Olympic Fisher Reintroduction Project: 2010 Progress Report

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The 2010 progress report is a summary of the reintroduction, monitoring, and research efforts undertaken during the third year of the Olympic fisher reintroduction project. Jeffrey C. Lewis of Washington Department of Fish and Wildlife, Patti J. Happe of Olympic National Park, and Kurt J. Jenkins of U. S. Geological Survey are the principal investigators of the monitoring and research program associated with the reintroduction. David J. Manson of Olympic National Park is the lead biological technician.

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Background
Historically, the fisher (*Martes pennanti*) occurred throughout much of the coniferous forests of Washington. However, the fisher was extirpated from Washington within the last century, largely as a result of historical, unregulated trapping and loss of forests in older age-classes at low and mid-elevations. A status review completed in 1998 by the Washington Department of Fish and Wildlife (WDFW; Lewis and Stinson 1998) documented these findings and prompted the listing of the fisher as a state endangered species by the Washington Fish and Wildlife Commission in October of 1998. The fisher was also listed as a federal candidate species by the U. S. Fish and Wildlife Service after the proposed listing of its west coast population as endangered was deemed warranted but precluded by higher-priority listings (U. S. Fish and Wildlife Service 2004).

The listing of the fisher in Washington prompted considerable interest in restoring the species to its historical range within the state, as well as the development of a fisher recovery plan (Hayes and Lewis 2006). Recovery efforts throughout much of the fisher's North American range have relied heavily on reintroductions and the fisher has proven to be one of the most successfully reintroduced carnivores (Berg 1982, Powell 1993, Breitenmoser et al. 2001, Lewis 2006). Due to the extirpation of fishers, the lack of nearby fisher populations to support recovery through recolonization, and the past success of reintroductions elsewhere, WDFW began planning a fisher reintroduction as a means to restore the species in Washington (Hayes and Lewis 2006).

A reintroduction feasibility study was initiated in 2002 by WDFW and Conservation Northwest, a non-profit conservation organization. The study concluded that fisher reintroductions to the Olympic Peninsula and to the Cascades of Washington were biologically feasible (Lewis and Hayes 2004), and that the most suitable location for a reintroduction was within Olympic National Park (ONP). Biologists with ONP had long been interested in the status of fishers in the Park. The preliminary results of the feasibility study prompted ONP to join the reintroduction partnership with WDFW and Conservation Northwest. Subsequently, WDFW and the National Park Service (NPS) developed a reintroduction implementation plan (Lewis 2006), and an environmental assessment/reintroduction plan (National Park Service et al. 2007) pursuant to the National Environmental Policy Act. With the approval of the environmental assessment and reintroduction plan by the NPS, the proposed reintroduction was initiated in the fall of 2007.

The intent of the Olympic fisher reintroduction project is to reestablish a self-sustaining population of fishers on the Olympic Peninsula. To achieve this goal, the Olympic fisher reintroduction project would release ~100 fishers on the Olympic Peninsula over three years. The reintroduction of fishers to the Olympic Peninsula is designed as an adaptive management project. The project incorporates research and monitoring of released fishers as a means to evaluate reintroduction success, investigate key biological and ecological traits of fishers, and inform future reintroduction, monitoring, and research efforts. WDFW and ONP are the co-leads for the reintroduction efforts, while WDFW, U. S. Geological Survey (USGS) and ONP are the leads for the research and monitoring program associated with the reintroduction. In this report, a preliminary summary is provided of the progress made during the third year (December 2009 – December 2010) of the reintroduction, monitoring, and research project. Summaries of previous year's accomplishments are available at http://wdfw.wa.gov/conservation/fisher/.

Acknowledgments

Reintroduction planning and implementation depended on the assistance of the British Columbia Ministry of Environment, who supported our efforts to undertake a translocation of British Columbia fishers to the Olympic Peninsula. Members of the British Columbia Trappers Association from central British Columbia captured fishers for the reintroduction. In addition to the 22 trappers that have provided fishers for this project, we would like to thank our hosts, Marg and Don Evans for working with the trappers and providing expert care for the fishers prior to their transport and release.

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Progress to Date

We previously described four main aspects of the reintroduction process: 1) the capture, housing and care of fishers; 2) the preparation of fishers for reintroduction; 3) transporting fishers to Washington; and 4) releasing fishers in ONP (Lewis and Happe 2009). We employed the same procedures during the second and third years of the project. During the first 3 years of the project we successfully captured 90 fishers in central British Columbia, transported them to Washington and released them in Olympic National Park (Table 1, Figure 1, Appendix 1).

Table 1. The number and age-class of fishers released over 3 years during the Olympic fisher reintroduction project.

Release year	Fisher age classes	Females	Males
Year 1 Releases in Jan 2008 and Mar 2008	Juveniles (<1 year old)	3	1
	Subadults (1 year old)	3	4
	Adults (≥2 years old)	6	1
	Total (18)	**12**	**6**
Year 2 Releases in Dec 2008, Jan 2009, and Feb 2009	Juveniles (<1 year old)	7	7
	Subadults (1 year old)	5	4
	Adults (≥2 years old)	8	0
	Total (31)	**20**	**11**
Year 3 Releases in Dec 2009, Jan 2010, and Feb of 2010	Juveniles (<1 year old)	7	8
	Subadults (1 year old)	3	5
	Adults (≥2 years old)	8	10
	Total (41)	**18**	**23**
Years 1-3	**Grand Total (90)**	**50**	**40**

In year 1 of the project, 18 fishers were released in ONP and these individuals were monitored (via radio-telemetry) for up to 30 months (January 2008-August 2010). In year 2, we released an additional 31 fishers in ONP (Table 1, Figure 1, Appendix 1). These year-2 fishers have been monitored via radio-telemetry for up to 24 months, however only 3 of the 31 are known to have functioning radio-collars as of 31 December 2010.

In year 3, we released 41 fishers in ONP (Table 1, Figure 1, Appendix 1) on 3 release dates. The first group (10 males, 6 females) was released on 24 December 2009 in the Elwha, Maiden Creek, and Sol Duc Valleys (Figure 2). The second group (6 males, 6 females) was released on 21 January 2010 in the Bogachiel drainage (Rugged Ridge) and in the Quinault Valley (Figure 2). The third group (7 males, 6 females) was released on 20 February 2010 in the Elwha and Quinault Valleys (Figure 2). Fishers released in year 3 have been monitored for up to 12 months (January – December 2010).

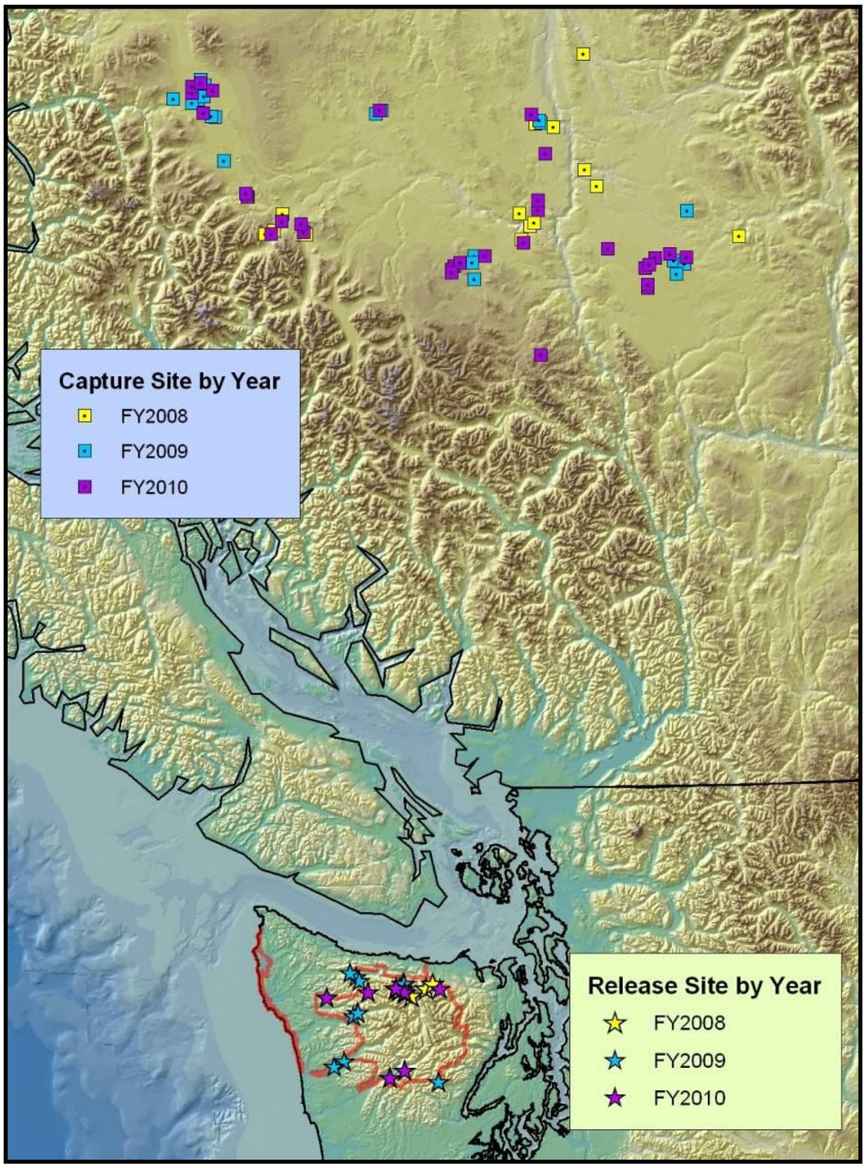

Figure 1. Capture (squares) and release (stars) locations for 90 fishers released in Olympic National Park in 2008 (yellow), 2009 (blue), and 2010 (purple).

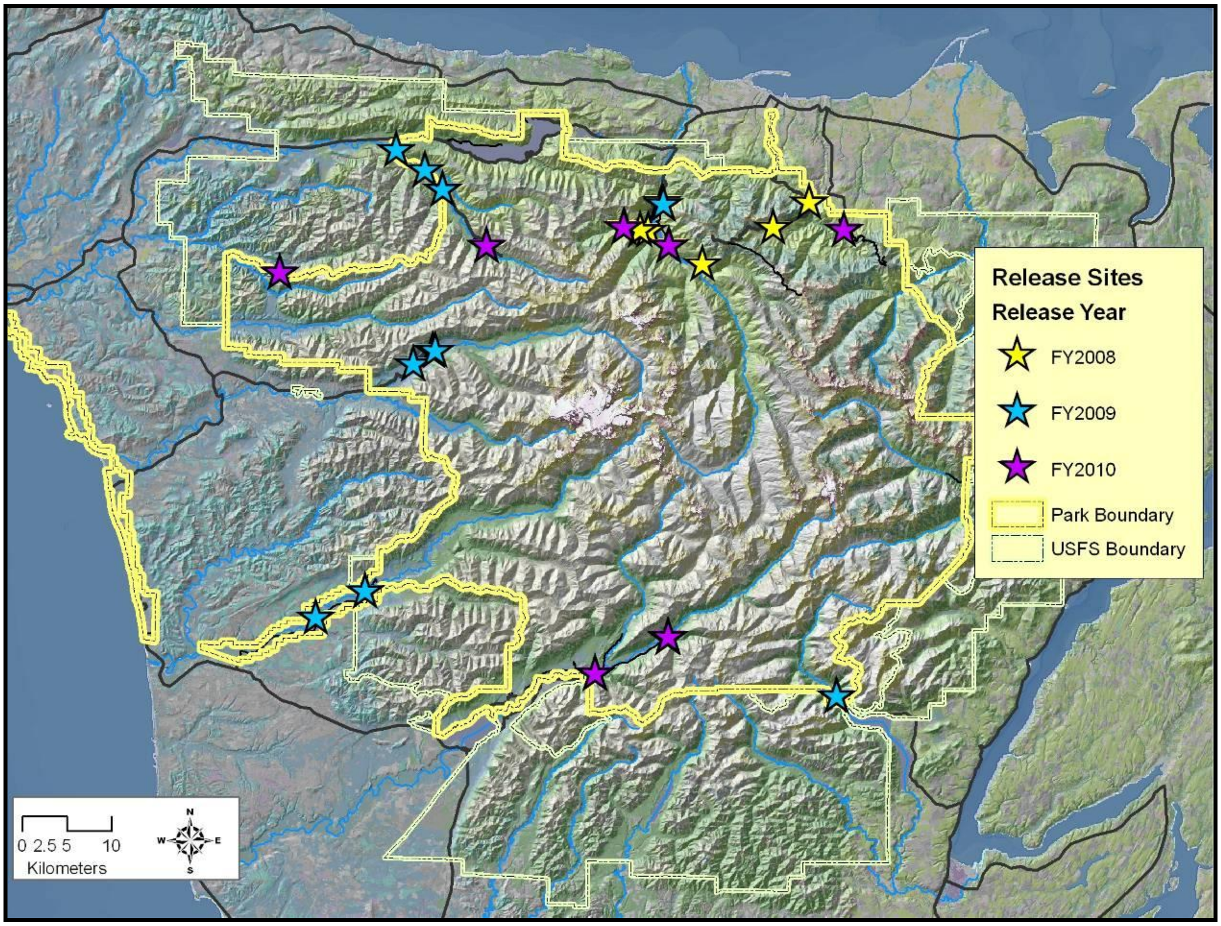

Figure 2. Release locations for fishers (n=90) in Olympic National Park in 2008 (yellow stars), 2009 (blue stars), and 2010 (purple stars). Release locations include the Morse, Elwha, Sol Duc, Bogachiel, Hoh, Queets, Quinault, and North Fork Skokomish Drainages.

Reintroduction Success Monitoring

Our monitoring efforts in years 1-3 focused on evaluating movements, survival, home range establishment and reproduction of reintroduced fishers. Because most of the released fishers occurred in areas that were relatively inaccessible to ground or vehicle-based telemetry, we relied primarily on aerial telemetry to monitor fishers following their release. Although we attempted to locate each fisher every week, inclement weather, poor flying conditions and logistical considerations often interfered. Hence, our goal was to locate each collared fisher up to once weekly, but no less than once per month. For more accessible individuals, we have also obtained locations using ground telemetry procedures. Ground telemetry locations, derived from homing and triangulation, were instrumental for locating and describing fisher rest and den sites and for discovering scats that will be used in food habits analyses.

Movements

We assessed post-release movements of fishers to determine if the landscape features (e.g., terrain, water bodies, alpine areas) of the Olympic Peninsula presented barriers or impediments to fisher movements and to determine if potential barriers or impediments are significant enough to prompt an adjustment to the planned reintroduction approach.

Although most fishers gradually moved away from release sites, the distance that fishers moved away from their release sites varied among individuals (Figures 3, 4 and 5; Appendix 2). The greatest distance that fishers were located from their sites ranged from approximately 8 to 72 km for females and from 15 to 111 km for males (Table 2). Fishers commonly move great distances following their release and during the subsequent breeding season (from March until 31 May), including movements across rivers, and through high-elevation mountainous terrain (Figures 3 and 4). Translocated fishers began using a smaller home range area following the breeding season (Figures 3 and 4).

Movements of fishers during their second year following release have also been variable (Figure 5). We observed 3 types of movement patterns during the breeding season (March to May): wide-ranging movements from a consistently occupied area and subsequent return (Figure 5; see M011, M014, F016), movement to a new area following the breeding season (e.g., F006, M032), and the continuation of localized movements within a consistently occupied area (Figure 5).

Table 2. Greatest distance that fishers were located away from their release site by release-year cohort and sex.

		Maximum distance located from release site			
Release cohort	**Sex**	**Mean (km)**	**SD**	**n**	**Range (km)**
1	F	38.0	18.2	10	18.2-72.3
	M	68.2	33.9	5	22.2-111.0
2	F	35.4	16.6	9	17.1-69.1
	M	51.5	25.3	7	15.0-95.0
3	F	39.8	18.8	10	8.2-61.5
	M	48.8	21.7	13	21.1-100.9

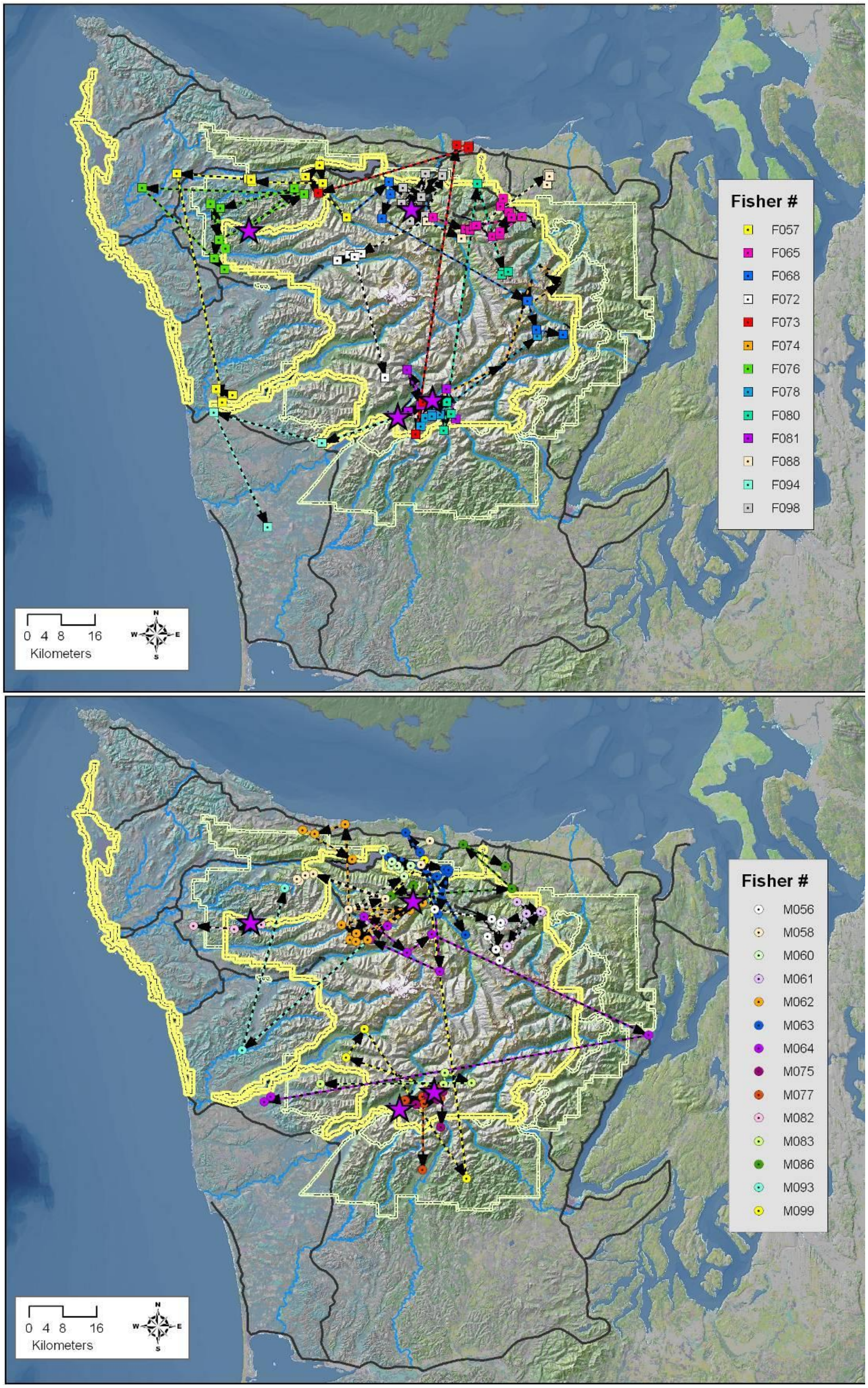

Figure 3. Locations and movements from their release date until 31 May 2010 for female (top) and male (bottom) fishers released in year 3. Release sites are indicated by purple stars.

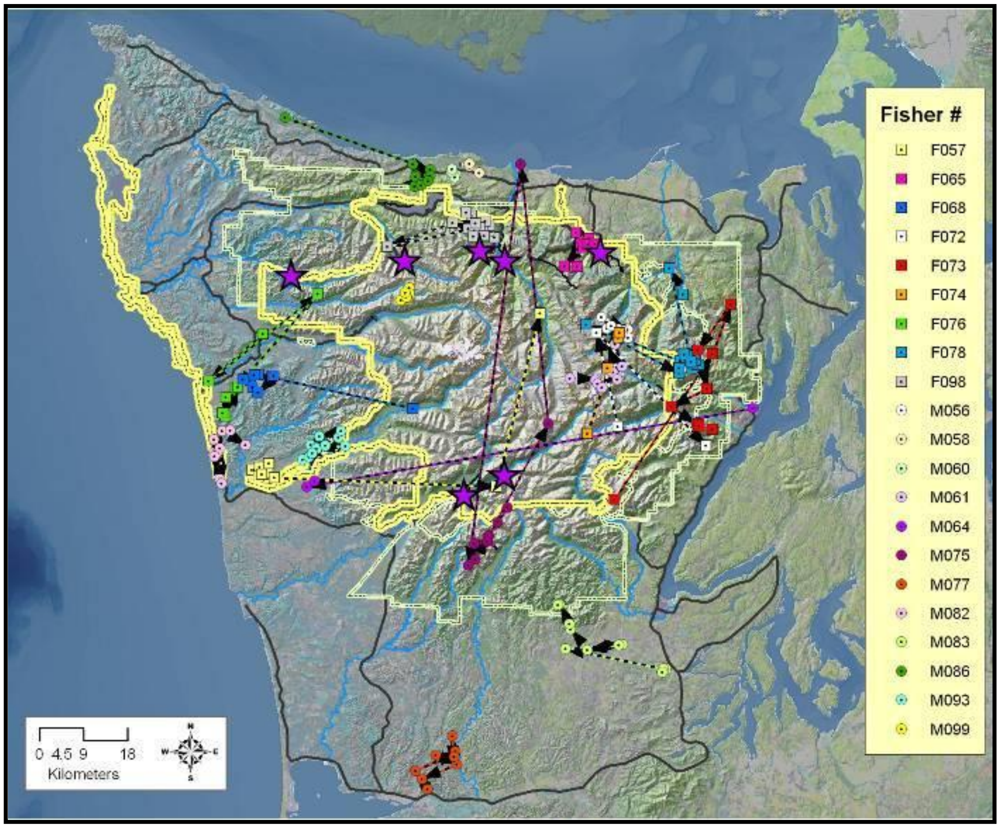

Figure 4. Locations and movements from 1 June to 31 December 2010 (the period after the breeding season) for fishers released in year 3. Release sites are indicated by purple stars.

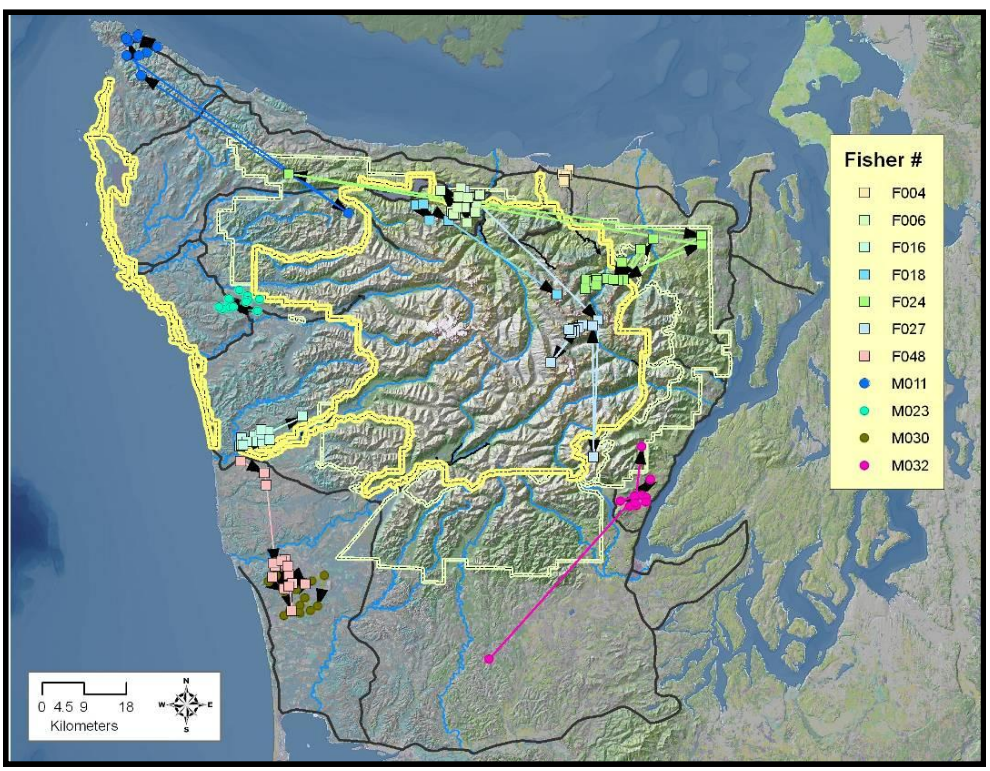

Figure 5. Locations and movements in 2010 for fishers released in year 1 and 2. The long distance movements of males M011, M032 and females F018, F024, and F027 occurred during the breeding season (March–May).

Survival

We determined the survival status of each radio-collared fisher at each location by noting whether a higher radio-transmitter pulse-rate (a mortality signal of 72 bpm vs the normal 42 bpm) indicated that a collar had remained motionless for $\geq$6 hours (indicating a collared individual is dead or that its collar came off). Whenever possible, we used ground telemetry to investigate mortality signals to determine the status of the fisher or its collar. During the first three years of the study we detected mortality signals from 39 fishers. We were able to determine the fate of 32, of which 30 (94%) were confirmed dead and two were dropped collars. We detected seven mortality signals in inaccessible locations and we were unable to investigate the fate of those fishers; they are recorded as presumed dead.

We calculated finite survival rates for males and females as the proportion of radio-collared animals that survived the year. If the fate of any fisher could not be determined throughout the year because we were unable to relocate it for more than three months, it was censored from the survival rate calculation (Table 3, Appendix 1).

The survival status (alive vs. dead) in year 1 was known for 17 of the 18 fishers released in year 1, for 29 of the 32 released in year 2, and for 32 of the 41 released in year 3 (Table 3). The large number of males with unknown status (censored) in release cohort 3 was in part due to the early failure of ARGOS satellite collars that we placed on 5 male fishers (Appendix 2).

Preliminary analyses indicate that first year survival rates varied widely across the 3 release cohorts (range: 44.8-82.4% for all fishers; Table 3). Pooled among years, first and second year survival rates averaged 59.7 and 78.9%, respectively (Table 4). We will focus on patterns in survival rates in future analyses.

Table 3. Preliminary estimates of percent survival for fisher release cohorts 1-3, based on numbers of fishers that were released, survived, died, or were censored.

Release Cohort	Year[1]	Sex	#	Survived	Dead[2]	Censored[3]	% Survival[4]	Standard error[5]
1	2008	F	12	10	2	0	83.3	11.2
		M	6	4	1	1	80.0	17.9
		All	18	14	3	1	82.4	9.2
	2009	F	10	8	1	1	88.9	10.5
		M	4	2	0	2	100.0	0.0
		All	14	10	1	3	90.9	8.0
	2010	F	8	0	2	6	--[6]	
		M	2	0	0	2	--[6]	
		All	10	0	2	8	--[6]	
2	2009	F	20	6	14	0	30.0	10.5
		M	11	7	2	2	77.8	13.1
		All	31	13	16	2	44.8	9.1
	2010	F	6	3	2	1	60.0	21.9
		M	7	2	1	4	66.7	19.2
		All	13	5	3	5	62.5	14.0
3	2010	F	18	9	8	1	52.9	12.1
		M	23	10	4	9	71.4	9.6
		All	41	19	12	10	61.3	7.7

[1]Survival rate calculations were based on a 1 January to 31 December time interval each year.
[2]Includes fishers presumed dead, but could include fishers that are alive but lost their collar.
[3]includes missing fishers and those with failed radios. These individuals were excluded (censored) from the survival calculations because their status was unknown.
[4]% survival = [survived/(survived + dead)]*100
[5]Standard error of the survival estimate (based on a sample from a binomial population; Zar 1984: 377)
[6]% survival was not calculated for 2010 for the year 1 release cohort as most individuals alive at the beginning of 2010 were lost as a result of expected radio-collar failure. Given the large number of censored animals (80%), a calculated survival rate for this year would lack validity.

Table 4. Preliminary estimates of first and second year survival rates as calculated across release year cohorts.

Year	Sex	Number	Survived	Died	Censored	Percent Survival	Standard error[1]
Year 1 for all 3 release cohorts	F	50	25	24	1	51.0	7.1
	M	40	21	7	12	75.0	6.9
	All	90	46	31	13	59.7	5.2
Year 2 for release cohorts 1 and 2	F	16	11	3	2	78.6	10.6
	M	11	4	1	6	80.0	12.6
	All	27	15	4	8	78.9	8.0

[1] Standard error of the survival estimate (based on a sample from a binomial population; Zar 1984: 377)

Causes of Mortality
With the assistance of wildlife pathologists at two laboratories (Veterinary Diagnostics Laboratory at Colorado State University and Veterinary Genetics Laboratory at UC Davis), we have been able to determine the cause of death, and in some cases the predator, of some of the fishers that have died to date. During the first 3 years of the project, we recovered the remains of 30 released fishers (23 F, 7 M; Table 5, Appendix 1); cause of death is known for 16 (53.3%; 13 F, 3 M) of these. Among known causes of mortality, predation and vehicle strikes were the most common causes (Table 5). Forensic evidence indicated that two females (F008 and F026) died as the result of bobcat predation (G. Wengert, UC Davis, unpubl. data).

Table 5. Cause of death of fishers recovered from January 2008 to December 2010.

Cause of death	Females	Males	All (%)
Unknown	6	2	8 (26.7)
Predation	5	2	7 (23.3)
Unknown (possible predation)	4	2	6 (20.0)
Vehicle strike	5	1	6 20.0)
Drowning	2	0	2 (6.7)
Trapping related[a]	1	0	1 (3.3)
total	23	7	30 (100.00)

[a] Female was caught in, and escaped from, a leg-hold trap ~14 months after release.

Home Range Establishment
The establishment of a home range is an indication that an area is suitable for occupancy by an animal. We have not analyzed home ranges of the released fishers, yet preliminary results indicate that fishers established home ranges during their first year in a variety of landscapes ranging from mountainous terrain to coastal plains and land ownerships including federal, state, private, and tribal (Figures 3, 4 and 5).

Reproduction
Because the production and recruitment of young into a breeding population are critical to population persistence, reproduction is an important indicator of reintroduction success. Efforts to document reproduction included identifying possible denning behaviors of females, by closely scrutinizing movements of females during the denning season (late March-July). When we identified females using localized areas during the denning season, we used radio-telemetry homing procedures in an attempt to find the female in a den. Frequently, it took several trips into the suspected denning area to identify a radio-collared female within a potential natal den; in other instances we never found the female within a den. We used two methods to document reproduction. If a suspected den was identified, we placed 2-3 cameras (Reconyx, Inc., Holmen,WI; models PC85 and PC90) in locations to photograph the female or kits entering or exiting the den. If we could not identify a den site, we placed baited camera stations within the area regularly used by an adult female in an attempt to photograph kits after they left the natal den.

We confirmed reproduction by three females in 2010: F004 (released in year 1), F080 (year 3) and F088 (year 3) (Figure 6).

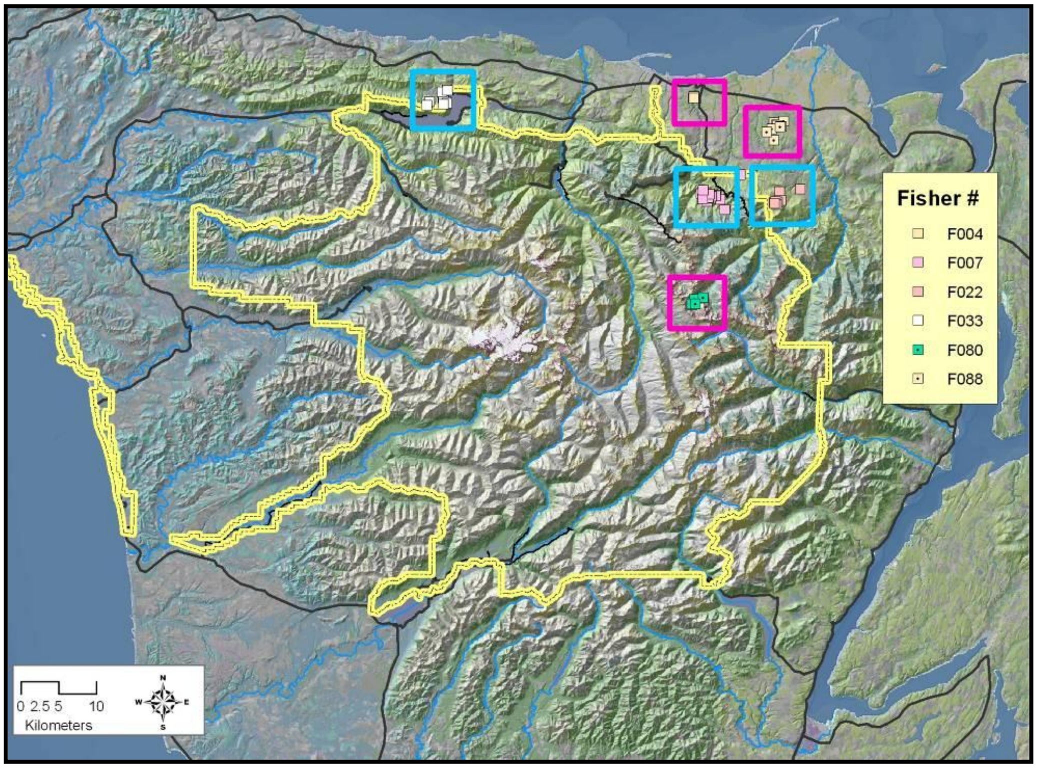

Figure 6. Confirmed den sites of reintroduced female fishers; den sites found in 2009 den sites are in blue boxes and den sites located in 2010 are in magenta. The presence of kits (from 1-4 kits) was confirmed by photo documentation at each site.

Female F004 was first photographed at a den tree on 14 April 2010. The tree was a declining big leaf maple (*Acer macrophylum*) located on private land. On 13 and 24 June 2010, 4 kits were photographed at the den tree (Figure 7). F004 and the four kits were last photographed at the site on 8 July 2010. Because her radio-collar failed soon after 28 May 2010, we were unable to locate any subsequent den sites she may have used.

Figure 7. Photograph of female F004 and her 4 kits on the bole of the den tree, 24 June 2010.

Female F080 was released in the Quinault River Valley in Olympic National Park on 21 January. F080 used a localized area in the upper Cameron Drainage in the northeastern portion of Olympic National Park. By the time we were able to access this site, she was moving around too much for us to identify a definitive den site. However, on 12 August 2010, F080 was found within her home range with a single kit (Figure 8). Her litter size and den site are unknown.

Figure 8. Female F080 photographed (right) with a kit (left, on log) at a remote camera and hair snare station in northeastern Olympic National Park, 12 August 2010.

Female F088 was released in Olympic National Park on 20 February 2010 in the Elwha River Valley. On 7 April 2010 she was found at a den site on lands owned and managed by Washington Department of Natural Resources north of the Park. On 28 May 2010, a bobcat was photographed climbing the den snag (Figure 9), and after that we did not document F088 at that site again. We found F088 using a second den snag, also on DNR lands, on 4 June 2010. On 6 June 2010, a bobcat was photographed climbing the second den snag as well. The digital images of the second den snag were examined on 8 June 2010, and we detected no use of the second den snag by F088 after 5 June. We located F088 later that day (8 June) and found her dead. With the assistance of DNR wildlife biologist Scott Horton, we were able to examine the second den snag late in the day and recovered two live kits, both males (Figure 10). These kits were raised in captivity, with minimal human contact, by the staff at Northwest Trek, and released in Olympic National Park on 15 October 2010. As of 31 December 2010, they continue to use areas in the northeastern portion of the Park.

Figure 9. Bobcat photographed climbing the den snag and looking into the den opening, 6 June 2010.

Figure 10. Two male kits (~10 weeks of age) that were rescued on 8 June, 2010, after their mother (F088) was killed by a predator.

Food Habits

Prior to releasing fishers, a basic assumption was made that the diversity and abundance of prey on the Olympic Peninsula would be sufficient to support a reintroduced population (Lewis and Hayes 2004). The reintroduction provides an opportunity to identify the prey species and other foods consumed by reintroduced fishers on the Olympic Peninsula. With our limited resources, our collection of scats has largely been limited to those collected at den sites, and consequently our findings will be limited to prey (and other foods) captured by reproductive females during the denning season. We have not had the funding to analyze fisher diets in the Olympic Reintroduction Area, but during 2010 we collected a total of 50 scats from den sites of fishers for future analyses, adding to the previous collection of 89 scats collected during the first two years. We have also archived the GI tract contents from ~ 10 recovered fishers for future analysis.

With the assistance of Tom Manning (Oregon State University), we conducted a pilot study during 2010, based on the analysis of contents of 20 scats collected during 2009, to determine methods and costs of future analyses and the level of taxonomic accuracy feasible. The 20 scats were collected between June and August of 2009 from the natal and maternal dens used by a single radio-collared female fisher (F033) and her litter on the northern Olympic Peninsula near Lake Crescent. Hence, the preliminary results are not representative of food habits of the reintroduced population.

We followed the methods previously outlined by Golightly et al. (2006) for similar studies of fisher diets in the Klamath region of northern California. Scat samples were frozen and stored in individual plastic bags immediately after collection. We washed each sample individually by placing it in a nylon stocking and soaking overnight in a dilute bleach solution (5 ml of household bleach in a liter of tap water) to sterilize and loosen compacted fecal material. The stockings and contents were then washed and rinsed in a clothes washing machine. The washed contents were weighed, dried at approximately 70^{o}C for several hours, and reweighed. The washed and dried scats were sorted into major categories, including bones, teeth, claws, fur, feathers, skin, plant material, arthropod parts, egg shell fragments, and unidentified material. Subsequently, items were identified more specifically using reference collections of mammal hairs provided by Olympic National Park, as well as the reference collection of bones and feathers maintained by Eric Forsman at the U.S. Forest Service, Pacific Northwest Research Station in Corvallis, OR.

Preliminary evidence shows that the female fisher and her litter consumed a wide variety of prey items during the denning and rearing period including mammals, birds, reptiles, arthropods, mollusks, plant material, rock and unidentified materials (Table 6). Ninety percent of the sample (i.e., 18 of 20 scats) contained remains of mammals, including mountain beaver (*Aplodontia rufa*; 15%), voles (*Microtus* spp; 10%), shrews (*Sorex* spp, 10%), snowshoe hares (*Lepus americanus*; 5%) and unidentified bone and fur. Bird remains found in 25% of the scats included mostly unidentifiable down plumules, but also the identifiable remains of a small owl and ruffed grouse (*Bonasa umbellus*). Additional items identified included a single snake (5%), hymenoptera (i.e., yellow jackets and hornets, 25%), carrion beetles (*Nicrophorus* sp.), and a clam shell (5%). All of the samples contained some fraction of assorted plant material.

The preliminary evidence indicated that approximately 3 hours of labor of a trained observer is required to determine diets to the lowest taxonomic level possible. Consistent with previous analyses of food habits of fishers, prey items of mammals were easily identified as mammals, and generally, classification to genus or species was possible (Aubry and Raley 1999, Zielinski et al. 1999, Golightly et al. 2006). Birds posed greater classification problems than mammals, and generally could only be identified as birds. It would be useful for future analyses to determine if more specific identification of birds is possible.

Table 6. Frequency of occurrence of items in 20 fisher scats, identified as specifically as possible.

Taxon	Common name	Generic name	Percent Frequency over 20 samples
Mammals			**90%**
Insectivora	Shrew	*Sorex*	**10%**
Rodentia	Mountain beaver	*Aplodontia*	**15%**
Rodentia	Vole	*Microtus*	**10%**
Rodentia	All rodents		**25%**
Lagomorpha	Snowshoe Hare	*Lepus*	**5%**
Unidentified bone			**55%**
Unidentified fur			**90%**
Birds			**30%**
Unidentified feathers	Small owl[1]		**5%**
Unidentified feathers	Ruffed grouse	*Bonasa*	**5%**
Unidentified feathers	All feathers		**25%**
Eggshell fragments			**5%**
Unidentified bone			**10%**
Unidentified feather sheaths			**5%**
Reptiles			**5%**
Snake vertebrae	Snake		**5%**
Unidentified scales			**5%**
Arthropods			**70%**
Hymenoptera	Yellowjackets and/or Hornets		**25%**
Coleoptera	Carrion Beetle	*Nicrophorus*	**25%**
Coleoptera	Other beetle		**20%**
Coleoptera	All beetles		**30%**
Unidentified arthropod			**15%**
Mollusks			**5%**
Unidentified bivalve	Clam or Mussel		**5%**
Plant material			**100%**
Lichens			**15%**
Fir or hemlock needles			**90%**
Cedar needles			**65%**
Moss			**50%**
Twigs			**40%**
Bark			**15%**
Grass			**20%**
Seeds			**30%**
Angiosperm leaves			**35%**
Wood chips			**20%**
Rock			**10%**
Unidentified material			**40%**

[1] i.e., northern saw whet (*Aegolius acadius*), northern pygmy (*Glaucidium gnoma*) or western screech (*Otus kennicottii*) owl

Genetic Analysis
We collected tissue samples from each of the 90 reintroduced fishers during the first 3 years of the project, as well as 2 kits that were rescued in June of 2010. Dr. Ken Warheit, Dr. Scott Blankenship and Cheryl Dean of WDFW's molecular genetics laboratory have extracted DNA from these samples and have conducted the initial genotyping work. They have used 25 microsatellite markers to successfully genotype each of the released fishers and will use these genotyping data to evaluate the heterozygosity, allelic richness and effective population size of the founding population under several scenarios. These scenarios include: 1) an evaluation of these characteristics of just the 49 fishers released in years 1 and 2 of the project, 2) an evaluation of the full founder population of 90 fishers, and 3) an evaluation that excludes founders that could not contribute genes to future generations (19 females that died will be excluded from the analysis). Genotype data provided by WDFW's molecular genetics laboratory will also provide essential baseline information for the long-term monitoring program. During this program, we will use these baseline data to identify individual fishers from the DNA in hair collected at survey stations deployed across the study area.

Expectations for Year 4 of the Project
In year 4, we will continue to track fishers released in years 2 and 3 that have functioning radio-collars. Through the spring and summer months we will locate suspected den sites and confirm reproduction. Our efforts to document denning will allow us to collect fisher scats at den and rest sites, which we will use when we initiate a complete analysis of food habits data after the completion of year 4 field activities if funding is available. We will have a completed report of the genetic characteristics of the 90 fishers in the founding population and this information will be used to identify surviving founders and offspring during our long-term monitoring program for fishers across the Olympic Peninsula. During years 4 and 5 of the project we will continue to refine the long-term monitoring strategy and we will also focus our efforts on data analysis and the preparation of manuscripts for publication.

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Appendix 1. Data associated with the capture, processing, transport, release and monitoring of the 90 individuals in the founding population.

Animal Number	Study Year	Sex	Capture Date	Release Date	Days Captive	Age upon release	Age Class	Weight (kg)	Fate as of 31 Dec 2010[1]	Number relocations as of 31 Dec 2010	Number Days monitored[2]
2008F001	Y1	F	14-Dec-07	27-Jan-08	44	0	Juvenile	3.4	Dead	105	877
2008M002	Y1	M	26-Dec-07	27-Jan-08	32	1	Sub-adt	4.3	Unknown	3	444
2008F003	Y1	F	27-Dec-07	27-Jan-08	31	2	Adult	1.8	Unknown	51	428
2008F004	Y1	F	29-Dec-07	27-Jan-08	29	2	Adult	2.5	Unknown	110	852
2008M005	Y1	M	5-Jan-08	27-Jan-08	22	4	Adult	5.4	Dead	33	257
2008F006	Y1	F	6-Jan-08	27-Jan-08	21	1	Sub-ad	2.8	Unknown	87	869
2008F007	Y1	F	6-Jan-08	27-Jan-08	21	2	Adult	2.9	Unknown	105	806
2008F008	Y1	F	7-Jan-08	2-Mar-08	55	3	Adult	2.7	Dead	14	32
2008M009	Y1	M	9-Jan-08	27-Jan-08	18	0	Juvenile	4.6	Unknown	36	234
2008M010	Y1	M	13-Jan-08	27-Jan-08	14	1	Sub-ad	3.9	Unknown	37	402
2008M011	Y1	M	13-Jan-08	27-Jan-08	14	1	Sub-ad	4.2	Unknown	88	942
2008F012	Y1	F	16-Jan-08	27-Jan-08	11	2	Adult	2.0	P Dead	26	311
2008F013	Y1	F	25-Jan-08	2-Mar-08	37	0	Juvenile	3.1	Dead	119	639
2008M014	Y1	M	13-Feb-08	2-Mar-08	18	1	Sub-ad	5.4	Unknown	29	689
2008F015	Y1	F	14-Feb-08	2-Mar-08	17	n/d	Adult	2.6	P Dead	10	46
2008F016	Y1	F	15-Feb-08	2-Mar-08	16	1	Sub-ad	2.8	Unknown	65	907
2008F017	Y1	F	23-Feb-08	2-Mar-08	8	0	Juvenile	2.9	Unknown	79	785
2008F018	Y1	F	29-Feb-08	2-Mar-08	2	1	Sub-ad	2.6	Unknown	72	831
2009F019	Y2	F	3-Nov-08	21-Dec-08	48	4	Adult	2.6	Dead	11	107
2009M020	Y2	M	13-Nov-08	21-Dec-08	38	1	Sub-ad	5.2	Unknown	20	466
2009F021	Y2	F	16-Nov-08	21-Dec-08	35	3	Adult	2.2	Dead	0	0
2009F022	Y2	F	23-Nov-08	21-Dec-08	28	1	Sub-ad	2.7	Unk	37	414
2009M023	Y2	M	29-Nov-08	21-Dec-08	22	0	Juvenile	4.0	Alive	33	still active
2009F024	Y2	F	30-Nov-08	21-Dec-08	21	0	Juvenile	2.8	Alive	43	still active
2009F025	Y2	F	30-Nov-08	21-Dec-08	21	0	Juvenile	2.7	Dead	41	317
2009F026	Y2	F	30-Nov-08	21-Dec-08	21	2	Adult	2.6	Dead	12	80
2009F027	Y2	F	30-Nov-08	21-Dec-08	21	2	Adult	2.5	Alive	30	still active
2009F028	Y2	F	6-Dec-08	21-Dec-08	15	n/d	Sub-ad	2.5	Dead	20	218
2009F029	Y2	F	8-Dec-08	17-Jan-09	40	2	Adult	2.9	Dead	7	68
2009M030	Y2	M	11-Dec-08	17-Jan-09	37	1	Sub-ad	4.1	Alive	33	still active
2009M031	Y2	M	11-Dec-08	21-Dec-08	10	0	Juvenile	4.5	Dead	13	129
2009M032	Y2	M	14-Dec-08	21-Dec-08	7	0	Juvenile	3.7	Unknown	32	647
2009F033	Y2	F	13-Dec-08	21-Dec-08	8	1	Sub-ad	2.6	Dead	32	222
2009M035	Y2	M	18-Dec-08	21-Dec-08	3	0	Juvenile	4.1	Unknown	43	466
2009F036	Y2	F	19-Dec-08	17-Jan-09	29	4	Adult	2.4	Dead	2	5
2009M037	Y2	M	22-Dec-08	17-Jan-09	26	1	Sub-ad	3.9	Dead	2	11

Appendix 1. continued.

Animal Number	Study Year	Sex	Capture Date	Release Date	Days Captive	Age upon release	Age Class	Weight (kg)	Fate as of 31 Dec 2010[1]	Number relocations as of 31 Dec 2010	Number Days monitored[2]
2009M039	Y2	M	23-Dec-08	17-Jan-09	25	1	Sub-ad	4.3	Unknown	4	55
2009F040	Y2	F	26-Dec-08	17-Jan-09	22	0	Juvenile	2.1	P Dead	1	0
2009F041	Y2	F	24-Dec-08	17-Jan-09	24	1	Sub-ad	2.3	Dead	12	146
2009M042	Y2	M	27-Dec-08	17-Jan-09	21	0	Juvenile	4.6	Unknown	4	72
2009F043	Y2	F	30-Dec-08	17-Jan-09	18	4	Adult	2.1	Dead	39	548
2009F044	Y2	F	31-Dec-08	17-Jan-09	17	0	Juvenile	1.9	Dead	5	55
2009M045	Y2	M	3-Jan-09	17-Jan-09	14	0	Juvenile	3.9	P Dead	21	355
2009F048	Y2	F	8-Jan-09	17-Jan-09	9	1	Sub-ad	2.5	Alive	30	still active
2009F049	Y2	F	8-Jan-09	17-Jan-09	9	n/d	Adult	2.6	Dead	2	11
2009F050	Y2	F	14-Jan-09	17-Jan-09	3	0	Juvenile	2.7	Dead	19	401
2009M051	Y2	M	14-Jan-09	17-Jan-09	3	0	Juvenile	3.6	Unknown	18	368
2009F054	Y2	F	16-Jan-09	23-Feb-09	38	0	Juvenile	3.0	Dead	9	98
2009F055	Y2	F	30-Jan-09	23-Feb-09	24	0	Juvenile	2.6	Dead	3	108
2010M056	Y3	M	4-Nov-09	24-Dec-09	50	0	Juvenile	4.7	Alive	18	still active
2010F057	Y3	F	9-Nov-09	24-Dec-09	45	0	Juvenile	2.4	Alive	26	still active
2010M058	Y3	M	15-Nov-09	24-Dec-09	39	1	Sub-ad	4.6	Alive	12	still active
2010M059	Y3	M	21-Nov-09	24-Dec-09	33	2	Adult	5.3	Unknown	2	84
2010M060	Y3	M	24-Nov-09	24-Dec-09	30	0	Juvenile	4.5	Unknown	14	228
2010M061	Y3	M	4-Dec-09	24-Dec-09	20	0	Juvenile	4.2	Alive	17	still active
2010M062	Y3	M	5-Dec-09	24-Dec-09	19	0	Juvenile	4.6	Unknown	11	123
2010M063	Y3	M	7-Dec-09	24-Dec-09	17	2	Adult	4.5	Dead	11	84
2010M064	Y3	M	9-Dec-09	24-Dec-09	15	3	Adult	5.7	Unknown	9	211
2010F065	Y3	F	11-Dec-09	24-Dec-09	13	0	Juvenile	2.0	Alive	28	still active
2010F067	Y3	F	12-Dec-09	24-Dec-09	12	0	Juvenile	2.0	Dead	15	116
2010F068	Y3	F	13-Dec-09	24-Dec-09	11	n/d	Adult	2.6	Alive	17	still active
2010M069	Y3	M	14-Dec-09	24-Dec-09	10	0	Juvenile	3.6	Dead	12	123
2010M070	Y3	M	16-Dec-09	24-Dec-09	8	0	Juvenile	3.8	Dead	9	176
2010F071	Y3	F	17-Dec-09	24-Dec-09	7	n/d	Juvenile	2.1	Dead	9	102
2010F072	Y3	F	18-Dec-09	24-Dec-09	6	2	Adult	2.4	Alive	9	still active
2010F073	Y3	F	22-Dec-09	21-Jan-10	30	0	Juvenile	2.6	Alive	17	still active
2010F074	Y3	F	24-Dec-09	21-Jan-10	28	1	Sub-ad	2.8	Alive	4	still active
2010M075	Y3	M	24-Dec-09	21-Jan-10	28	0	Juvenile	3.4	Alive	19	still active
2010F076	Y3	F	26-Dec-09	21-Jan-10	26	4	Adult	2.6	Alive	18	still active
2010M077	Y3	M	28-Dec-09	21-Jan-10	24	n/d	Juvenile	3.5	Alive	16	still active
2010F078	Y3	F	30-Dec-09	21-Jan-10	22	0	Juvenile	2.3	Alive	22	still active

Appendix 1. continued.

Animal Number	Study Year	Sex	Capture Date	Release Date	Days Captive	Age upon release	Age Class	Weight (kg)	Fate as of 31 Dec 2010[1]	Number relocations as of 31 Dec 2010	Number Days monitored[2]
2010M079	Y3	M	2-Jan-10	21-Jan-10	19	3	Adult	4.7	Unknown	16	112
2010F080	Y3	F	5-Jan-10	21-Jan-10	16	4	Adult	2.7	P Dead	26	287
2010F081	Y3	F	6-Jan-10	20-Feb-10	45	5	Adult	3.2	Dead	12	160
2010M082	Y3	M	12-Jan-10	21-Jan-10	9	0	Juvenile	3.4	Alive	14	still active
2010M083	Y3	M	16-Jan-10	21-Jan-10	5	1	Sub-ad	3.8	Alive	17	still active
2010M084	Y3	M	17-Jan-10	21-Jan-10	4	2	Adult	5.1	Unknown	5	84
2010F085	Y3	F	18-Jan-10	21-Jan-10	3	1	Sub-ad	2.2	Unknown	2	70
2010M086	Y3	M	19-Jan-10	20-Feb-10	32	0	Juvenile	5.0	Alive	17	still active
2010F087	Y3	F	20-Jan-10	20-Feb-10	31	1	Sub-ad	2.6	P Dead	3	61
2010F088	Y3	F	22-Jan-10	20-Feb-10	29	3	Adult	3.2	Dead	19	105
2010M089	Y3	M	25-Jan-10	20-Feb-10	26	0	Juvenile	3.8	Dead	3	16
2010F091	Y3	F	29-Jan-10	20-Feb-10	22	n/d	Adult	2.6	Dead	3	30
2010M092	Y3	M	29-Jan-10	20-Feb-10	22	2	Adult	6.0	Unknown	9	46
2010M093	Y3	M	1-Feb-10	20-Feb-10	19	1	Sub-ad	4.5	Alive	15	still active
2010F094	Y3	F	1-Feb-10	20-Feb-10	19	0	Juvenile	2.7	Dead	5	107
2010M096	Y3	M	7-Feb-10	20-Feb-10	13	1	Sub-ad	4.4	Unknown	48	124
2010M097	Y3	M	10-Feb-10	20-Feb-10	10	4	Adult	5.6	Unknown	30	109
2010F098	Y3	F	11-Feb-10	20-Feb-10	9	2	Adult	2.4	Alive	27	still active
2010M099	Y3	M	12-Feb-10	20-Feb-10	8	0	Juvenile	4.6	Alive	15	still active
2010M100	Y3	M	8-Jun-10	15-Oct-10	129	0	Juvenile	5.5	Alive	8	still active
2010M101	Y3	M	8-Jun-10	15-Oct-10	129	0	Juvenile	5.1	Alive	9	still active

[1]Alive= found alive within the past 3 months; Dead=carcass recovered; P Dead is presumed dead= collar on mortality mode but carcass not recovered; Unknown= Includes animals missing > 3 months, shed collars, known failed radios, or animal whose last known location was live and their radio is now past its' effective life.

[2]Number of days between the release date and date of the last live location for dead, presumed dead and unknown status animals. Individuals listed as still active were actively tracked (and alive) until 31 Dec 2010, which was used as the cut-off date for data used in this report.

Appendix 2. The use of Argos satellite collars on 5 male fishers released in year 3 of the project.

In January and February of 2010, we released 5 large (>4.5 kg) males that we equipped with 120g Argos satellite collars (Kiwisat 202 from Sirtrack Ltd., Havelock, New Zealand). These collars were effective for tracking the movements of both male and female fishers in a resources selection study in Idaho (J. Sauder, IDFG, pers. comm.), and initial tests of collars deployed throughout the study area indicated that data acquisition was sufficient to warrant the experimentation of these collars on fishers. We acquired used collars from Idaho Department of Fish and Game, and then had them refurbished by Sirtrack Ltd, at a cost savings of ~$1000 per collar over the purchase of new collars. The use of these collars on large males was done as an experiment to determine if we could improve our ability to track the post release movements of males and to determine if satellite collars would prove effective in the mountainous and forested terrain of the Olympic Peninsula. The programming of the collars provided for 1 6-hour transmission period every third day, from 4 am to 10 am. With this scenario, collar lifespan was estimated to be 25 months (757 days).

We did not see the results that we had hoped for with these collars. We were able to obtain a limited number of locations for each fisher (range:5-48, mean=21.6) for 46-124 days after release (mean = 95 days). Collars on released fishers provided intermittent locations, including both low quality (imprecise: >1000m precision) and high quality (precise to within 1000 m of the true location) for a short period of time, and then location quality and frequency diminished until collars failed to transmit signals at all and could not be located by satellites. One collar functioned long enough (124 days) to provide 48 locations (many of high quality), and thus documented, for the first time, fisher movement off of the Olympic Peninsula. These data may be sufficient to track his movements and to estimate a home range and describe seasonal resource selection. The other 4 collars provided too little data to be of use for survival, movements or resource selection analyses. The status of these male fishers is currently unknown.

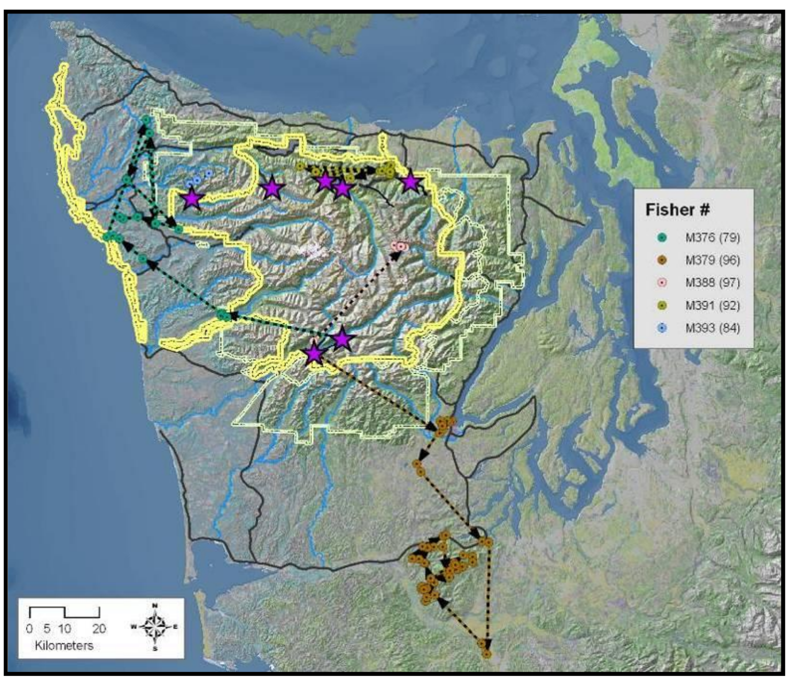

Figure 10. Locations and movements of 5 males with Argos satellite collars, from January–June 2010.