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Olympic Fisher Reintroduction Project: Progress Report 2008-2011



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Summary

This progress report summarizes the final year of activities of Phase I of the Olympic fisher restoration project. 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 released 90 fishers within Olympic National Park from 2008 to 2010. The reintroduction of fishers to the Olympic Peninsula was designed as an adaptive management project, including the monitoring of released fishers as a means to (1) evaluate reintroduction success, (2) investigate key biological and ecological traits of fishers, and (3) inform future reintroduction, monitoring, and research efforts.

This report summarizes reintroduction activities and preliminary research and monitoring results completed through December 2011. The report is non-interpretational in nature. Although we report the status of movement, survival, and home range components of the research, we have not completed final analyses and interpretation of research results. Much of the data collected during the monitoring and research project will be analyzed and interpreted in the doctoral dissertation being developed by Jeff Lewis; the completion of this dissertation is anticipated prior to April 2013. We anticipate that this work, and analyses of other data collected during the project, will result in several peer-reviewed scientific publications in ecological and conservation journals, which collectively will comprise the final reporting of work summarized here. These publications will include papers addressing post-release movements, survival, resource selection, food habits, and age determination of fishers.

Disclaimer

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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).

Following the listing of the fisher in Washington, WDFW developed a recovery plan for the species (Hayes and Lewis 2006). Because of the extirpation of fishers, the lack of nearby fisher populations to support recovery through natural recolonization, and the past success of reintroductions elsewhere, the recovery plan identified reintroductions to three

recovery regions of the state (Olympic, South Cascades, and North Cascades) as the primary strategy to recover the species in Washington. 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 et al. 2012). WDFW began planning a fisher reintroduction to the Olympic recovery region as a means to begin restoration of the species in Washington (Hayes and Lewis 2006, Lewis 2006).

A reintroduction feasibility study was completed in 2004 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, and ONP joined the reintroduction partnership with WDFW and Conservation Northwest. 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 reintroduction was initiated in the fall of 2007.

The goal of the Olympic fisher reintroduction project is to reestablish a self-sustaining population of fishers on the Olympic Peninsula. The reintroduction of fishers to the Olympic Peninsula was 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. This report provides a preliminary summary of progress made during the fourth (final) year (December 2010 – December 2011) 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 translocate British Columbia fishers to the Olympic Peninsula. Twenty-two members of the British Columbia Trappers Association from central British Columbia captured fishers for the reintroduction. In addition, 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.

Funding for the project has come from a number of sources including the U. S. Geological Survey, U. S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Doris Duke Foundation and the Wildlife Conservation Society, National Park Service, National Park Service Donations, and Washington's National Parks Fund.

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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; Lewis et al. 2010, 2011). From 2008 to 2010, 90 fishers were successfully captured in central British Columbia, transported to Washington and released in Olympic National Park (Appendix 1). Eighteen fishers released in the park in Year 1 of the project were monitored via radio-telemetry for up to 30 months (January 2008 to August 2010); 31 released in Year 2 were monitored for up to 24 months (December 2008 to January 2010); and 41 released in Year 3 were monitored for up to 24 months (December 2009 to December 2011; Appendix 1). The last telemetry locations were obtained in December of 2011.

As planned, no additional fishers were captured or released in 2011. Activities in 2011 included the continued data collection associated with the research and monitoring of fishers released from 2008 to 2010.

Reintroduction Success Monitoring

Our monitoring efforts have 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. Our initial goal was to locate each collared fisher once per week; however inclement weather, poor flying conditions and logistical considerations often prevented us from obtaining locations. As a result, our goal was revised to obtain a minimum of at least one location per month for each fisher. For more accessible individuals, we also obtained ground telemetry locations using homing and triangulation procedures. The ground locations allowed us to locate and describe fisher rest and den sites and to discover scats for an analysis of food habits.

Movements

From 2008 to 2011, we tracked the movements of each released fisher for as long as its radio-transmitter functioned. We were able to track several fishers for over 2 years, but contact was lost with many fishers before 2 years elapsed. Most newly released fishers made large movements as they explored a new environment, however a few appeared to find and occupy a home range very shortly (within a month) after being released. Almost all fishers established a home range in <1 year after being released, but most established a home range after the breeding season (March-May). We will analyze the timing and distance of post-release movements in relation to sex, age, release year, and body condition to determine if these factors influence the movement behaviors or the establishment of a home range.

During 2011, we monitored the movements of 18 of the 41 fishers that were released in year 3 (2010) of the reintroduction (Figure 1). The small number of fishers monitored in 2011 reflected the high rate of radio-collar failure as well as mortality of fishers during 2010. Our goal was to accumulate telemetry locations for these 18 individuals to allow us to estimate a home range for each fisher and to evaluate resource selection. In 2011, most of these 18 fishers occupied a localized area (e.g., F068, F074, F098; Figure 1) or made only small, temporary forays away from the occupied area (e.g., M077, M093; Figure 1). Several fishers moved during the breeding season and subsequently could not be found (M075, M032; Figure 1). Fishers tracked during 2011 did not make the long distance movements typical of newly released fishers (Lewis and Happe 2009, Lewis et al. 2010, 2011).

Survival

We determined the survival status of each radio-collared fisher by noting whether their radio-collar was emitting a faster radio-transmitter pulse-rate (a mortality signal of 72 beats per minute vs the normal 42 beats per minute). A mortality signal is emitted when a collar has remained motionless for ≥ 6 hours, which indicates that the 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. From 2008 through 2011, we detected mortality signals for 46 fishers and independently recovered 5 dead fishers (F013, F049, F071, M031, M039) without the aid of a mortality signal (e.g., road-killed fishers recovered by members of the public). We were able to determine that 30 (65.2%; 23F, 7M) of the 46 fishers with collars emitting a mortality signal had died (Appendix 1). Of the remaining 16 collars emitting a mortality signal, no assessment of

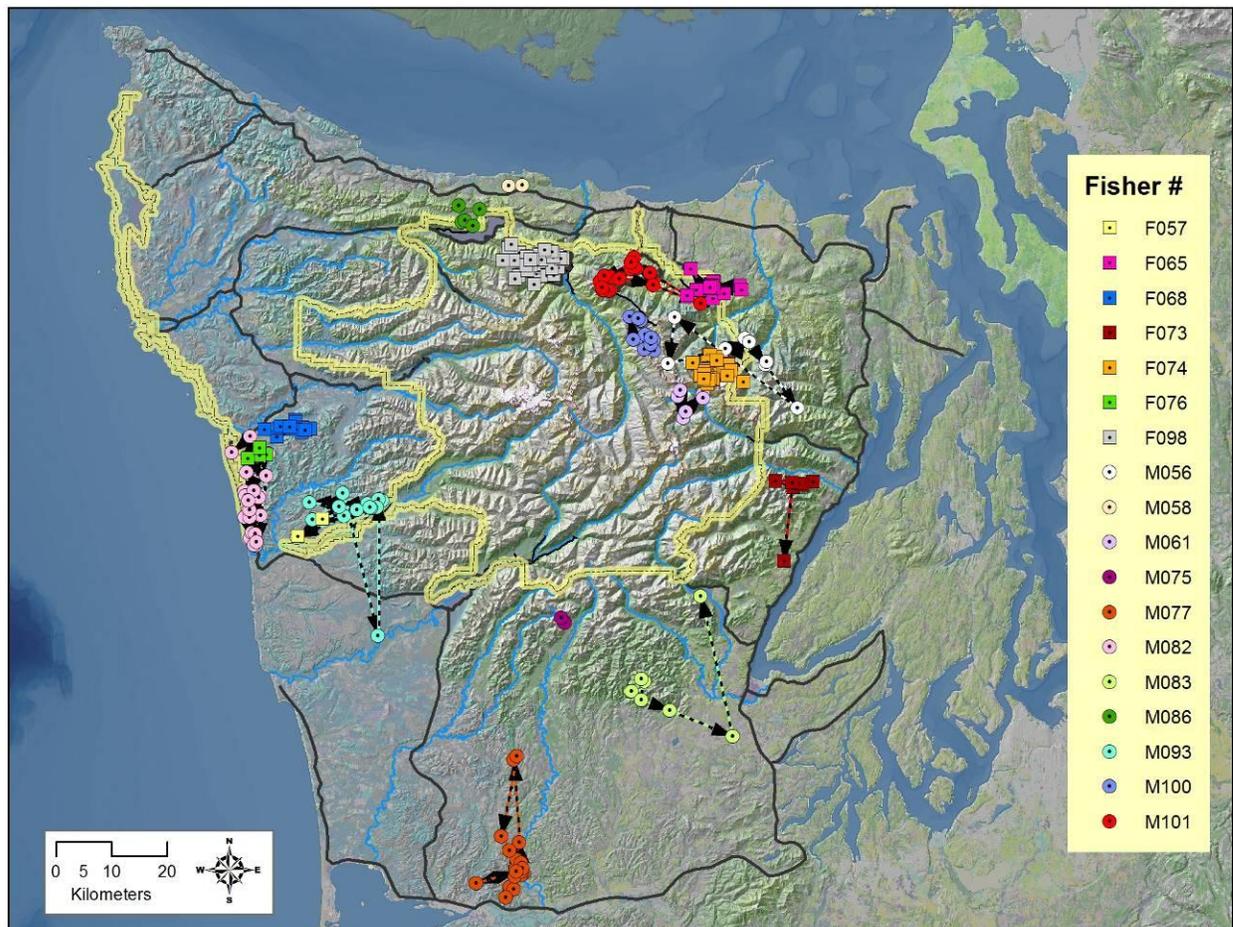


Figure 1. Telemetry location and movements of the 18 fishers tracked in 2011; all 18 fishers were released in year 3 of the reintroduction. The movements of M056, M077, M083 and M093 occurred during the breeding season (March-May).

fate of the fisher could be made for 12 collars (26.1%; 7F, 5M) because the collar was inaccessible; 3 collars had come off the fisher (6.5%; 2F, 1M); and one collar that was found appeared to have been cut by someone (2.2%; 1M). The histories and fates of two juvenile males (M100 and M101) are provided separately (Appendix 2). These 2 males were rescued after their mother (F088) was killed in May 2010. They were subsequently raised in captivity, then radio-collared and released in Olympic National Park in October, 2010.

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

The survival status (alive vs. dead) during their first year following release was known for 17 of the 18 fishers released in year 1, 29 of the 32 released in year 2, and 32 of the 41 released in year 3 (Table 1). Percent survival was not calculated for 2011 for the Year-3

Table 1. 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	9	0	50.0	12.1
		M	23	9	4	10	69.2	9.6
		All	41	18	13	10	61.3	7.7
	2011	F	9	2	1	6	--- ⁶	
		M	9	0	2	7	--- ⁶	
		All	18	2	3	13	--- ⁶	

¹Survival rate calculations were based on a 1 January to 31 December time interval each year.

²Includes fishers presumed dead, but could include fishers that are alive but lost their collar.

³includes 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. Note: Preliminary estimates assume that all 12 collars that transmitted a mortality signal, but were not retrieved, represented mortalities.

⁵Standard error of the survival estimate (based on a sample from a binomial population; Zar 1984: 377)

⁶% survival was not calculated for this year for this cohort because most individuals alive at the beginning of the year were lost as a result of radio-collar failure. Given the large number of censored animals, a calculated survival rate for this year would lack validity.

cohort because most individuals alive at the beginning of the year were lost as a result of radio-collar failure. As a result these missing individuals were censored from the survival calculation (Table 1). Given the large number of censored individuals, a calculated survival rate for this year would lack validity.

We will use Program Mark (White and Burnham 1999) to generate survival estimates for all fishers with sex, age, release year, genetic haplotype and body condition incorporated as covariates in the analysis.

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 of predation the species of predator, of some of the fishers that died. From 2008 to 2011, we recovered the remains of 35 released fishers (26 F, 9 M; Table 2, Appendix 1); cause of death is known for 23 (65.7%; 18 F, 5 M) of these. Among known causes of mortality, predation and vehicle strikes were the most common causes (Table 2). Forensic evidence indicated that two females (F008 and F026) died as the result of bobcat predation and one female (F065) died as a result of mountain lion predation (G. Wengert, UC Davis, unpubl. data).

Table 2. Cause of death of fishers recovered from January 2008 to December 2011.

Cause of death	Females	Males	All (%)
Predation	10	3	13 (37.1)
Vehicle strike	5	2	7 (20.0)
Unknown	6	0	7 (17.1)
Unknown (possible predation)	2	4	6 (17.1)
Drowning	2	0	2 (5.7)
Trapping related ^a	1	0	1 (2.9)
total	26	9	35 (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. While we have not yet analyzed home ranges of the released fishers, preliminary results indicate that fishers concentrated their use in localized areas during their first year in a variety of landscapes that ranged from mountainous terrain to coastal plains and included federal, state, private, and tribal ownerships (Figure 2). The date when a fisher began its use of a localized area varied among fishers; some would use a localized area soon after being released while others moved extensively for 6-10 months before using a localized area.

We have ≥ 20 home range locations for 20 female and 11 male fishers. We will estimate home range sizes for these 31 fishers using fixed kernel and minimum convex polygon methods. These ranges will also be used to assess used ranges in comparison to available (generated spatially random) ranges in an analysis of fisher resource selection.

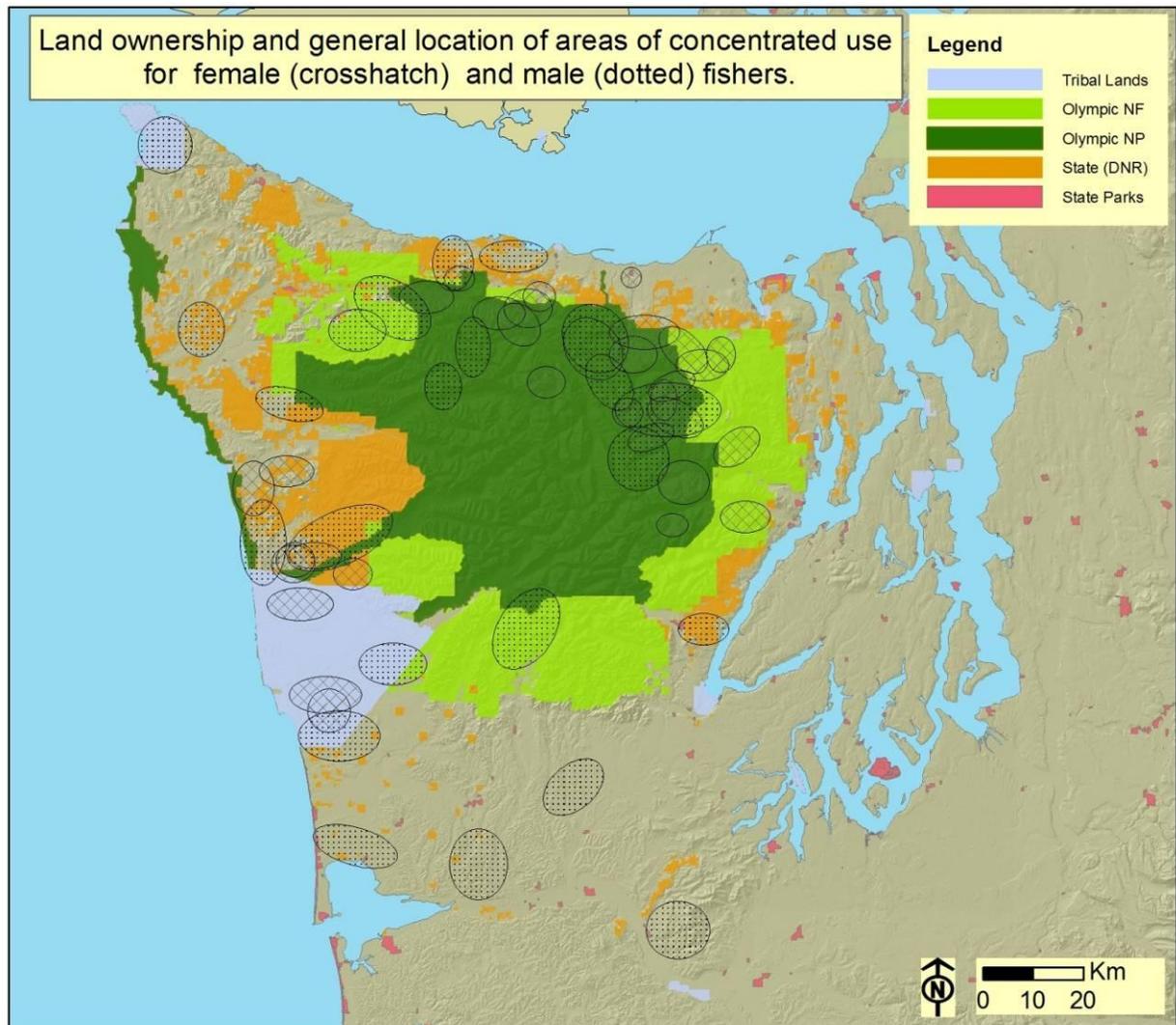


Figure 2. Areas of concentrated use by male and female fishers on the Olympic Peninsula, 2008-2011.

Reproduction

Because the production and recruitment of young are critical to population persistence, reproduction is an important indicator of reintroduction success. We closely monitored the movements of females during the denning season (late March-July) to identify possible denning behaviors of females. 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. It frequently took several trips into the suspected denning area to identify a radio-collared female within a potential natal den; and in some cases we never found the female within a den. We used two methods to document reproduction. When 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.

Prior to 2011, we documented the production of 6 litters by 6 females (F004, F007, F022, F033, F080 and F088; Figure 3; Lewis et al. 2011). It is likely that other litters were produced that we were unable to document. Litter sizes ranged from ≥ 1 to 4 kits. Litters of 4 kits were produced by females F004 and F007; litters as large as 4 kits had not been previously reported for fishers in western North America.

In 2011, we investigated possible reproduction by five females (F065, F068, F074, F078, F098); we were able to confirm reproduction for only one (F065; Figure 3). F065 was released in year 3 (on 24 December 2009) as a juvenile and mated with a male in Washington when she was approximately 1-year-old, in March-May of 2010. In mid-April, 2011, F065 was located at a suspected den site and was photographed regularly revisiting this site. On 16 April, she was photographed moving 2 kits from the den site. Unfortunately F065 was killed by a mountain lion between 11 May and 18 May 2011, before we could locate her 2nd den site and her kits.

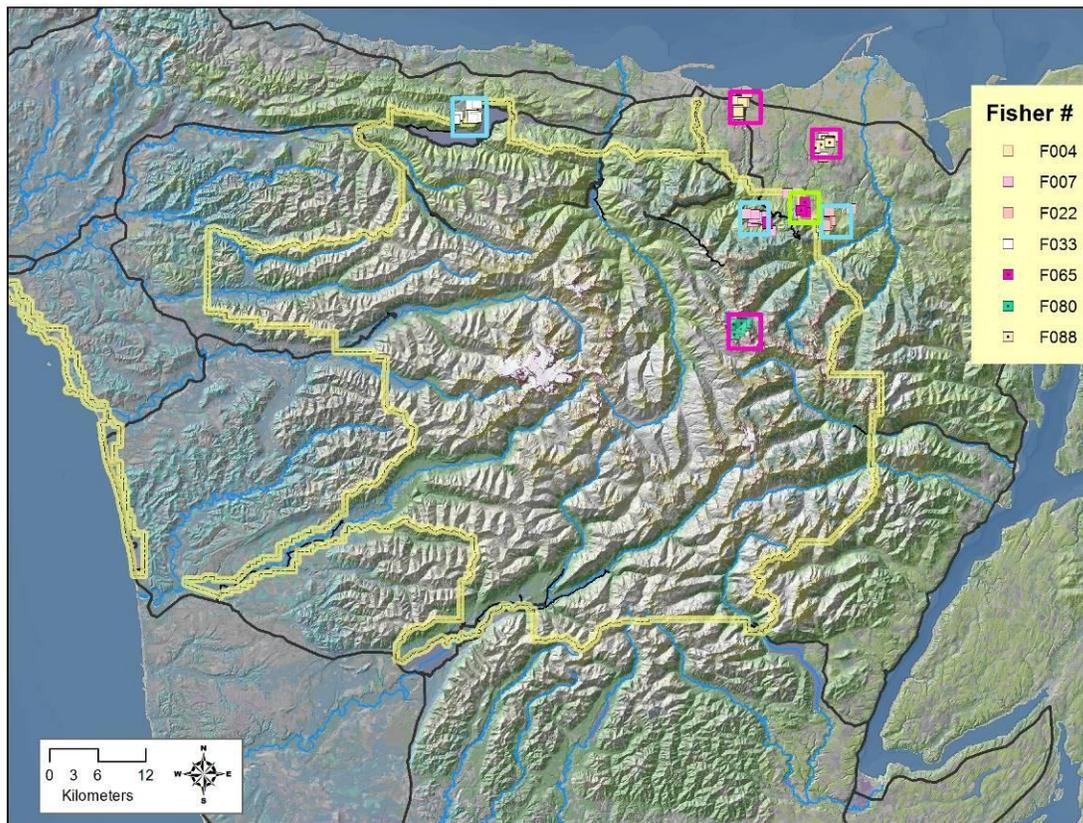


Figure 3. Confirmed den sites of reintroduced female fishers; den sites found in 2009 are in blue boxes, those located in 2010 are in magenta, and F065's den site in 2011 is in light green. The presence of kits (from 1-4 kits) was confirmed by photo documentation at each site. Among the seven dens found, three were located in Olympic National Park (F007, F033, F080), two were located in Olympic National Forest (F022, F065), one on Washington Department of Natural Resources land (F088) and one on private land (F004).



Figure 4. Female F065 carrying one of two kits she moved from her den on 16 April 2011. The large western red cedar in the left side of the photo was her first den site. This den site was located on U.S. Forest Service land near the northeastern boundary of Olympic National Park (Figure 3).

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 conducted a scat analysis pilot study in 2010 to determine the feasibility of detecting prey items. Using 20 scat samples collected from female F033's den site, we found mammal remains in 90% of scat samples, arthropod remains in 70%, and bird remains in 25% (Lewis et al. 2011). Plant material was found in 95% of the samples but it was not clear to what extent fishers consumed plant material intentionally because plant material can adhere to defecated scat and can be incidentally included in scat samples.

During 2011 we obtained 3 GI tracts from recovered fishers (F065, M039, M093). Our inventory of data to be analyzed now includes 180 scats from den and rest sites and 14 GI tracts from recovered fishers. We have not yet acquired funding to analyze fisher diets in the Olympic Reintroduction Area; however we submitted funding proposals in 2011 to conduct this analysis.

Genetic Analysis

We collected tissue samples from each of the 90 reintroduced fishers, 10 BC fishers that were not suitable for translocation, and two juvenile males that were rescued in June of 2010 and released in the park when they were full-grown. Dr. Ken Warheit, Cheryl Dean, Dr. Scott Blankenship, and Dr. Todd Seamons of WDFW's molecular genetics laboratory extracted DNA from these samples, used 22 microsatellite markers to genotype each sample, and used these genotypes to evaluate the genetic characteristics of the reintroduced population.

Seamons and Dean (2011) analyzed the genotypes of the 90 released fishers and found a mean of 4.77 alleles per locus, and a mean observed (H_o) and expected heterozygosity (H_e) of 0.53 and 0.54, respectively, for 22 sampled loci. Preliminary findings for historical fisher specimens from the Olympic Peninsula indicated a mean of 4.4 alleles per locus and a mean H_e of 0.63, for 10 loci (Schwartz 2007a). Seamons and Dean (2011) also found that most fishers were unrelated, as indicated by a low mean-relatedness score (mean pairwise $R_{xy} = -0.02$) for the 90 founding individuals. They found four mitochondrial DNA haplotypes in the reintroduced population including haplotype 4 (18.8% of fishers), haplotype 6 (28.8%), haplotype 7 (11.1%), and haplotype 9 (41.1%). Using 50 historical fisher specimens from Washington, Schwartz (2007b) found 3 haplotypes including haplotype 1 (78%), haplotype 4 (20%) and haplotype 6 (2%).

The genetic diversity added to the population with the year-3 release of 41 fishers was investigated by Seamons and Dean (2011). They found that an average of 0.3 alleles/locus were added to the population when the additional 41 fishers were added to the population. When they removed the 20 females that could not have reproduced (i.e., they died before they could produce independent kits), Seamons and Dean found that the average number of alleles/locus was reduced by only 0.04 alleles. While these findings speak to the level of genetic diversity that is gained or lost by adding or removing individuals from a founding population, there is currently no meaningful way to translate these changes in genetic diversity into a probability that a reintroduction will succeed (T. Seamons, WDFW, pers. comm.).

Future Work

Work in 2012 will focus on analyzing the data collected from 2008 to 2011. These analyses will include an assessment of post-release movements, estimation of home range size, survival, and landscape-scale resource selection patterns. Much of the monitoring and research project will be reported on in greater detail in the doctoral dissertation being developed by Jeff Lewis and future peer-reviewed scientific publications.

In collaboration with a number of other researchers, we submitted proposals for funding in 2011 to support three research projects associated with the Olympic Fisher Reintroduction. First, we are seeking funding to conduct a long-term monitoring program on the Olympic Peninsula to assess the success of the fisher reintroduction. This program will place hair snares and camera stations throughout a broad area of the Olympic Peninsula to assess fisher occupancy, abundance and population genetic characteristics. Second, we are seeking funding to conduct an analysis of fisher food habits using the scats, prey remains and GI tracts that we collected from 2008 to 2011. Third, we anticipate using the genotype data from the founding population and data from historical fisher specimens from Washington to assess their levels of genetic diversity and degree of similarity.

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Appendix 1. Data associated with the capture, processing, transport, release and monitoring of the 90 fishers from British Columbia comprising the founding population on the Olympic Peninsula in Washington state.

Animal Number	Study Year	Sex	Capture Date	Release Date	Days Captive	Age upon release	Age Class	Weight (kg)	Fate as of 31 Dec 2011 ¹	Number relocations by 31 Dec 2011	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	Unknown	33	652
2009F024	Y2	F	30-Nov-08	21-Dec-08	21	0	Juvenile	2.8	P Dead	44	779
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	Unk	30	719
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	Unknown	36	732
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 2011 ¹	Number relocations by 31 Dec 2011	Number Days monitored ²
2009M039	Y2	M	23-Dec-08	17-Jan-09	25	1	Sub-ad	4.3	Dead	3	871
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	Unknown	34	746
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	P Dead	3	108
2010M056	Y3	M	4-Nov-09	24-Dec-09	50	0	Juvenile	4.7	P Dead	26	526
2010F057	Y3	F	9-Nov-09	24-Dec-09	45	0	Juvenile	2.4	Unknown	29	391
2010M058	Y3	M	15-Nov-09	24-Dec-09	39	1	Sub-ad	4.6	Unknown	14	404
2010M059	Y3	M	21-Nov-09	24-Dec-09	33	2	Adult	5.3	P Dead	2	469
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	P Dead	21	481
2010M062	Y3	M	5-Dec-09	24-Dec-09	19	0	Juvenile	4.6	P Dead	11	383
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	Dead	46	510
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	Unknown	31	575
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	Unknown	9	351
2010F073	Y3	F	22-Dec-09	21-Jan-10	30	0	Juvenile	2.6	Unknown	24	501
2010F074	Y3	F	24-Dec-09	21-Jan-10	28	1	Sub-ad	2.8	Alive	39	684
2010M075	Y3	M	24-Dec-09	21-Jan-10	28	0	Juvenile	3.4	Unknown	20	355

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 2011 ¹	Number relocations by 31 Dec 2011	Number Days monitored ²
2010F076	Y3	F	26-Dec-09	21-Jan-10	26	4	Adult	2.6	Unknown	22	377
2010M077	Y3	M	28-Dec-09	21-Jan-10	24	n/d	Juvenile	3.5	Unknown	35	560
2010F078	Y3	F	30-Dec-09	21-Jan-10	22	0	Juvenile	2.3	Alive	41	679
2010M079	Y3	M	2-Jan-10	21-Jan-10	19	3	Adult	4.7	Unknown	16 ³	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	Unknown	35	589
2010M083	Y3	M	16-Jan-10	21-Jan-10	5	1	Sub-ad	3.8	Unknown	25	442
2010M084	Y3	M	17-Jan-10	21-Jan-10	4	2	Adult	5.1	Unknown	5 ³	84
2010F085	Y3	F	18-Jan-10	21-Jan-10	3	1	Sub-ad	2.2	Dead	2	70
2010M086	Y3	M	19-Jan-10	20-Feb-10	32	0	Juvenile	5.0	Unknown	22	367
2010F087	Y3	F	20-Jan-10	20-Feb-10	31	1	Sub-ad	2.6	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 ³	46
2010M093	Y3	M	1-Feb-10	20-Feb-10	19	1	Sub-ad	4.5	Dead	28	458
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 ³	124
2010M097	Y3	M	10-Feb-10	20-Feb-10	10	4	Adult	5.6	Unknown	30 ³	109
2010F098	Y3	F	11-Feb-10	20-Feb-10	9	2	Adult	2.4	P Dead	70	654
2010M099	Y3	M	12-Feb-10	20-Feb-10	8	0	Juvenile	4.6	Unknown	15	249

¹Alive= 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.

²Number 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 2011, which was used as the cut-off date for data used in this report.

³This male was equipped with an Argos satellite collar that failed shortly after the fisher was released.

Appendix 2. Histories and fates of fisher males M100 and M101.

The survival data available for males M100 and M101 were not included in survival calculations because their histories and fates involved an intervention by project biologists.

On 8 June 2010, fisher female F088 was found dead after she was killed by a bobcat. Two kits, males M100 and M101, were recovered from her den later that day. These two males were taken to Northwest Trek Wildlife Park on 10 June 2010, where they were raised for the purpose of releasing back to Olympic National Park when they were fully grown. When they reached adult male weights and were capable of killing and eating small and mid-sized wild mammals, males M100 and M101 were radio-collared on 14 October, 2010 and released in Olympic National Park on 15 October, 2010. Both males were tracked weekly via aerial-telemetry flights and were found to use areas not far from where they were released.

On 23 May 2011, a mortality signal was detected for male M100. Using telemetry equipment to locate the collar, project biologists found a broken collar, indicating that his collar came off while M100 was still alive. He had survived at least 189 days (6 months, 8 days) since being released; his status is currently unknown.

On 28 July 2011, a mortality signal was also detected for male M101. A broken collar was all that was found by project biologists, indicating that M101's collar came off while he was still alive. He had survived at least 255 days (8 months, 14 days) since being released. His status is currently unknown.

These observations are significant for several reasons. First, it was not known if wild kits could be raised in captivity and successfully released in the wild with any hope of success. These 2 males grew very quickly and learned to capture, kill and eat live, wild prey effectively in a captive setting. Second, while it may be possible to raise these kits in captivity, it was not known if they could survive for very long in the wild. These 2 kits exceeded expectations by surviving at least 6 months (M100) and 8 months (M101). This indicates that rescued fishers raised in captivity and released back to the wild can survive a significant time. Third, these observations indicate that the 2 males survived long enough to potentially mate and contribute demographically and genetically to the population. This experience indicates that raising rescued fishers for release back to the wild may be a sound conservation investment.

