

**From:** [Guinotte, John](#)  
**To:** [Betty Grizzle](#)  
**Subject:** Fwd: Wolverine and trapping  
**Date:** Thursday, March 9, 2017 1:36:51 PM  
**Attachments:** [Weir\\_fisher\\_wolv\\_pop\\_delineation\\_overview.docx](#)

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Hi Betty, You want me to set up this call for tomorrow? Probably best to have it before our FWS call. If yes, what time works for you?  
Best, John

John Guinotte  
Fish and Wildlife Biologist  
Ecological Services  
U.S. Fish and Wildlife Service  
Mountain Prairie Region 6  
134 Union Blvd., Lakewood, CO 80228  
303-236-4264  
[john\\_guinotte@fws.gov](mailto:john_guinotte@fws.gov)

----- Forwarded message -----

**From:** **Weir, Rich ENV:EX** <[Rich.Weir@gov.bc.ca](mailto:Rich.Weir@gov.bc.ca)>  
**Date:** Thu, Mar 9, 2017 at 1:24 PM  
**Subject:** RE: Wolverine and trapping  
**To:** "Guinotte, John" <[john\\_guinotte@fws.gov](mailto:john_guinotte@fws.gov)>, Betty Grizzle <[betty\\_grizzle@fws.gov](mailto:betty_grizzle@fws.gov)>  
**Cc:** Bill Harrower <[harrower@biodiversity.ubc.ca](mailto:harrower@biodiversity.ubc.ca)>

Sure, I will be around tomorrow if you want to chat. I've included the proposal outline for our population genetics project to give you a bit more background on what we are hoping to achieve. Bill Harrower (cc'd) is helping run the analysis.

Cheers,

Rich

Richard D. Weir, R.P.Bio. | Carnivore Conservation Specialist

Ecosystems Branch, Ministry of Environment

PO Box 9338 Stn Prov Govt | 4<sup>th</sup> Floor, 2975 Jutland Road

Victoria, BC | V8W 9M1 | 250.356.8186

**From:** Guinotte, John [mailto:[john\\_guinotte@fws.gov](mailto:john_guinotte@fws.gov)]  
**Sent:** Tuesday, March 7, 2017 13:48  
**To:** Weir, Rich ENV:EX; Betty Grizzle  
**Subject:** Re: Wolverine and trapping

Hi Rich,

Do you have some time to talk this week with Betty Grizzle and I about your genetics results from the 300 pelts? Betty is the lead biologist for us on the SSA we are working on.

Thanks John

On Thu, Mar 2, 2017 at 12:31 PM, Weir, Rich ENV:EX <[Rich.Weir@gov.bc.ca](mailto:Rich.Weir@gov.bc.ca)> wrote:

You are in luck – I just finished collating and compiling the wolverine harvest data for the province for 2007-2015. Let me know what you are looking for and I can probably help you out. It is public information, so easily share-able.

Rich

Richard D. Weir, R.P.Bio. | Carnivore Conservation Specialist

Ecosystems Branch, Ministry of Environment

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**From:** Shevenell Webb [mailto:[Shevenell.Webb@ab-conservation.com](mailto:Shevenell.Webb@ab-conservation.com)]  
**Sent:** Monday, February 27, 2017 11:01  
**To:** Guinotte, John  
**Cc:** Weir, Rich ENV:EX; Mowat, Garth FLNR:EX  
**Subject:** Re: Wolverine and trapping

Hi John,

I'm just checking with the Alberta government about releasing the data. I will get back to you once I can find out more. I don't know if there is a B.C. Furbearer Biologist, but Richard Weir or Garth Mowat might know how you could get B.C. wolverine harvest locations.

cheers, Shevenell

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Shevenell Webb, Wildlife Biologist

Alberta Conservation Association

phone: 207-242-2875

email: [shevenell.webb@ab-conservation.com](mailto:shevenell.webb@ab-conservation.com)

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**From:** Guinotte, John <[john\\_guinotte@fws.gov](mailto:john_guinotte@fws.gov)>

**Sent:** Monday, February 27, 2017 9:20 AM

**To:** Shevenell Webb

**Cc:** Betty Grizzle

**Subject:** Fwd: Wolverine and trapping

Dear Shevenell,

We are currently involved in a species status assessment for the wolverine in the lower 48 states and are trying to obtain all occurrence records, den sites, and trapline information for Alberta and BC. Would you be able to provide this information from your 2016 paper? And do you know who I should contact to obtain this information for BC? Happy to chat on the phone

if you prefer.

Many thanks,

John

John Guinotte, PhD  
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----- Forwarded message -----

From: **Doherty, Kevin** <[kevin\\_doherty@fws.gov](mailto:kevin_doherty@fws.gov)>

Date: Mon, Feb 27, 2017 at 6:54 AM

Subject: Fwd: Wolverine and trapping

To: Stephen Torbit <[stephen\\_torbit@fws.gov](mailto:stephen_torbit@fws.gov)>, "Guinotte, John" <[john\\_guinotte@fws.gov](mailto:john_guinotte@fws.gov)>

see below from Boyce. Two names for trap line. No effort data. Low density pops and little harvest is the short story from his experience.

----- Forwarded message -----

From: **Mark Boyce** <[boyce@ualberta.ca](mailto:boyce@ualberta.ca)>

Date: Sun, Feb 26, 2017 at 10:44 PM

Subject: Re: Wolverine and trapping

To: "Doherty, Kevin" <[kevin\\_doherty@fws.gov](mailto:kevin_doherty@fws.gov)>

Hi Kevin:

On Crown land (govt land in mtns) all trapping is restricted to registered traplines in Alberta. Although there has been an attempt to compile effort data, e.g., trap nights, it has not happened yet. On average about 50% of traplines are actively trapped in any particular year. Harvests of wolverines are rare in southern Alberta and BC. We know that they can move quite a long distance, especially young males, so there will be no surprise when wolverines are captured in southern Alberta and BC, but generally the densities are very low. I have a trapline at Nordegg and I had a wolverine ravaging my marten sets last year (2015). But it did not stick around and I never had an opportunity to trap him/her. We have a quota of 1 wolverine per trapline per year but I've never caught one.

Shevenell has compiled all wolverine harvest records from registered trapline fur reports, and I believe that these data would be the best available for Alberta. Similar records exist for BC.

I'm not sure that I told you anything new--we do not have records on trapping effort. And I doubt that trappers in southern areas are likely to be making many sets for wolverines. Most would be caught in wolf or lynx sets.

Cheers,

Mark

On Tue, Feb 21, 2017 at 1:04 PM, Doherty, Kevin <[kevin\\_doherty@fws.gov](mailto:kevin_doherty@fws.gov)> wrote:

Mark,

Some folks in the USFWS asked if I would reach out to you about your opinion on a potential Canada and United States boundary effect for Wolverine. Specifically, there is a desire to understand if there is any data on trapping effort and harvest totals for wolverines in southern B.C. and Alberta. From your Alberta Wolverine paper in JWM it appeared that wolverine trapping was low in the trapping record from Southern Alberta. So a couple questions:

Is there an information base that would include trapping effort and trapping success for wolverines that could be used to understand the potential effects of movement on Wolverine between the US and Canada?

If there is data, who would we need to contact to discuss getting access to the data?

Please let me know if you would like to discuss via the phone.

Cheers

Kevin

p.s. We have met a long time ago at the wildlife society meetings in Calgary, when I was a brand new Ph.D. student. When I was googling your information I saw that we were co-authors in Google Scholar, but could not figure out what the paper was. It looked this morning at my pubs, and it was Krissy Bush's Sage-grouse Genetics work.

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Kevin Doherty, PhD  
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## **PROJECT OVERVIEW**

### **Project Name**

Helping trappers ensure sustainable harvests of fisher and wolverine populations

### **Project Description**

This project aims to use landscape genetic analyses to identify functional population units for fishers and wolverines within BC. This information will be used to help trappers and wildlife managers better evaluate sustainable harvest levels for these wide-ranging, low-density species of conservation concern.

## **EXECUTIVE SUMMARY AND ISSUE**

### **Executive Summary**

Fishers and wolverines are wide-ranging, valuable furbearers of conservation concern that occur at low densities that preclude management of populations by individual trappers. Although good information exists on the distribution and abundance of the species and useful harvest guidance is available (e.g., Fur Management Guidelines), information on the extent of where populations occur, as well as size and sustainable harvest rates, is needed. This information will help trappers and other wildlife managers estimate sustainable harvest rates for each population, and assist the Conservation Data Centre to identify Element Occurrences and, in combination with evaluating threats, assess the viability of each population of fishers and wolverines.

This is a multi-phased project that will delineate functional populations of fishers and wolverines in BC and estimate the size and sustainable harvest of each population. Using this and other information, our team will engage individual trappers, the British Columbia Trappers Association, and other wildlife managers in sustainable management of these Class 2 furbearers. In Phase 1 (Years 1-3), these objectives will be met through the collection of genetic material from pelts of fishers and wolverines harvested from throughout BC and, using landscape genetics analyses, delineate populations and barriers that might exist among them. In Phase 2 (Year 4) of the program, we will combine this information with that on species distribution, abundance, and vital rates to estimate sustainable harvest rates for each functional population. We will facilitate enhanced management of the fur resource by developing and implementing an extension program targeted at trappers and other wildlife managers that make decisions regarding harvest of these species. Specific objectives of our project include:

1. Identify and delineate functional populations of fishers and wolverines in BC.
2. Estimate size and sustainable harvest for each functional population.
3. Engage individual trappers, the BC Trappers Association, and wildlife managers in co-operative active management of Class 2 furbearers.

### **Issue**

Fishers and wolverines are valuable furbearers for which conservation concern exists in BC; both species are on the BC Conservation Data Centre blue list and wolverines are designated as Special Concern by COSWEIC. Previous work has suggested that fishers and wolverines are “structured” into populations

(Kyle et al. 2001, Cegelski et al. 2006). That is, functional sub-populations likely exist; each able to support differing levels of harvest. Both are Class 2 species, which mean that populations cannot be managed by individual trapline holders and harvest rates in some areas may hamper the viability of local populations. Lofroth and Ott (2007) identified at least 15 areas with unsustainable harvest of wolverines, and although it has never been empirically evaluated, the annual harvest declined from 1750 in 1973 to 253 in 2011. Trappers may not know the sustainable harvest rate for these species, which limits their ability to manage for population sustainability. A biologically meaningful and appropriate spatial approach is needed to effectively estimate sustainable harvest levels for these species throughout BC.

Trappers have in-depth knowledge of their traplines, but are challenged by not knowing the extent, size, and sustainability of the populations from which they harvest. We will use landscape genetics analyses to delineate populations to solve this problem. We will help trappers inform trapline management with the best available science, thereby helping ensure that harvest levels are sustainable. This enhanced management will benefit the resource and trapping industry by improving the level of information upon which decisions are based.

## **OBJECTIVES**

### **PHASE 1 (2014-16)**

#### **Identify and delineate functional populations of fishers and wolverines in British Columbia.**

The first objective of the proposed project is to identify the metapopulation structure and delineate functional populations of fishers and wolverines in British Columbia. A function population is a spatially distinct population that has intrinsic demographics and genetic structuring relative to other populations, such that gene flow is restricted among populations and the demographics of each population functions somewhat independently of others. Our proposed activities build on prior genetic analyses for both species, which have been at very coarse scales (continental or sub-continental, e.g., Kyle et al. 2001, Schwartz et al. 2009) and sampled few locations in BC. Our project aims to assess the metapopulation structure across the entire province by evaluating genetic relationships at finer, regional spatial scales.

Each year, approximately 250 fishers and 140 wolverines are harvested by licensed trappers on registered traplines throughout British Columbia. Once trappers skin the animals, the pelts are scraped of moist tissue and air-dried prior to shipping (i.e., not treated with any chemicals). These pelts present an excellent opportunity to collect high-quality geo-referenced genetic samples for fishers and wolverines because each pelt is tied to a discrete geographic area (i.e., trapline). We propose to work with fur-traders to collect small samples of excess hide from stockpiled pelts prior to auction. This amount of dried tissue will provide excellent samples assuring a high rate of successful sequencing and PCR amplification (D. Paetkau, pers. comm.). Samples will be collected from pelts harvested from as many Wildlife Management Units as possible to ensure consistent spatial sampling (see attached map for spatial details of expected sampling). Because sex and age ratios of harvested animals are believed to be close to being representative of the population (Douglas and Strickland 1987, Banci 1994), we do not expect issues with under- or over-representation of any sex or age class in our sample. We propose

to collect samples from pelts harvested during the 2014 and 2015 trapping seasons during visits to participating fur-traders 3 times during each trapping season.

We anticipate collecting tissue samples from 300 fisher and 125 wolverine pelts during 2 trapping seasons and will complement with samples collected during previous research (approximately 220 fisher and 90 wolverine samples). We will sequence mitochondrial DNA and genotype nuclear microsatellite DNA from these samples using standard sequencing and PCR amplification techniques at commercial laboratory facilities (Wildlife Genetics International, Nelson, BC). The sex and individual genetic fingerprint will be identified for each sample. Previous studies on wolverine have demonstrated the importance of using both molecular markers to assess population structure and patterns of dispersal (Chappell et al. 2004, Cegelski et al. 2006). Comparing patterns between mitochondrial and microsatellite DNA markers can also allow us to understand the causes of population diversity and structure, including historical patterns of divergence and gene flow, sex-biased dispersal, and contemporary landscape and anthropogenic effects. To provide sufficient power to effectively delineate populations, we will genotype each sample at 15 or 16 microsatellite loci (slightly different for each species) following standard DNA fingerprinting techniques (e.g., Cegelski et al. 2006).

We will use a number of approaches to identify functional populations and assess the degree of differentiation among them. We will use maternally inherited mitochondrial DNA to examine genetic structure and diversity across each species' distribution. Standard measures of genetic diversity will be used, including haplotype frequency and diversity, and nucleotide diversity. Patterns of genetic structure and the processes responsible for the observed structure will be determined using techniques such as F-statistics, analysis of molecular variation, and nested clade analysis.

For the microsatellite data, we will use standard measures of genetic diversity such as the number of alleles per locus, Hardy-Weinberg proportion tests, and expected and observed heterozygosity. We will use a variety of assignment procedures and tests to evaluate population structuring, identify population clusters, and delineate functional populations. Based on the distribution and habitat use of wolverines and fishers in BC, knowledge of potential barriers to dispersal such as mountain ranges and rivers, and previous genetic studies, we can predict a number of putative populations for both species. We will first conduct an analysis without prior information on putative population structure to determine the number of populations and to assign individuals to these populations, using program STRUCTURE (Pritchard et al. 2000). This will provide an independent test of putative population structuring across BC. We will determine the spatial location and extent of delineated populations by linking the population clustering analyses to the geo-spatially explicit trapline information. This approach is feasible as assignment methods and tests have been used to delineate populations of several species, including wolverines in the contiguous USA (Cegelski et al. 2003) and grizzly bears in southeastern BC (Proctor et al. 2005). Assignment tests will also allow us to detect the presence of migrants between populations by determining the likelihood that an individual belongs to the population where it was sampled compared to that of another delineated population. We will subsequently evaluate differentiation among populations using analyses such as Nei's standard genetic distance, pairwise  $F_{st}$ , and the proportion of shared alleles. We will also estimate the association between geographic and genetic distance values using a 2-way Mantel test. Finally, we will use the methods of Palsbøll et al. (2007) to identify functional

populations based upon the amount of genetic divergence among samples and compare these results with those from the assignment tests.

This portion of the project will be considered successful if the following targets are achieved:

1. >200 fisher and >100 wolverine samples are collected from pelts harvested from throughout each species' distribution in BC during 2014 and 2015 trapping seasons by March 2016.
2. Samples are collected from 75% of traplines reporting harvests of fishers or wolverines during each trapping season by March 2016.
3. Collected samples are sequenced or genotyped and functional populations are identified by September 2016.
4. Functional populations are delineated for each species, with geospatial maps showing the distribution of each functional population within the province by March 2017.
5. A manuscript on the delineation of functional populations of fishers and wolverines is submitted for publication in a peer-reviewed scientific journal by March 2017.

We will evaluate each of these measures of success by determining if each task and deliverable has been achieved by the specified date. Delineation of functional populations (i.e., population units) for fishers and wolverines will be the operational outcomes of this objective.

There is a potential risk that the genetic information in the samples (e.g., number of samples or degree of genetic differentiation) will not be sufficient to adequately delineate functional populations. To help ensure the success of the first phase of our project, we will conduct a thorough assessment of power analysis after the first season of data collection, so that we will have a better idea if sufficient information exists to be able to reach our goal. For this reason, we will only proceed to activities in Phase 2 of this project provided that the above-mentioned targets are achieved.

## **PHASE 2 (2016-18)**

### **Estimate size and sustainable harvest for each functional population.**

Following population delineation, we will apply known species-specific information on the distribution and abundance of each species in the province to estimate the size of each functional population. We will use the peer-reviewed and published algorithms and methods of Lofroth and Krebs (2007) to estimate number of wolverines in each delineated population. Following this, we will apply the BC-specific vital rate data from Lofroth and Ott (2007) to determine sustainable harvest rates for each wolverine population. For fishers, we will follow the same approaches, but use data from Lofroth (2004), Weir and Corbould (2006), Weir et al. (2011), and Davis (2013) to estimate the number of individuals in each delineated population. Population vital rate data for fishers will be estimated through the analysis of survival and reproduction data of 4 regional radio-telemetry studies conducted on fishers in BC (Cariboo, Weir 1995; Williston, Weir and Corbould 2008; Chilcotin, Davis 2009; Peace, Weir et al. in prep), following the methods of Krebs et al. (2004) and Lofroth and Ott (2007). Sustainable harvest rates for each population will be estimated using the population vital rate data (i.e., rates of births and deaths), ensuring that spatial and temporal components of harvest are included in this estimation.

This activity is feasible because reliable BC-specific information has been collected during the course of research projects that have occurred over the past 20 years, most funded in part by the HCTF, including fisher studies in the Cariboo [1989-93], East Kootenay [1996-99], Chilcotin [2005-09], and Kiskatinaw [2005-09] regions; wolverine studies in the Columbia [1995-2000] and Cascades mountain ranges [2009-2012].

This portion of the project will be considered successful if the following measures are achieved:

1. Analyses of population vital rate data for fishers are completed by September 2017 (under contract).
2. A manuscript on population vital rates of fishers is submitted for publication in a peer-reviewed scientific journal by March 2018.
3. Population size and sustainable harvest rates are estimated for each population by December 2017.
4. Manuscripts on population size and sustainable harvest rates for fishers and wolverines in British Columbia are submitted for publication in a peer-reviewed scientific journal by March 2018.

We will evaluate each of these measures of success by determining if each task and deliverable has been achieved by the specified date. Operational outcomes of this objective include estimates of population size for each functional population, along with projected sustainable harvest rates for each species.

## **PHASE 2 (2016-18)**

Recognizing that trappers (and other wildlife managers) are the primary group that makes decisions regarding the harvest of fishers and wolverines in BC, the most important outcome of this project is the application of new information on harvest sustainability by trappers and other wildlife managers. As such, we intend to design and implement, with the help of an experienced extension specialist, an effective extension program targeted specifically at trappers that operate within the range of fishers or wolverines in BC. The specific objective of this extension program is to facilitate incorporation of the best available science into each trapper's fur management plan for fishers and wolverines.

We anticipate using several activities to achieve this objective. The primary activity that will facilitate adoption of this information into trapper's fur management plans will be through targeted workshops with trappers throughout the range of fishers and wolverines. These engagements will occur as face-to-face information sharing sessions, likely associated with meeting of BCTA locals throughout BC. Targeted extension activities will, in a co-operative setting:

1. Provide expert advice to trappers on the application of sustainable harvest targets for fishers and wolverines in their particular population unit.
2. Build capacity (relevant knowledge and applied skills) among trappers to facilitate the incorporation of sustainable harvest information into their decision-making.
3. Inspire these groups to further implement the knowledge and skills they have learned to ensure sustainable population outcomes.

Additionally, we propose several other avenues for getting this new information to trappers. We will incorporate this new information into updates of the Furbearer Management Guidelines for fishers and wolverines. Furthermore, we will attempt to incorporate information on population units and sustainable harvest levels into updated Trapper Education materials (currently administered by the BC Trappers Association). Presentations on the project will be made at the annual general meeting of the British Columbia Trappers Association and regular updates will be provided to members through the BC Trapper magazine.

To evaluate the effectiveness of our extension program, we will measure and document changes in the following outcome objectives (Bennett's Evaluation Ladder; Bennett, 1977):

1. Reactions to the program by target audiences
2. Changes in knowledge, attitudes, skills, and aspirations of target audiences
3. Changes in behaviour, practice, decisions, and policies of target audiences

We will conduct effectiveness evaluations of the extension activities described in this project via detailed evaluation questionnaires among target audiences after the delivery of these activities to assess if this project was successful in achieving its objectives. Specific operational outcomes of this project include the following:

- Over 75% of questionnaire respondents indicate that this project has provided useful advice on the application of fisher and wolverine harvest targets in various management contexts.
- Over 75% of questionnaire respondents indicate that this project has built capacity among trappers regarding the incorporation of sustainable harvest levels into relevant decision-making processes.
- Over 75% of questionnaire respondents indicate that this project has inspired the further implementation of learned knowledge and skills to increase desired population outcomes.

## **LITERATURE CITED**

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