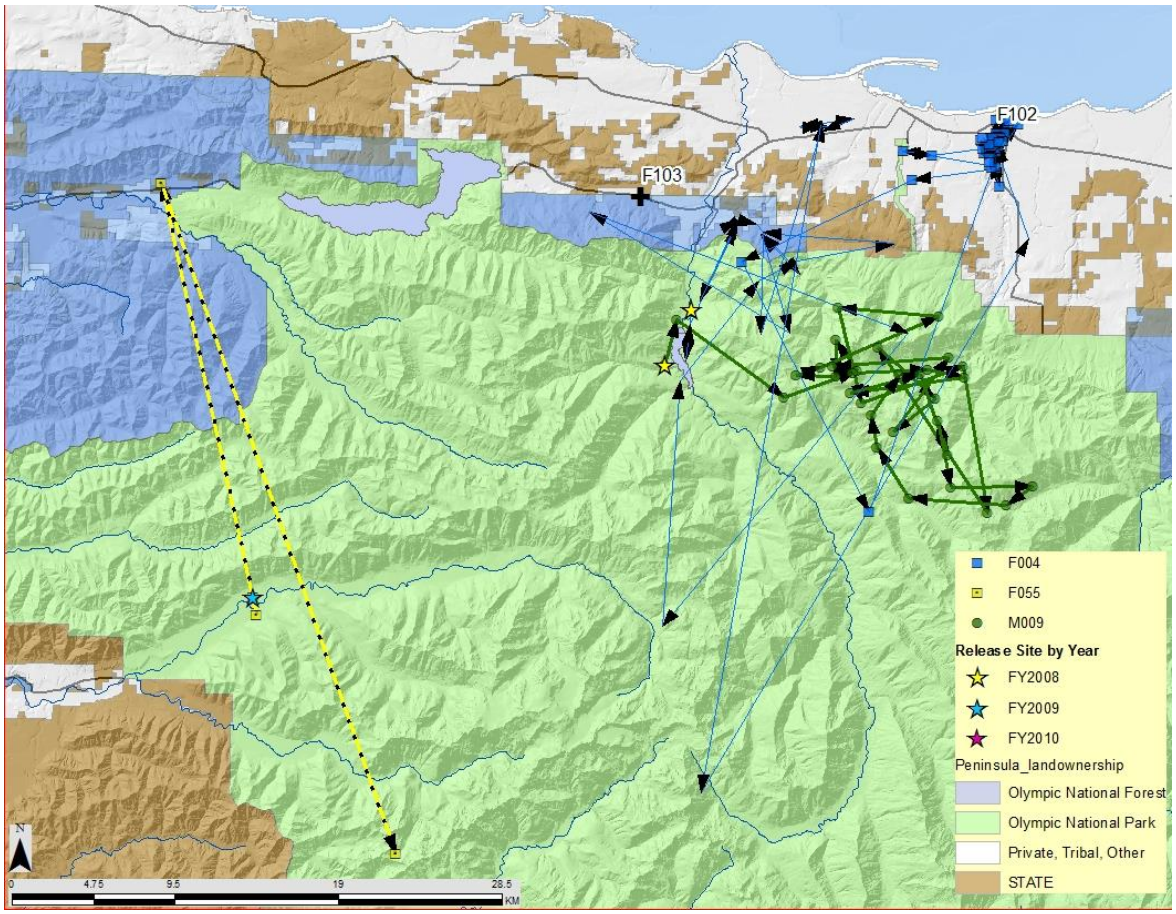

Figure C1. Locations and movement directions of F004, M009, and F055. For F004, all movements are shown, but points are from August 2008 through May 2010 (hence omitting her post release wandering around in 2008). Consequently, the points outside her home range are from her breeding season wanderings in 2009.

F004 was released in the Elwha in 2008 at age 2, and we radio-tracked her for 2.5 years (fig. C1). Following release she did a lot of exploration, but finally settled down in August (so no denning that year) in a rural residential area just east of the Port Angeles city limits, in the lower Morse Creek drainage. She resided in that restricted area until her radio-collar failed in May 2010. She made extensive forays out of her home range in the breeding and early denning season in 2009—so no denning in 2009 either. In 2010, when she was 5 years of age, she was detected denning within her home range, and having a litter size of 4.

M009 was released in the Elwha at age 0, and soon after his release he settled down in the upper Morse Creek drainage (fig. C1). His implant failed in the fall of 2008, so our last location of him was in September 2008.

F102 was a young female, estimated to be 0–1 years old (her canines were white and had little wear; however, we are awaiting confirmation of her age from tooth analysis). She was determined to be the offspring of F004 and M009. She was recovered within her mother's home range. Since she was a young female, it appears (but will be confirmed by the tooth analysis) that F004 and M009 were alive at least in 2011, and potentially in 2012, and that F004 had at least 2 litters.

F103 was an adult female recovered along U.S. Highway 101 in May 2013. She was actively lactating and had 4 placental scars. The DNA report from the U.S. Forest Service Carnivore Genetics Lab stated the following: *In the case of female F103 there are two females consistent with being her mother. If M009 is indeed the father (the only male currently in the database consistent with this relationship) then female F004 is the mother.*

	OPF_0684T F103 Female		
Parental identification	Maternal: F055	Maternal: F004	Paternal: M009
Release year	2010	2008	2008
Capture site separation		16	
Release age	0	2	0
Release site	Hoh Ranger Station	Elwha (Hot Springs Road)	Elwha (Altair)
Last heard	10/06/2010	05/28/2010 (seen in July 2010)	09/17/2008
Fate	Presumed Dead	Unknown (collar at end of life)	Unknown (implant failure)
Home range determined	No	Yes	Yes
Home range area	No	Morse Creek (lower)	Morse Creek (upper)

It is very unlikely that F055 is the mother. F055 was released in 2010 at age 0. We had very little success radio-tracking her—after her release, we only got two live locations, on April 15 and again on June 11. She was detected on mortality mode on October 20 in a remote area that we infrequently flew over. No other female that did not have a litter of kits was found to have shed a collar in less than a year, so it is likely that she died. In addition, F103 was an adult female (we are waiting on her tooth analysis for age determination). If F055 was her mother, F055 would had to have bred in 2010, F103 would have been born in 2011, bred at age 1 (2012), and been at a sufficient plain of nutrition for her first litter, at age 2, to consist of 4 kits in 2013.

The more likely explanation is that F103 is one of the litter of 4 that we observed F004 having in 2010; that would make F103 3 years of age at her death. We will confirm this with the teeth data. In addition, we observed F004 going on a walkabout in the breeding season in 2009. She traversed the area occupied by M009 during March and early April.

Appendix D. National Park Service Necropsy Reports

IN REPLY REFER TO:

United States Department of the Interior
NATIONAL PARK SERVICE
Biological Resource Management Division
1201 Oakridge Drive, Suite 200
Fort Collins, CO 80525

Biological Resource Management Division
Final Case Report

Date: August 2, 2013
Date Submitted: May 22, 2103
WHB VDS Case Numbers: NPS 13- 100 [OLYM 2013-F-102] and 13-101 [OLYM 2013-F-103]
National Park Unit: OLYM
Species: Fisher (*Martes pennanti*)

FINAL DIAGNOSIS: Trauma and Anticoagulant Toxicosis (NPS 13-100); Suspect Trauma and Parasitic Enteritis (NPS 13-101)

HISTORY & FINDINGS: **NPS 13-100**: The frozen carcass of a wild, young adult, female fisher was submitted by Dr. Patti Happe of OLYM. This fisher was found dead by a Washington State trooper on April 1, 2013 on Highway 101 at Port Angeles, Morse Creek curves. It was then given to OLYM park staff who then placed it in a freezer on April 2, 2013. The carcass was submitted to the WHB VDS for necropsy, histopathology, and ancillary testing as needed. **NPS 13-101**: The fresh carcass of a wild, adult, female fisher was submitted by Dr. Patti Happe of OLYM. This fisher was found dead on May 21, 2013 on U.S. Highway 101 at milepost 237 at 20:00 hours. The carcass was placed in a refrigerator the same day at 21:00 hours. OLYM staff report it to have been "*an obvious road kill"*. The carcass was submitted to the WHB VDS for necropsy, histopathology, and ancillary testing as needed. Neither carcass appeared to be previously micro-chipped or tagged, and presumed to be progeny/ recruits from the reintroduced fisher population.

NPS 13-100: necropsy revealed an adult female fisher with severe head trauma, in very good body condition. There were no placental scars, and no indication of current/ recent pregnancy. Histopathology revealed no significant lesions. Anticoagulant screening of liver tissue revealed **676 ppb** of **brodifacoum**. Fluorescent antibody assay of brain tissue revealed no evidence of either rabies virus or canine distemper virus.
NPS 13-101: necropsy revealed an adult, female fisher in a fair-good plane of nutrition with massive cranial hemorrhage, hepatic fractures, and hemothorax. Reproductive assessment showed prominent nipples, and histopathology confirmed active lactation. There were 4 placental scars, and the reproductive tract was involuted. Stomach contents appeared to include

some feathers (samples collected and frozen for return to park). Histopathology revealed blood in the lungs; e.g. possible aspiration of blood and a cestode tapeworm in the intestinal mucosa with associated inflammation.

Fluorescent antibody assay of brain tissue revealed no evidence of either rabies virus or canine distemper virus. Anticoagulant screening of liver tissue revealed no evidence of anticoagulants.

COMMENTS: **NPS 13-100** appears to be a healthy young female fisher killed secondary to having being struck by a vehicle; however, high performance liquid chromatography (HPLC) assay of liver tissue revealed a 676 parts per billion concentration of Brodifacoum. Brodifacoum is a common, second generation anticoagulant pesticide that inhibits vitamin K in the normal clotting cascade; resulting in excessive, often lethal bleeding. Such chemicals are most often used for rodent control; however, non-target animals; e.g. wildlife can come in contact with them in the form of baits, or even direct, malicious intent. Brodifacoum is a powerful anticoagulant, requiring a much smaller dose than first generation anticoagulants; e.g. Warfarin and/or Coumadin to effect deleterious changes in animals. **NPS 13-101** is also a relatively healthy, adult, lactating female fisher with massive hemorrhage in the head and lungs. This would be consistent with some sort of trauma; e.g. vehicle collision. No abnormalities were identified in this submission. It is indeed a loss to the developing population of fishers in the northwest.

Tissues collected for OLYM include teeth for aging from 13-100, and stomach and/or intestinal contents from both. Additional tissues were collected and frozen for temporary archive, and available for additional diagnostics/ return to the park as requested. Several digital photographs were taken during gross necropsy, and also available as requested (NPS 13-101 pleural hemorrhage, reproductive tract, teeth).

Diagnostician: John A. Bryan, II, DVM, MS

John A. Bryan, II

Preliminary updates were sent to Dr. Happe via email on May 23, May 28, and May 31, 2013.

IN REPLY REFER TO:

United States Department of the Interior
NATIONAL PARK SERVICE
Biological Resource Management Division
1201 Oakridge Drive, Suite 200
Fort Collins, CO 80525

Biological Resource Management Division
Final Case Report

Date: January 23, 2014
Date Submitted: December 13th & December 18th, 2013
WHB VDS Case Numbers: NPS 14-014 [OLYM F104] and 14-016 [OLYM M023]
National Park Unit: OLYM
Species: Fisher (*Pekania pennanti*)

FINAL DIAGNOSIS: Malnutrition/ Starvation (NPS 14-014); Trauma (NPS 14-016)

HISTORY & FINDINGS:

NPS 14-014: The frozen carcass of a wild, young adult, female fisher was submitted by Dr. Patti Happe of Olympic National Park (OLYM). This fisher was found dead by a citizen and frozen while passed along to Washington State Patrol on December 10th, 2013, and then to Patti Happe at OLYM on December 11th, 2013.

The carcass was received frozen at BRMD on 12/13/2013, and thawed over the weekend for submission on 12/16/2013 for necropsy, histopathology, rabies and canine distemper testing, and an anticoagulant assay. Necropsy findings revealed very poor body condition (weighed 2.4 kg, no internal or bone marrow fat stores), no indication of trauma, and no signs of current/ recent pregnancy (involuted reproductive tract, no placental bands or scars, not currently lactating or signs of mammary tissue development).

Fluorescent antibody assay of brain tissue revealed no evidence of either rabies virus or canine distemper virus. Histopathology findings revealed no evidence of infectious disease or other significant findings. Anticoagulant screening of liver tissue for rodenticide compounds were not detected.

OLYM collected a piece of ear for DNA before submission, and samples of stomach contents (consistent with pine needles), feces, and premolar for aging were collected and frozen for return to OLYM on 2/18/2014. Additional samples temporarily archived at BRMD include lung, liver, kidney, brain, femur, spleen & heart for additional diagnostics/ ancillary testing as needed.

NPS 14-016: The fresh carcass of a wild, adult, 5.5 year old "known" male fisher was submitted by Dr. Patti Happe of OLYM. This fisher was observed being struck by a truck on December 14th, 2013 at 6:45 am. The carcass was retrieved and refrigerated until submitted to park biologists on 12/16/2013. This animal was originally collared, chipped, and released in December 2008, at 10 months of age.

The carcass was submitted to the WHB VDS for necropsy, histopathology, and an anticoagulant assay. Prior to submission, a chip was recovered from the neck region for confirmation of identification. Necropsy revealed an adult male fisher with severe trauma in very good body condition (weighed 5.4 kg, abdominal fat present). Noted trauma included extensive hemothorax, fractured ribs (right 4 and 7), a fractured right femur, hemoabdomen (blood clots present) with abdominal wall tear and evisceration, and a fractured liver. Additional findings included chronic right canine tooth fracture (not believed to be associated with acute trauma event).

Histopathology revealed no underlying lesions of significance. Anticoagulant screening of liver tissue for rodenticide compounds were not detected.

Gastrointestinal tract was collected (primarily empty) and frozen, as well as skull and baculum for return to OLYM on 2/18/2014. Additional samples temporarily archived at BRMD include lung, liver, kidney, spleen, femur, heart & brain for additional diagnostics/ ancillary testing as deem relevant.

Diagnostician: John A. Bryan, II, DVM, MS

John A. Bryan, II

Preliminary updates were sent to Dr. Happe via email on December 16th, 17th, and 19th, 2013.