NEWSLETTER

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FROM THE CHAIR

The Membership cycle of our *Martes* Working Group

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Only 2 years ago, we were sitting together in Seattle, reviewing what we knew about martens, sables, and fishers, and discussing what we wanted to do as researchers and managers. During the last 2 years, the Symposium Organizing Committee, under the chairmanship of Keith Aubry, has been busy putting together a synthesis book on the biology and conservation of *Martes* species, which will be published next year by Cornell University Press.

Some of our members are now busy discussing the fate of marten or fisher conservation programs in their part of the world, meeting in colloquiums to discuss pressing issues, or getting ready for their winter field work. Working on *Martes* species, their populations and their habitats, is a sustained effort shared by hundreds of researchers and their "acolytes".

I am glad to announce that all these people will have the opportunity to present and discuss their findings at the 6th International *Martes* Symposium that will be held in 2014 at Jagiellonian University in Krakow, Poland, under the leadership of Izabela Wierzbowska and Andrzej Zalewski.

Of course, there is much that needs to be done to prepare for such a gathering, and we have an imperative need to maintain our *Martes* Working Group (MWG) membership. The MWG membership is known to be cyclic. As we get closer to a symposium, old members remember that they must join the gang once again. Graduate students join eagerly with the hope of presenting their findings and the promise that they will change the world for the good of their *Martes* species. At these points in the MWG membership cycle, we experience a peak. At the symposium, everybody is high with emotions. Everybody enjoys the camaraderie and is thrilled to belong to such a great group of scientists. Then, everybody goes back home and – suddenly, many of our members get amnesia and forget to stay with MWG for the next few years. MWG then experiences a low in its membership curve. Even though MWG has repeatedly demonstrated that it is a productive and reliable scientific organization, it must continuously re-invent its membership every 4–5 years. Fighting this membership cycle is not easy because MWG does not publish proceedings and syntheses on a yearly basis, it does not constantly bother its membership for scientific contributions, and it has a relatively low profile due to its specialized focus.

However, in spite of these membership cycles, MWG is still active on a yearly basis. This Newsletter is our lifeline – it keeps us connected. The MWG Executive is always busy answering members' inquiries, thinking about ways to improve our website, discussing possible activities and projects (even though we are limited by a lack of funding), and looking into the preparation of the next symposium. All these activities cost nothing other than time. So, why do we need to maintain a membership?

Without a membership, we cannot develop an effective network of resources. When students or government agencies contact us to find people who know something on the genus *Martes*, we can refer them to the right people to deal with the right subjects. We know these people and what they do (or can do) because they belong to MWG. We all want to discuss a research idea or seek local support from a colleague; and we all know that we can contact the colleagues that we met at the last symposium. Being an MWG member means being part of an active network of contacts, and having the opportunity to work with others, outside our small world.

So, if this entire network of contacts and exchanges is maintained at no cost, why do we need membership dues? We need money to organize our symposia and pave the way for the publication of our proceedings. With money, we can initiate talks with academic institutions, secure facilities, cover expenses associated with organization meetings, and help some of our members travel and participate in our symposia. With money, we can contribute to the publication of our proceedings and syntheses, and secure the involvement of publishers. We are also thinking about developing a library where manuscripts would be accessible to members only. We are in the process of refurbishing our website, and we are investigating ways for our members to become involved at different levels in international research projects involved with *Martes* species. These new services will likely bring new expenses.

Think about it, our annual membership dues are lower than the cost of a case of beer! Yet, from a professional point of view, you will get much more in return by belonging to MWG. As you will see in this issue, members now have the choice of renewing for 1 year ($ 18), 2 years ($ 30) or 3 years ($ 40).

Some of the new services that we wish to offer to our membership will not happen overnight because we are doing those changes while trying to make a living, but they will happen faster with your support and involvement. What else can we do to secure your support, and further improve MWG? What publication, meeting, project or service should we offer to meet your needs? We are here to help; just let us know how we can do a better job. In the meantime, we need you all to be members in good standing.

FROM THE TREASURER AND MEMBERSHIP DIRECTOR

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By popular demand, we have created a new membership form that offers more ways to join the *Martes* Working Group than ever before! This form should accompany this newsletter, or you can access it from the recently updated MWG website: http://www.martes.laurentian.ca

You can join for one year for $18 USD, or save money – and having to remember to renew your membership – by joining for 2 years ($30 USD), or for 3 years ($40 USD). If you choose the 3-year option, you will be paid up until the 2014 International Symposium in Krakow! We also offer 3 convenient ways to pay: you can pay via check, money order, or PayPal. Please see the membership form for details.

As always, we waive fees for students to encourage their participation. Likewise, we do not want membership dues to be a roadblock for any fellow *Martes* enthusiast wanting to join, so please let interested parties know that we value and desire their participation and will work with those who feel the dues are a financial burden.

Speaking of dues, it is time for most of us to renew our membership. Only 30% of 2010 members renewed their membership for 2011 and beyond. I suspect some people attempted to renew and were thwarted by the technical difficulties we were having with PayPal. Those problems appear to be ironed out now, so it would be great for you to try again.

If Gilbert did not provide ample arguments of why you should be a Martes member, perhaps I can appeal to your competitive side. I have started a GIS project to display home countries of current members in future newsletters. Make sure your country is represented in in our global community…update your membership today!

As always, we want to provide a topnotch service for all of you, so please do not hesitate to contact me if you have questions or suggestions.

FROM THE WEBMASTER

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In addition to this newsletter and the international symposia, your *Martes* Working Group membership also helps support a website dedicated to facilitating communication and collaboration among *Martes* researchers:
http://www.martes.laurentian.ca

The MWG website is intended to serve as an informational tool for current members, as well as a promotional tool for newcomers. The website currently includes:

- The MWG Mission Statement;
- Current and previous MWG membership directories;
- The current and previous MWG Newsletters;
- A bibliography of *Martes* research, including hyperlinks to the documents when available, and
- A catalog of publicly available images of *Martes* species from around the world, as well as hundreds of images from the International Symposia.

We are continually updating the MWG website and always looking for new ways to make it better! For example, in addition to polishing the site's general appearance, we have recently updated the Mission Statement and the subscription page, and are developing a French-language version.

We can also use your help in making the website more useful. For example, our image library is still relatively small, especially with respect to the more exotic *Martes* species. In addition, we always appreciate new contributions to the bibliography, including citations, original documents in MS Word or PDF formats, and links to online documents. If you have any photos, citations, or documents that you would like to share, please send them to me at the email address above, and I will see that they are posted in a timely fashion.

We are also looking into providing a (moderated) forum platform to facilitate casual exchanges among members, something that has been lacking at least since Portugal 2004. We will advertise to all current members once this is done.

As always, we appreciate new ideas from the MWG membership. What additional services would you like to see?

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Please note that we have renamed the "Rest of the World" region to the "Asia" region. Perhaps we will change it back, if and when a tayra (*Eira barbara*) researcher joins the *Martes* Working Group!

William B. Krohn, a founding member of the *Martes* Working Group, has retired, so we are now in need of a new Regional Representative for Eastern North America. Please see the *Help Wanted* section (p. 46) for more details.

For more contact information, please see the Executive page at the MWG website: http://www.martes.laurentian.ca

PUBLICATION OF THE 5TH *MARTES* SYMPOSIUM BOOK

"Biology and Conservation of Martens, Sables, and Fishers: A New Synthesis"

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In September 2009, the *Martes* Working Group convened the 5th International *Martes* Symposium at the University of Washington in Seattle. Soon after, work began on the publication of the next edited volume on the genus *Martes*. Unlike those that were published after the previous 3 *Martes* symposia, the forthcoming *Martes* book will not represent the proceedings of the symposium; rather, it will provide a new synthesis of knowledge on the genus *Martes* that reflects the breadth of recent scientific investigations, current societal concerns, and new technological tools for conducting research on these species. Consequently, it will be much more than simply an updating of the original *Martes* synthesis book that was published in 1994 after the 1st *Martes* Symposium was convened in 1991.

To produce this new synthesis, we needed to organize the 5th *Martes* Symposium around the planned content of the book, not vice versa as are most proceedings volumes. Thus, a year before we convened the Symposium, we spent several months planning the structure and content of a new synthesis book, and identifying the key topic areas it would need to contain. We organized the book into 5 major sections:

- Evolution and Biogeography of the Genus *Martes*
- Ecology and Management of *Martes* Populations
- Ecology and Management of Habitat for *Martes* Species
- Advances in Research Techniques for *Martes* Species
- Conservation of *Martes* Populations

We then identified the researchers whom we considered best qualified to cover the material in each topic area, and invited them to write a chapter for the book and give an oral presentation at the Symposium, which we also organized into these 5 major sections. Draft manuscripts were due to the editors by the end of March 2010, and the peer-review and revision processes took place during the following year. Altogether, we accepted 20 synthesis chapters for publication in the book, including at least 3 chapters in each section.

Some of the new topic areas that will be covered include:

- The use of genetic data in *Martes* research and conservation
- Pathogens, parasites, and the biogeography and coevolution of host-parasite systems
- Ecophysiological relations
- Multi-scale analyses of habitat relationships
- Non-invasive survey methods and occupancy modeling
- Bioregional conservation strategies
- The potential effects of global warming on the distribution and status of *Martes* populations

We delivered the complete manuscript of the book to Cornell University Press in June 2011, and are expecting publication to occur in the summer of 2012. Additional notifications will be sent to all *Martes* Working Group members, once we know exactly when publication will occur and what the final cost of the book will be.

WESTERN NORTH AMERICA

Limiting factors and landscape connectivity: the American marten in the Rocky Mountains

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The following is the abstract of a paper published in Landscape Ecology (2011) 26:1137–1149 (DOI 10.1007/s10980-011-9645-8).
http://www.springerlink.com/content/f4206nj7852v3147/

Abstract – In mobile animals, movement behavior can maximize fitness by optimizing access to critical resources and minimizing risk of predation. We sought to evaluate several hypotheses regarding the effects of landscape structure on American marten (*Martes americana*) foraging path selection in a landscape experiencing forest perforation by patchcut logging. We hypothesized that in the uncut pre-treatment landscape marten would choose foraging paths to maximize access to cover types that support the highest

density of prey. In contrast, in the post-treatment landscapes we hypothesized marten would choose paths primarily to avoid crossing openings, and that this would limit their ability to optimally select paths to maximize foraging success. Our limiting factor analysis shows that different resistant models may be supported under changing landscape conditions due to threshold effects, even when a species' response to landscape variables is constant. Our results support previous work showing forest harvest strongly affects marten movement behavior. The most important result of our study, however, is that the influence of these features changes dramatically depending on the degree to which timber harvest limits available movement paths. Marten choose foraging paths in uncut landscapes to maximize time spent in cover types providing the highest density of prey species. In contrast, following landscape perforation by patchcuts, marten strongly select paths to avoid crossing unforested areas. This strong response to patch cutting reduces their ability to optimize foraging paths to vegetation type. Marten likely avoid non-forested areas in fragmented landscapes to reduce risk of predation and to benefit thermoregulation in winter, but in doing so they may suffer a secondary cost of decreased foraging efficiency.

Second-year translocation of fishers into the northern Sierra Nevada and southern Cascades of California

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For the second year we released fishers (*Martes pennanti*) into the northern Sierra Nevada and southern Cascade mountain ranges in California. The translocation is a collaborative effort of the California Department of Fish and Game, U.S. Fish and Wildlife Service, Sierra Pacific Industries, and North Carolina State University.

In total, 16 female and 12 male fishers were released between late 2009 and early 2011. The second-year cohort of translocated fishers (7 females: 6 males) were released in close proximity to the first-year cohort, but settled and dispersed with some marked differences.

In year 1, the greatest movement away from a release site for females was 14.6 km (mean = 10.4 ± 6.18 SD), compared to 22 km (mean = 13.2 ± 3.9) for females in year 2. Year 1 females settled (measured as the center of their home range) on average 3.4 ± 1.5 km from their respective release sites, whereas females in year 2 settled on average 12.8 ± 4.0 km from their release sites. In general, female fishers in year 2 avoided the established home ranges of females from year 1, and preliminary analyses indicate that they moved at greater speeds while in those home ranges.

Male fishers moved further than female fishers in both years. Across both years, the average greatest movement away from a release site for males was 26.6 ± 15.7 km, and there was little difference in mean movement distances between years 1 and 2. Male fishers appear to explore the release area more extensively than females and periodically venture into land cover types inconsistent with those typically associated with fishers (e.g., oak savannah and chaparral). Males settled farther (mean = 18.5 ± 12.8 km) from their release sites than females.

Both females and males showed strong intra-sexual spatial selection, which caused fishers from the second release to settle in areas that were presumably unoccupied by other fishers. Thus, we predict that fishers released in the future will move farther than either the first- or second-year cohorts did to establish home ranges. Additionally, we posit the places that later cohorts avoid or settle will provide a tool for assessing where juveniles settled and for assessing whether "lost" fishers (those whose transmitters died) are still alive.

We documented no mortality events for any animal (n=28) during the first 5 months following release, suggesting that the stress of translocation has little effect on their ability to survive at a new location. To date, we documented mortality of 5 of the 28 released fishers (4 females and 1 male) across both years of the translocation. Three females from the year 1 cohort died in 2010, and 1 male and 1 female died from the year 2 cohort.

Survival of both adult male and female fishers has been high, with no apparent effects due to time of year, sex, or release cohort. Analyses in program MARK (known fates model) indicate a constant monthly survival rate of 0.987 (95% CI = 0.95 – 0.99; annual survival = 0.85) with no effect due to time or sex. Estimates of survival based on other tested models all show high monthly survival (>0.95).

The relatively high support for a constant model is likely an effect of small sample size, which currently limits exploration of other more complex models that include habitat or individual covariates. During periods when the fate of an animal was unknown it was censored from the analysis (~15 individuals in total). True survival rates could differ from our estimates, particularly for animals in the later part of year 1, but no evidence suggests they are outside the range of confidence intervals reported for annual survival in the literature. Currently, we cannot assess juvenile survival, as no kits were captured from the year 1 cohort. Evidence from baited camera stations, however, indicates several (>5) un-collared, or otherwise unidentifiable, fishers, suggesting that some juveniles did indeed survive.

Translocated fishers successfully reproduced in both years. In year 1, we documented denning behavior in 5 of 9 (55%) females, and observed 4 kits from 4 of the denning females (mean litter size = 1.0 ± 0.44). In year 2, 7 of 9 (77%) females denned, with observations of 14 kits (mean litter size = 2.0 ± 0.82). Females from year 1 that successfully produced kits in year 2 demonstrate that females were able to breed on site with translocated males. Additionally, we predict continued reproduction because we observed male fishers at females' den trees in both years. Although we were tracking relatively few females from the first year's cohort in the second denning season of the project, we suspect as many as 4 females were still on the study site and likely produced additional kits. Trapping and monitoring in fall of 2011 will be used to estimate the minimum number of kits that were both born and that survived on site.

Monitoring and initial population estimation strategies will commence in the fall of 2011. During late October we will conduct a large-scale trapping effort that will provide insight into, and a statistically rigorous method for, estimating the number of fishers on or near the study site. Trapping during this period will facilitate re-collaring of translocated fishers. We will deploy over 100 traps during 2 weeks (~1400 trap nights) over much of the study site (>80%) to trap as many fishers as possible. We will use these data in a mark-capture approach to estimate population size. Additionally, we deployed over 40 baited camera stations throughout the study site and will expand these efforts throughout the winter.

Future project efforts include trapping new animals (beginning in November 2011) from donor sites in northwestern California for release onto the Stirling Management Area. We shall attempt to capture 8 females and 4 males, which will meet our goal of translocating 40 total fishers over 3 years, as outlined in the California Department of Fish and Game's translocation plan (Callas and Figura 2008).

Measurement of habitats used at den sites and modeling of home range is ongoing. We are exploring collaborative monitoring projects with local U.S. Forest Service districts and other interested parties. In addition to providing baseline information for future monitoring efforts in the northern Sierra Nevada and southern Cascade Ranges, such efforts will be key to identifying, estimating, and describing areas that fishers currently occupy both on federal and private lands.

References

Callas, R.L. and P. Figura. 2008. Translocation plan for the reintroduction of fishers (*Martes pennanti*) to lands owned by Sierra Pacific Industries in the northern Sierra Nevada of California. California Department of Fish and Game.

Decline in American marten occupancy rates at Sagehen Experimental Forest, California

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Photo of a male American marten kit taken in Lassen National Forest, California, on 26 August 2011. Photo courtesy of K. Moriarty.

The following is an abstract from a paper published in the Journal of Wildlife Management 75(8) 2011, pp. 1774-1787.

Abstract – We compared the distribution and frequency of American marten (*Martes americana*) detections during historic surveys and a recent survey on the Sagehen Experimental Forest (SEF) in the Sierra Nevada Mountains, California. This area has been the location of 9 previous marten surveys during 1980–1993, each involving a systematic detection/non-detection survey on the same grid. These data are a time series of information on the occupancy of martens that can be related to habitat change in the study area. Our objectives were to 1) resurvey martens in SEF using methodology similar to previous studies to assess current marten occupancy; 2) evaluate changes in marten occupancy during the period 1980–2008; and 3) examine associations between marten occurrence and changes in habitat and landscape metrics. Current marten occupancy was estimated using surveys conducted in summer 2007, winter 2007–2008, and summer 2008.

From 1978 to 2007 there was a decrease in predicted habitat patch size, core area, and total amount of marten habitat in the study area, as well as an increase in distance between patches. Marten detections in 2007–2008 were approximately 60% lower than in surveys in the 1980s. We detected no martens in the summers of 2007 and 2008, and 10 detections in winter 2007–2008 were limited to higher elevations in the southwestern portion of SEF. No martens were detected in the lower elevations where most of the recent forest management activity occurred. We suggest that the marten population at SEF has been negatively affected by the loss and fragmentation of habitat. We recommend that future management of forests in the Sagehen basin focus on restoring and connecting residual marten habitat to improve habitat quality for martens.

Oregon State University prepared the following press release to announce this publication to the wider world. We thought it would be of interest to fellow Martes researchers who would like to communicate their own work to a wider audience.

Fewer marten detections in California forest linked to decline in habitat
21 October 2011

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Photo of a female American marten taken in Lassen National Forest, California, on 13 October 2011. Photo courtesy of K. Moriarty.

TRUCKEE, CA – Scientists tracking the reclusive American marten in the Sierra Nevada Mountains have estimated that detection rates of marten have declined by 60 percent compared to historical surveys in the 1980s – and one postulated cause, they say, is habitat loss from logging.

The findings, announced this week in the Journal of Wildlife Management, are important because previous research had demonstrated that marten populations had become increasingly fragmented in northeastern California, and this new study offers an explanation for the pattern.

Martens also are considered an "indicator" species that reflect beneficial conditions for other animals that occupy old forests.

Katie Moriarty, an Oregon State University doctoral student and lead author on the study, says martens typically utilize large home ranges with patches of dense trees, large snags, downed logs, and decadent trees for resting and denning. Martens are often found in areas where these patches are connected, which may allow them to safely travel from one area to the next without being predated by large carnivores, including bobcats, coyotes and goshawks.

Timber harvests and recent fires have reduced some of the available habitat or created gaps that fragment the landscape, the authors say. In addition, efforts to reduce the risk or severity of fire – including the removal of "fuel" in the form of downed woody material – may contribute to habitat loss.

"In the Sierra Nevada and Cascade mountain ranges, martens are associated with older forests above 5,000 feet and are usually found in wooded areas that contain red and white fir, or lodgepole pine, and riparian areas," Moriarty said. "Marten numbers may be declining throughout this range as the highest densities of detections have been in isolated and unmanaged areas.

"Preserving marten habitat is important," Moriarty added, "because what is beneficial for martens is presumably good for other species that thrive in old forests at high elevations. Marten habitat is associated with favorable conditions for spotted owls, pileated woodpeckers, northern goshawks, northern flying squirrels, red-backed voles and other species."

Martens are one of the smaller members of the weasel family, weighing between one and two-and-a-half pounds – and they look something like a cross between a fox and a mink. Martens are "smaller than a Chihuahua," Moriarty said, "but have the attitude of a pit bull."

Small but fierce predators, martens feast on snowshoe hare, chipmunks, voles and other small mammals, and also consume bird eggs and berries. They can survive rugged winters with snow more than a dozen feet deep.

Moriarty's study focused on the Sagehen Experimental Forest, which is located on the eastern slope of the Sierra Nevada mountain range. The Sagehen Creek Field Station, established in 1951 and operated by the University of California, is located about 30 miles north of Lake Tahoe. The Sagehen Creek study area is particularly important as it is the only place in the United States where martens have been surveyed, using similar methods, for more than a quarter-century.

The marten detections in the study were recorded in part by using "track plates" – long, rectangular black boxes that are set in the woods and baited. When the martens enter them they leave tracks on contact paper. Other methods include snow tracking, cameras and hair snares, which are devices that snag bits of hair off the animal as it tries to reach a piece of bait. The hair can then be used to identify individual martens based on DNA analysis.

Nine previous surveys of martens had been conducted from 1980 to 1993, using similar methods on the same grid, giving the scientists an ideal basis for comparison. The focus of the Journal of Wildlife Management study was a series of surveys in 2007-08, which found 60 percent fewer detections than previous surveys – a decline the authors suggest may be due to habitat fragmentation and loss.

"We've estimated that there has been about a 25 percent loss in suitable habitat for martens since the 1980s," Moriarty said.

Moriarty and her co-authors recommend three strategies for retaining marten habitat at Sagehen Creek:

- Resource managers should consider retaining the remaining contiguous patches of closed-canopy and old forest, which are thought to be the highest quality marten habitat;

- Corridors of dense, late-seral forest should be retained among thinned areas to provide corridors that martens and other animals can use to travel between patches of closed-canopy forests;
- Managers should strive for a "silvicultural paradigm" that retains large snags, diverse tree structure, large downed woody material, and patches of decadent trees as potential resting and denning habitat.

Moriarty has been studying martens in northern California for several years and gained attention in 2008 when she and her field crew photographed a wolverine during this marten research – the first wolverine seen in California in three-quarters of a century.

Co-authors on the Journal of Wildlife Management study are William Zielinski, of the U.S. Forest Service's Pacific Southwest Research Station in Arcata, CA., and Eric Forsman, of the U.S. Forest Service's Pacific Northwest Research Station in Corvallis, OR.

Use of non-invasive genetic data to estimate fisher population parameters in the eastern Klamath Mountains of California

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Introduction
Wildlife managers must understand the population dynamics of managed species. Many species are sensitive to disruption from human activities, which can include invasive methods of collecting data. Non-invasive methods are, therefore, desirable to benefit sensitive species and to economize on costs and surveyor time (Long *et al*. 2008).

We collected hair follicles from baited stations across our study area in the eastern Klamath Mountains of California and used microsatellite analysis to identify individual fishers (*Martes pennanti*). Bait stations were set in late autumn of 2006 and again each autumn through 2010. Population sizes and demographic structure for each year, as well as apparent survival and realized population growth rates between years, will be estimated using mark-recapture estimators.

Our study allows us to directly monitor the effects of removing fishers to service an ongoing translocation effort in the Northern Sierras of California. While fishers have been translocated numerous times throughout the century, the response of the source populations has never been studied (Powell *et al*. in press). Following data collection in autumn 2009, 6 fishers were removed for the translocation project (5 translocated and 1 incidental death). Following data collection in 2010, 4 more animals were removed.

Relevant population parameters will be used to assess effects of this removal. No more removals are planned for the future.

Methods

Our 507-km^2 study site in Northern California, extending to Mt. Ashland, Oregon (Figure 1), contains public land in the Klamath National Forest, and land owned privately by Timber Products Company and Fruit Growers Supply Company (2 private timber companies).

At the inception of the study in 2006, only 78 stations of the Mt. Ashland and Collins-Baldy sections were surveyed, as the Klamath River and California route 96 were thought to present barriers to movement by fishers, presumably isolating the 2 areas. Analysis of samples in 2006, however, showed that 1 fisher crossed the river on more than one occasion. The Klamath River section (22 stations) was added to the study area in 2007.

The sampling regime is a modification of an occupancy estimation protocol developed by Zielinski *et al*. (1995). Two sample stations are set within each 10.5-km^2 grid cell across the landscape.

We collected hair follicles using a 4-sided tunnel made from corrugated plastic. 3 wooden slats were placed in the entrance of the tunnel, forcing an animal to crawl underneath the slats, and a screen prevented entry through the rear. A glue strip attached to the bottom slat snagged hair from any mammal ducking underneath the slats to reach bait in the rear of the tunnel. Bait was a chicken quarter and a can of wet cat food.

Each tunnel also had a sooted track plate to provide a second ID of animals that left hair. We surveyed for 28 days, separated into 4 back-to-back 7-day sampling weeks. Loss of a survey week, usually from bear damage to the station, resulted in the addition of 1 or 2 sampling weeks, not to exceed a total effort of 42 days for any sampling station.

The USDA Forest Service Rocky Mountain Research Station (Missoula, MT) analyzed all of our samples. Samples belonging to the genus *Martes* were then identified to individual level, if the DNA was of sufficient quality (roughly 90% of samples across 5 years). American martens (*Martes americana*) are not found in the area, removing them as a possibility.

Data Analysis and Results

Estimates of population size and population growth rates (λ) were produced using Pollack's robust design in MARK (White and Burnham 1999). Population sizes for the whole study area were estimated for 2007–2010, and for the Collins-Baldy and Mt. Ashland sections separately for 2006. Parameter estimate averages and 95% confidence intervals were calculated in MARK. We estimated population growth rates and apparent reproduction and survival using Jolly-Seber models.

Using the robust design in MARK for 2007–2010 was straightforward. Parameter structure was chosen to reflect that we do not know the full extent of this portion of the Klamath population. Temporary immigration was modeled such that a fisher's non-detection in one year is reflected in its status in the model the following year (a fisher "remembers" that it was not in the population at the previous time step). Population estimates range from 27.7 fishers in 2010 to 33.3 fishers in 2008 (Figure 2).

A simple closed population model was used to estimate the population size for the separate Collins-Baldy and Mt. Ashland sections (Figure 2). Analyzing this year with later years is difficult, as the spatial extent of the study changed in 2007, with 22 sites added in 2007 to produce a total of 100 sites. A population size estimate of 22 was returned for all models without confounded variables, along with miniscule confidence intervals.

Realized population growth was estimated using Jolly-Seber open population models. Due to the spatial continuity problem pointed out above, only data from 2007–2010 can be compared. Estimates are not statistically different from 1 (indicating no change, Figure 3), even for 2009–2010, when 6 animals were removed from the population during trapping for the translocation.

Discussion

Our data suggests that the population in our study area is stable, despite removals in 2009. Data scheduled to be collected this fall and again in autumn of 2012 will complete this picture. In mark-recapture analysis, survival and detection probability estimates cannot be separated in the final time step of an analysis (White and Burnham 1999). To be sure we have the appropriate information to assess the effects of removing animals, we need to collect data in 2011 and 2012. We will then be able to separate all relevant parameters for 2011, the first year after removal has concluded.

We have also demonstrated that an occupancy design, whether in place or planned, can also be used to estimate population sizes and other demographic parameters within a mark-recapture framework. This provides wildlife managers with another tool to manage species of concern, and has the benefit of being non-invasive. Differing costs to implement this type of design instead of traditional capture-based mark-recapture designs may include, but are not limited to, bait stations and DNA analysis vs. manpower and live-traps. The potential also exists to couple DNA analyses with habitat data and to relate movement corridors and core population areas to relevant habitat parameters.

References

Long, R.A., P. MacKay, W.J. Zielinski, and J.C. Ray, editors. 2008. Noninvasive Survey Methods for Carnivores. Island Press, Washington DC, USA. 385 pp.

Powell, R.A., J.C. Lewis, B.G. Slough, S.M. Brainerd, N.R. Jordan, A.V. Abramov, V. Monakhov, P.A. Zollner, and T. Murakami. 2012 (in press). Evaluating translocations of martens, sables, and fishers: testing model predictions with field data. In K.B. Aubry, W.J. Zielinski, M.G. Raphael, G. Proulx, and S.W. Buskirk, editors. Biology and conservation of martens, sables, and fishers: a new synthesis. Cornell University Press, Ithaca, New York, USA.

White, G.C. and K.P. Burnham. 1999. Program MARK: Survival estimation from populations of marked animals. Bird Study 46 Supplement: 120-138.

Zielinski W.J., T.E. Kucera, and J.C. Halfpenny. 1995. Definition and distribution of sample units. Pages 17-24 *in* W.J. Zielinski and T.E. Kucera, editors. American Marten, Fisher, Lynx, and Wolverine: Survey Methods for their Detection. USDA Forest Service General Technical Report PSW-GTR-157.

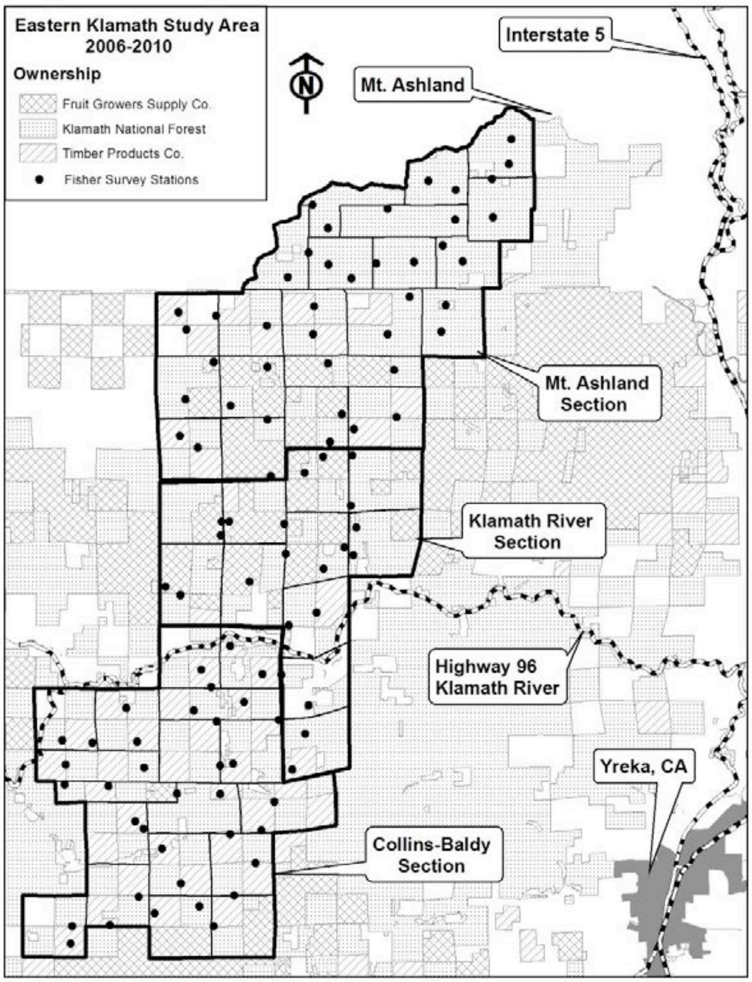

Figure 1. Study site, located in northern California and southern Oregon, showing the 3 sections of the study area, land ownership, station locations, and associated landmarks.

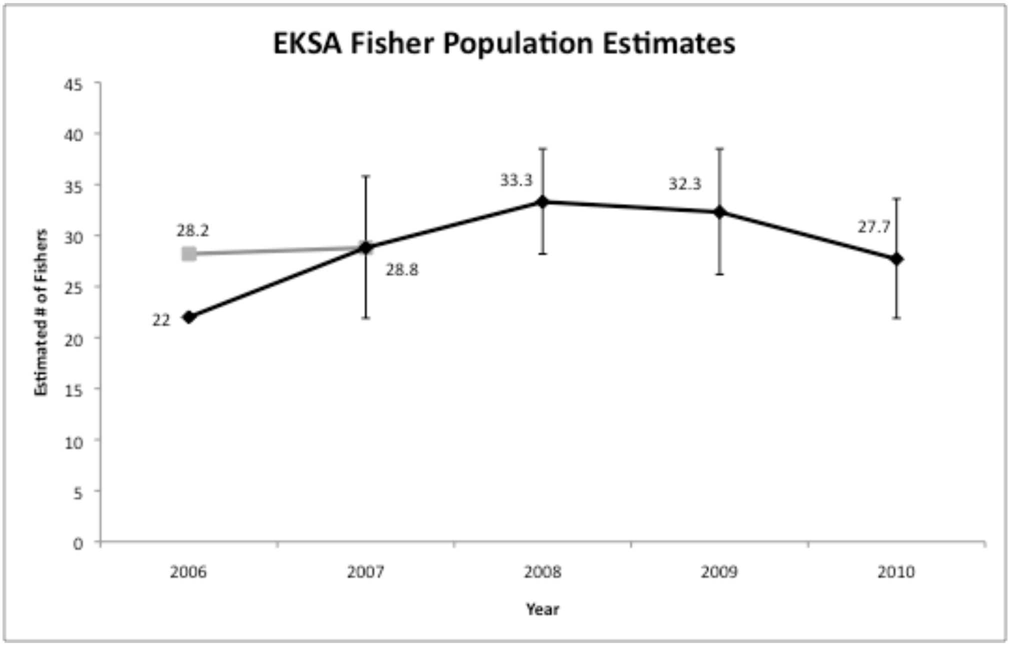

Figure 2. Population estimates for the Eastern Klamath study area (EKSA). The restricted size of the 2006 survey area (78 stations vs. the full 100) should be noted. A ratio test was used to investigate the possible population size in 2006 had all 100 stations been surveyed (grey line).

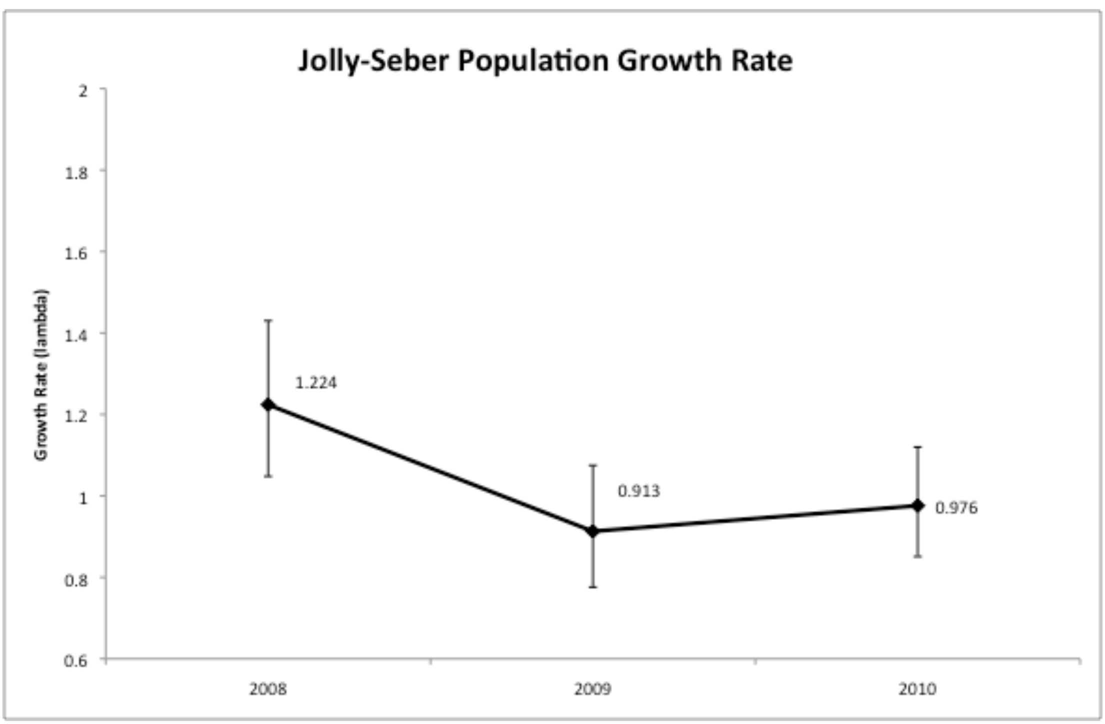

Figure 3. Realized population growth rates using Jolly-Seber models. Despite removal of 6 individuals between 2009 and 2010, the growth rate has risen. No animals were removed from 2008 to 2009.

Simulating the effects of climate change on population connectivity of American marten in the northern Rocky Mountains, USA

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The following is an abstract of a paper published online 15 September 2011 (in press) by T.N. Wasserman, S.A. Cushman, A.S. Shirk, E.L. Landguth, and J.S. Littell in Landscape Ecology (2011). (ISSN: 09212973 DOI: 10.1007/s10980-011-9653-8)
http://www.springerlink.com/content/u086740252847684/

Abstract – We utilize empirically derived estimates of landscape resistance to assess current landscape connectivity of American marten *Martes americana* in the northern Rocky Mountains, USA, and project how a warming climate may affect landscape resistance and population connectivity in the future. We evaluate the influences of five potential future temperature scenarios involving different degrees of warming. We use resistant kernel dispersal models to assess population connectivity based on full occupancy of suitable habitat in each of these hypothetical future resistance layers. We use the CDPOP model to simulate gene exchange among individual martens in each of these hypothetical future climates. We evaluate: (1) changes in the extent, connectivity and pattern of marten habitat, (2) changes in allelic richness and expected heterozygosity, and (3) changes in the range of significant positive genetic correlation within the northern Idaho marten population under each future scenario. We found that even moderate warming scenarios resulted in very large reductions in population connectivity. Calculation of genetic correlograms for each scenario indicates that climate driven changes in landscape connectivity results in decreasing range of genetic correlation, indicating more isolated and smaller genetic neighborhoods. These, in turn, resulted in substantial loss of allelic richness

and reductions in expected heterozygosity. In the U.S. northern Rocky Mountains, climate change may extensively fragment marten populations to a degree that strongly reduces genetic diversity. Our results demonstrate that for species, such as the American marten, whose population connectivity is highly tied to climatic gradients, expected climate change can result in profound changes in the extent, pattern, connectivity and gene flow of populations.

EASTERN NORTH AMERICA

Modeling habitat quality for American martens in western Newfoundland, Canada

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The following is the abstract from Adair, W.A. 2003. Modeling habitat quality for American martens in western Newfoundland, Canada. Ph.D. Dissertation, Utah State University, Logan, UT, USA. 488 p.

The "Den Mother" marten habitat quality models were created to provide insight into American marten habitat selection behavior and to promote the recovery of the Newfoundland marten (*Martes americana atrata*) population. Although these objectives are typical of most wildlife habitat modeling projects, the Newfoundland marten's idiosyncratic habitat ecology, and apparently intractable conflicts associated with timber harvesting, motivated a unique, process-oriented approach to appraising landscapes.

The Den Mother models used optimal decision-making principles to synthesize critical resources (den sites and foraging opportunities) and constraints (adverse thermal situations and exposure to predations) into a single hierarchical framework. The resulting spatially explicit, combinatorial optimization models depend on a complex array of interacting assumptions. However, in mechanistic models, explicit assumptions provide the means by which insights are gained. For example, manipulating prey population parameters provided a clear demonstration of how resource conditions confound the relationship between landscape configuration and marten fitness, thereby challenging conventional definitions of habitat based on vegetation alone. Likewise, the models' sensitivity to spatial circumstances argued against the concept of an "optimal landscape," a traditional objective for wildlife habitat analyses.

Although the model analyses did not refute the conventional wisdom that Newfoundland marten are strongly associated with (and may depend on) large contiguous blocks of senescing and defoliated forests, they did suggest that the marten is an opening-sensitive,

rather than core-sensitive, species. The models also suggested new avenues for research addressing marten den site selection, predator avoidance behavior, foraging efficiency, and space use strategies, as well as new techniques for assessing the trade-offs that govern marten habitat selection behavior. Finally, the models also suggested new guidelines for promoting marten recovery in an adaptive management context, including recommendations for placing artificial resting structures; creating favorable landscape mosaics; managing ephemeral resources such as transition old-growth forests, defoliation, and coarse woody debris; and developing alternative, competing management scenarios that address both forest and prey conditions simultaneously.

Multiscalar effects of forest fragmentation by timber harvesting on American marten in the boreal forest of eastern Canada

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The following is the abstract from Cheveau, M. 2010. Multiscalar effects of forest fragmentation by timber harvesting on American marten in the boreal forest of eastern Canada. Dissertation, Université du Québec en Abitibi-Témiscamingue, 226 p.

Abstract – Habitat loss and fragmentation represent major threats for wildlife populations. Ongoing human disturbances affect habitat and could consequently threaten sensitive species survival. Even though forest management creates temporal habitat loss, it covers vast areas and opens up the forest matrix to a degree not previously experienced in eastern boreal forest of North America. The American marten (*Martes americana*) is reported as sensitive to habitat loss and fragmentation. Marten could thus be used as a focal species that could guide forest management for species having similar habitat requirements.

The objective of this thesis was to evaluate effects of habitat loss (proportion of clearcuts) and fragmentation (clearcut dispersion and amount of created edges) on marten at different spatial scales. The study area was located in the Waswanipi Cree Model Forest, where 2 clearcut dispersion patterns (clustered vs. dispersed) were used, the second being considered to mitigate negative impacts of forest harvesting on traditional activities of indigenous peoples.

The first chapter examined effects of habitat loss and fragmentation by forest harvesting on marten at the landscape (100-300 km^2) and the home range (5-10 km^2) scales. We showed that marten abundance was two-fold higher in unharvested than in harvested landscapes, despite a similar proportion of mature forests. However, at a finer scale, marten site occupancy, abundance, and body condition were only weakly affected by habitat loss.

Clearcut dispersion pattern did not influence marten abundance, whereas body condition was reduced in clustered-cut landscapes. We conclude that marten populations are sensitive to habitat loss but not to the configuration and the amount of clearcuts when ~50% residual forests are maintained in the surrounding landscape. These results suggest that the marten is more tolerant to habitat loss and fragmentation in coniferous boreal forest that in southern regions.

In the second chapter, we documented individual response to habitat loss and fragmentation, as well as habitat selection within winter home ranges, in order to verify if this greater tolerance was also found at smaller scale. Again, proportion and dispersion of clearcuts did not influence marten home range size. However, home range sizes decreased with the proportion of mixedwood forests, which are rare in the landscape. This importance of mixedwood forests for marten was confirmed by habitat selection at the home range scale, as well as by home range and activity zone locations within the landscape. In parallel, recent clearcuts was the least used habitat at the home range scale, and open (including clearcuts) and disturbed (roads and edges) areas were avoided in activity zones. Even though martens did not use clearcuts, they tolerated such areas within their home ranges.

Chapter 3 evaluated effects of creating forest/clearcut edges on marten movements. Single edges were created in dispersed-cut landscapes, whereas multiple edges were created in clustered-cut landscapes. Single edges represented barriers for marten movements, as they avoided clearcuts. Moreover, movements were more parallel to the edge and more linear in the 0-100 m zone from the edge than deeper in the forest. However, marten distribution with regards to edge tended to follow prey distribution, being more abundant near edges. Forest corridors (multiple edges) were highly used by marten (concentration effect) and movements were more linear in such habitats (canalization effect).

Chapter 4 aimed to develop a common vision (Cree-scientists) on marten in managed boreal forest, in integrating Cree trappers' traditional knowledge and perceptions on the impacts of forest management on marten with results from the 3 previous chapters. Marten represented both an income source and a symbol of the traditional Cree way of life. Cree trappers' knowledge was highly concordant with our results on marten ecology as well as on the impacts of timber harvesting on this species. We suggest that this concordance was highly due to the fact that both sources of knowledge (traditional and scientific) came from the same study area. Cree trappers were more favorable to the use of dispersed clearcuts in their familial hunting territories. Such a common vision on marten could contribute to improve mutual understanding between Crees and forest managers and facilitate forest co-management in the region.

Although the American marten is more tolerant to habitat loss and fragmentation in the boreal forest, we cannot judge if retention levels imposed by the current law would be sufficient to maintain this species. Despite the fact that dispersed clearcuts provided only a weak ecological advantage for martens, this type of clearcut is more socially acceptable for Cree trappers. While the first pass is currently ongoing, it is time to plan how the second cut will be done. We recommend retention of corridors to conserve connectivity for wildlife species and protection of mixed wood stands, which are highly selected by martens in the region.

Distribution and detection rates of a reintroduced fisher population in western Maryland

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By the early 1900s fisher (*Martes pennanti*) populations had declined or were extirpated in many parts of their historic range in the United States (Powell *et al*. 2003), including extirpation from Maryland and surrounding states (Merritt 1987). In 1969, 23 fishers were reintroduced into West Virginia. Of these, 14 animals were placed in Blackwater Falls State Park, 4 km from the Maryland state border (Pack and Cromer 1981). Trapping records dating to 1977 indicate that fishers have recolonized western Maryland, likely from the West Virginia reintroduction (Maryland Wildlife and Heritage Service, unpublished data). The bag limit was increased from 1 to 2 fishers per season for the 2008 – 2009 harvest year, at which time 49 fishers were legally harvested (Maryland Wildlife and Heritage Service 2008). The current range and population size of fishers in Maryland is unknown, and no formal procedure to monitor the population has been established.

The purpose of our project was to assess the distribution and habitat associations of fishers in western Maryland (Figure 1). We used digital remote cameras (Cuddeback® Capture, Expert, Excite, and NoFlash) placed at 40 sites on a 120-km^2 grid to assess the presence and location of fishers within Savage River State Forest (SRSF) in western Maryland, USA, from August 2008 through July 2009 (Hanley 2010; Figure 2). During the survey period (from August 2008 through July 2009) we detected fishers at 20 (50%) sites (Table 1).

In addition, we evaluated the number of times a fisher was detected at a site, termed a "detection occasion." If >30 min elapsed between 2 photographs of a fisher, the photographs were considered separate detection occasions (adapted from Smith 2010). We recorded 152 detection occasions for fishers annually (Table 1), and the highest number of detection occasions for an individual site was 24 occasions. Fishers stayed at camera sites, sniffing the ground and hanging lures, or eating the bait for extended periods (often in excess of 30 min), and would return multiple times within a survey period. These observations are consistent with behaviors attributed to fishers by Powell (1993), who stated they are naturally very inquisitive animals, which makes them highly susceptible to trapping.

Our investigation demonstrates that fishers are persisting in Maryland since their reintroduction and subsequent expansion from West Virginia during 1969. Based on our outcomes, the increased bag limit on fisher population harvests in western Maryland seems relatively secure in SRSF. However, further research is needed to more thoroughly assess the distribution, and population status and trends elsewhere in Maryland.

References

Hanley, Z.L. 2010. Spatial and temporal factors associated with detections of bobcats (*Lynx rufus*) and fishers (*Martes pennanti*) in western Maryland. M.S. Thesis, Frostburg State University, Maryland, USA.

Maryland Wildlife and Heritage Service. 2008. Guide to Hunting and Trapping 2008-2009. Maryland Department of Natural Resources, Annapolis, Maryland, USA.

Merritt, J.F. 1987. Guide to the mammals of Pennsylvania. University of Pittsburgh Press, Pittsburgh, USA

Pack, J.C., and J.I. Cromer. 1981. Reintroduction of fisher in West Virginia. Worldwide Furbearer Conference Proceedings 2:1431-1442.

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

Powell, R.A., S.W. Buskirk, and W.J. Zielinski. 2003. Fisher and marten (*Martes pennanti* and *Martes americana*). Pages 635-649 *in* G.A. Feldhamer, B.C. Thompson, and J.A. Chapman, editors. Wild mammals of North America: biology, management, and conservation. Second edition. Johns Hopkins University Press, Baltimore, Maryland, USA.

Smith, J. 2010. Seasonal variation in detections of forest carnivores in western Maryland using remote cameras. M.S. Thesis, Frostburg State University, Maryland, USA.

Table 1. Presence of fishers at 40 remote camera sites placed in Savage River State Forest, western Maryland, USA, as indicated by the number of remote camera sites with detections, and the number of detection occasions (defined in text).

	Remote Camera Sites		Detection Occasions	
	No.	% Total	No.	% Total
Fall (Sep– Nov)	9	23	41	27
Winter (Dec– Feb)	13	33	43	28
Spring (Mar– May)	12	30	40	26
Summer (Jun– Aug)	9	23	28	18
Survey Period (Aug 2008 – Jul 2009)	20	50	152	--

Figure 1. Fisher investigating a camera site in Savage River State Forest, Maryland. April 29, 2009. Photo taken by a Cuddeback® Capture remote sensing camera.

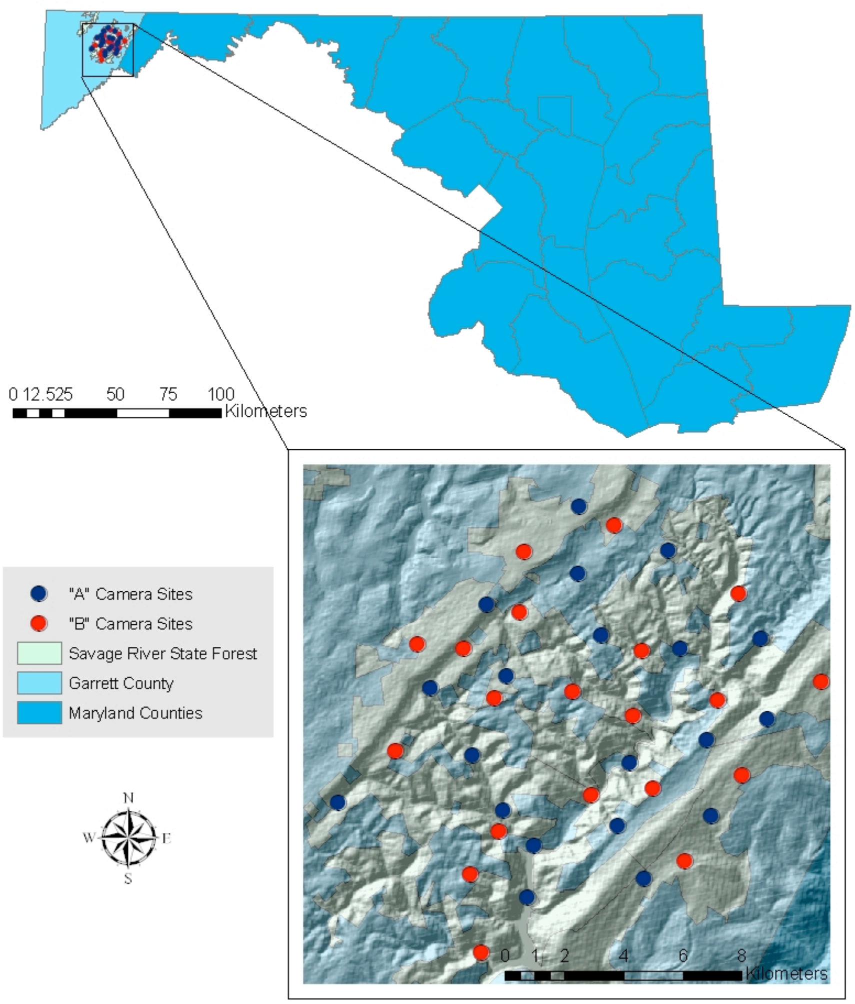

Figure 2. Location of camera sites (n = 40) established to detect bobcats and fishers in Savage River State Forest, Maryland, USA, August 2008 – July 2009. See Hanley (2010) for explanation of "A" and "B" camera sites.

Population ecology of American marten: Impact of wind farm development in high-elevation spruce-fir habitat in New Hampshire

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Distribution patterns and habitat use models predict that American martens (*Martes americana*) in northern New Hampshire should prefer high-elevation mixed and coniferous stands where deep snow exists (Kelly 2005). Further, seasonal use patterns indicate that martens require forests with greater canopy cover (Buskirk and Ruggiero 1994, Hodgman *et al*. 1997, Fuller and Harrison 2005) and/or enhanced structural complexity (e.g., regenerating spruce-budworm (*Choristoneura fumiferana*) stands; Potvin *et al*. 2000) during winter months.

In New Hampshire, wind farm development was identified as the greatest immediate threat to high-elevation spruce-fir habitat (WAP 2005). Impacts of wind farm development within these forests could be substantial, as the rate of forest succession is slower compared to lower-elevation habitats (Sprugel 1976), and the associated fragmentation might reduce marten occupancy (Harrison 2011). Much of the current and proposed wind farm development in the northeast occurs along high-elevation ridgelines where measureable disturbance could destabilize the fragile forest community. Additionally, climate change models predict that these forests may either disappear (Iverson and Prasad 2001) or become reduced (Tang and Beckage 2010) in the long term.

The objectives of this study were to assess the potential impacts of wind farm development, specifically the Granite Reliable Power Windpark (GRP Windpark; 33 turbines), on American marten in high-elevation (>823 m) spruce-fir habitat in northern New Hampshire. Specific objectives included measurement of seasonal home ranges, movements, and habitat use, as well as development of a cost-effective method to index abundance and distribution. The study area was located in Coos County, New Hampshire, within the townships of Millsfield, Dixville, Odell, and Ervings Location. Mt. Kelsey, Owlhead Mountain and the surrounding lowlands delineate the study area (Figure 1).

Current Status

A total of 15 American martens were captured in 2010–2011 in the study area of ~50 km^2 in northern New Hampshire. The use of high-elevation spruce-fir habitat by ~10 martens was continuously monitored by 3 ATS 4500S receiver/dataloggers, which detect and store radio signals within a prescribed area of ~8 km^2. Monitoring periods were divided into leaf-off (1 November – 30 April) and leaf-on seasons (1 May – 31 October).

The mean daily detection rate of radio-marked martens (n = 5) was 88% in the leaf-off season, declining to 62% during the leaf-on season (Table 1). All martens were detected on the majority of leaf-off days (range 78–99%). In the leaf-on season 3 of 5 martens were detected on the majority of days (range 58–98%), but 2 martens were detected <50% of days (23% and 44%; Table 1).

Telemetry locations (n = 5 martens) were used to conduct an elevation analysis: locations above and below 823 m were tallied for each period and % change was calculated between leaf-off and leaf-on periods. There was an 11% decrease in locations above 823 m, and a 71% increase in locations below 823 m, during the leaf-on season (Table 2).

As of October 2011, 8 martens (6 males: 2 females) met the location requirements to calculate 95% MCP for leaf-on home ranges (Table 3). Our observed male home range size ($\bar{x}$ = 4.07 km^2) was similar to that reported for martens in trapped ($\bar{x}$ = 4.44 km^2) and untrapped ($\bar{x}$ = 4.89 km^2) industrial forests in Maine (Payer and Harrison 1999), and larger than that reported for a nearby forest reserve (3.25 km^2, Phillips *et al*. 1998). The mean 95% MCP home range of males was 65% larger in the leaf-on than leaf-off season (Table 3). The opposite trend occurred for martens with >10% partial harvests within their home range in Maine (Fuller and Harrison 2005); Phillips *et al*. (1998) did not detect changes in home range area between leaf-on and leaf-off periods in a Maine forest reserve. It is anticipated that sufficient locations will be available to calculate leaf-on home ranges for one additional marten (M11) captured during summer 2011.

A capture-mark-recapture (CMR) effort using camera traps was conducted during winter 2011 to calculate population density. All radio-marked martens (n = 7), and 1 marten with eartags only, were detected ≥ 2 times (Figure 2); 3 unmarked martens were detected >1 time. Our initial density estimate from this effort was 0.42 marten/km^2. In Maine, densities were 0.63 marten/km^2 in a forest reserve, 0.31/km^2 in an untrapped industrial forest, and 0.19/km^2 in a trapped industrial forest (Payer *et al*. 2004). We are experimenting with computer software to distinguish individual throat patches from digital images and video in an attempt to better identify/mark unmarked martens during efforts in winter 2012.

Future Work

The wind farm is scheduled to go on-line December 2011. Data from the stationary receivers will be partitioned into distinct periods related to the wind farm construction process (2010-2012) to assess impacts of the different stages on marten use of high-elevation habitat. We will gather telemetry locations for another set of leaf-on and leaf-off seasons to calculate seasonal and annual home ranges, forest stand/habitat use, and to assess temporal change in marten habitat use, movements, and distribution. A second camera trapping effort to estimate population density will occur in winter 2012. To determine the impact of the newly established road access into the study area, snow tracking of fishers (*Martes pennanti*), coyotes (*Canis latrans*), and red foxes (*Vulpes vulpes*) will occur along established transects during winter 2012.

References

Buskirk, S.W., and L.F. Ruggiero. 1994. American marten. Pages 7–37 *in* L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, editors. The scientific basis for preserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. U.S. Forest Service General Technical Report RM-254.

Fuller, A.K., and D.J. Harrison. 2005. Influence of partial timber harvesting on American martens in northcentral Maine. Journal of Wildlife Management 69: 710–722.

Kelly, J.R. 2005. Recent distribution and population characteristics of American marten in New Hampshire and potential limiting factors affecting their occurrence. M.S. Thesis, University of Massachusetts, Amherst, Massachusetts, USA.

Harrison, D.J. 2011. Wind power development, American martens, and Canada lynx: food for thought. Wind Energy and Wildlife Forum, 2011.

Hodgman, T.P., D.J. Harrison, D.M. Phillips, and K.D. Elowe. 1997. Survival of American marten in an untrapped forest preserve in Maine. Pages 86-99 *in* G. Proulx, H.N. Bryant, and P.M. Woodard, editors. *Martes*: taxonomy, ecology, techniques and management. Provincial Museum of Alberta, Edmonton, Canada.

Iverson, L.R., and A.M. Prasad. 2001. Potential changes in tree species richness and forest community types following climate change. Ecosystems 4: 186–199.

Payer, D.C., and D.J. Harrison, 1999. Effects of forest structure on spatial distribution of American marten. Technical Bulletin No. 787, National Council of the Paper Industry for Air and Stream Improvement, Inc., Research Triangle Park, North Carolina, USA.

Payer, D.C., D.J. Harrison, D.M. Phillips. 2004. Territoriality and home-range fidelity of American marten in relation to timber harvesting and trapping. Pages 99-114 *in*: D.J. Harrison, A.K. Fuller, and G. Proulx, editors. Martens and fishers (*Martes*) in human altered environments. Springer Science and Business Media Inc., New York.

Phillips, D.M., D.J. Harrison, and D.C. Payer. 1998. Seasonal changes in home-range area and fidelity of martens. Journal of Mammalogy 79: 180-190.

Potvin, F., L. Bélanger, and K. Lowell. 2000. Marten habitat selection in a clearcut boreal landscape. Conservation Biology 14: 844–857.

Sprugel, D.G. 1976. Dynamic structure of wave-regenerated *Abies balsamea* forests in the northeastern United States. Journal of Ecology 64: 889-911.

Tang, G. and B. Beckage. 2010. Projecting the distribution of forests in New England in response to climate change. Diversity and Distributions 16: 144-158.

WAP. 2005. New Hampshire Wildlife Action Plan. New Hampshire Fish and Game Department, Concord, New Hampshire, USA

Table 1. Detection data for 5 martens from 3 remote datalogger receivers on Kelsey Mountain, New Hampshire. Detection days are the maximum number of days that martens were detected by any single receiver in the study area. Seasons are defined as leaf-off (1 November – 31 April) and leaf-on (1 May – 31 October).

	Leaf-off Season				Leaf-on Season				
Marten	North	Middle	South	Detection Days	North	Middle	South	Detection Days	Difference
F5	0.6	0.19	0.78	78%	0.23	0.02	0.21	23%	55%
M1	0.56	0.27	0.87	87%	0.55	0.18	0.58	58%	29%
M3	0.19	0.99	0.75	99%	0.03	0.98	0.41	98%	1%
M5	0.8	0.94	0.78	94%	0.53	0.86	0.39	86%	8%
M7	--	0.63	0.83	83%	0.01	0.44	0.43	44%	39%
				88% (±0.04)				62% (±0.14)	26% (±0.10)

Table 2. The proportion of locations relative to elevation and season for 5 radio-collared martens in northern New Hampshire. Only adult martens with established home ranges were included in this analysis.

Elevation	Leaf-off Locations	Leaf-on Locations	Percent Change
≥ 832 m	74	65	-11%
≤ 823 m	48	80	+71%
Total	122	148	

Table 3. Number of marten locations, home range area (95% MCP), and mean (± SE) home range size during leaf-off (1 November – 30 April), and leaf-on (1 May – 31 October) seasons in northern New Hampshire. A minimum of 25 locations was required to calculate a seasonal MCP. An additional 4 martens had 17-24 locations in either season; additional analyses will be used to estimate their home range size.

Males					Females				
	Leaf-off		Leaf-on			Leaf-off		Leaf-on	
ID	No. Locations	Area (km^2)	No. Locations	Area (km^2)	ID	No. Locations	Area (km^2)	No. Locations	Area (km^2)
M1	27	2.11	39	5.43	F4	25	1.32	--	--
M3	31	2.49	17[a]	5.31[a]	F5	37	1.51	37	1.57
M5	21	2.78	31	5.34	F8	--	--	19[a]	2.38[a]
M6	--	--	30	2.29	F9	--	--	27	0.92
M7	17[a]	1.76[a]	28	1.98					
M8	--	--	30	4.35					
M10	--	--	25	2.22					
M11	--	--	24[a]	2.19					
		2.46 (±0.2)[b]		4.07 (±0.79)[b]			1.42 (±0.10)		1.25 (±0.33)

[a] Not included in means and home range analysis.
[b] 65% increase between seasons.

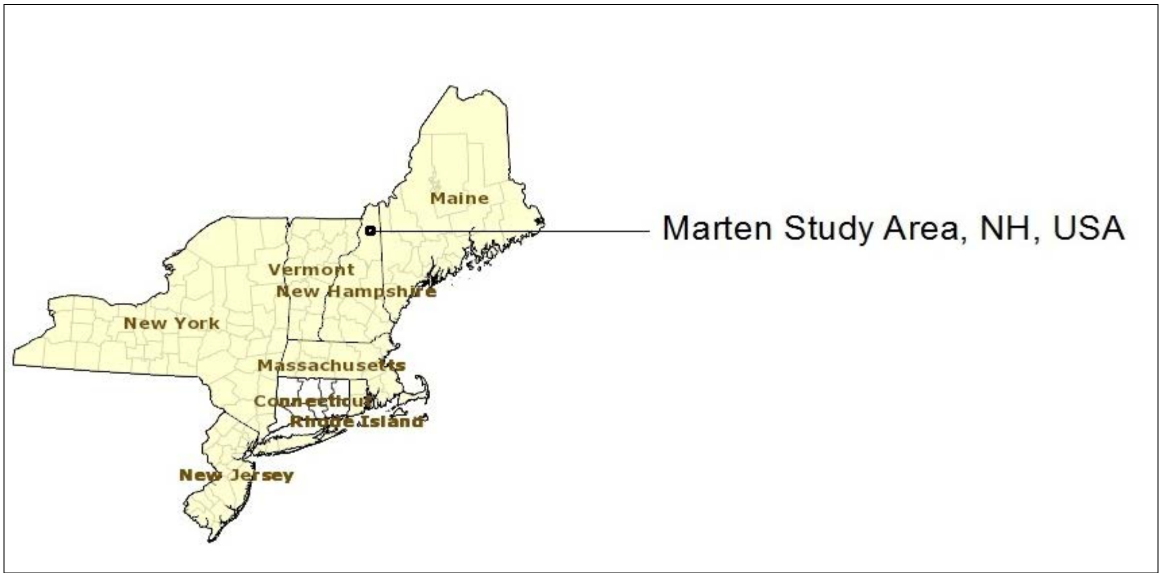

Figure 1. Kelsey Mountain Study Area (~50 km^2) in northern New Hampshire.

Figure 2. Photo capture of radio-marked marten, 11/08/10 at 0717 hr. The shapes and colors of reflective material provide artificial markings to aid in the identification and "recapture" for the mark-recapture population estimate.

EUROPE

Teeth variations and pathologies in stone martens from Croatia

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Two years ago, a study of variations in teeth size, shape, number and occurrence of dental pathologies in stone martens (*Martes foina*) was launched within the framework of a scientific project entitled "Dental Pathology of Wild Mammals." The preliminary study included an analysis of 35 skulls published in the Natura Croatica journal (Konjević *et al*. 2011). This note is a synopsis of that article.

Skulls were visually inspected, as described in Abbot and Verstraete (2005), and the complete dentition was thoroughly examined, with special attention paid to noticeable alterations. In the case of tooth absence, the alveolar bone was thoroughly examined to determine whether the respective tooth was lost during the life or post mortem.

Irregular arrangement of lower incisors was observed in 9 individuals (25.7%). It is worth mentioning that irregular arrangement of incisors is so common that, in certain taxa, authors consider irregular arrangement as a normal finding. The P1 was absent bilaterally in 6 individuals (17.1%) and unilaterally in 5 individuals (14.3%). In contrast, the P1 was absent only unilaterally in 2 cases (0.57%). It is clear that P1 is predisposed to complete reduction, which is in accordance with terminal reduction theory and the fact that P1 is reduced in size and probably without any function in feeding process.

Of the other teeth, I1 was absent in 2 cases unilaterally (0.57%), while I2, C1 and P3 were missing in one case each (0.29%). Differently, we noted only one supernumerary tooth, the upper right premolar, followed with rotation of P2 and P3 as a consequence of overcrowding. Rotation was observed on 6 premolars in total (2 lower and 4 upper).

Complicated crown fractures were observed in 3 skulls (0.86%). Kryštufek and Polak (1996) reported 13.7% incidence of dental injuries in stone marten skulls (95 examined). According to their observations, the most frequently affected were the incisors and lower premolars, while the canines and carnassials that are essential for carnivores were rarely damaged. This is not in accordance with our observations, where we found complicated crown fractures of 1 or all canines in 3 animals. Furthermore, we noted traumatic losses of

3 incisors (2 animals) and one P3. Similarly, Van Valkenburgh (2009) also reported that canines were the most frequently fractured teeth in mustelids. The associated porous alveolar bone was observed just over the 1 fractured canine.

Finally, excessive wear was recorded in 9 skulls (25.7%). The excessive wear was quite common; this was due to the fact that observed wear of P1 was also included.

An absence of teeth is a frequent finding in all carnivores, reflecting a trend to reduce the number of teeth. The relatively low incidence of tooth fractures and almost complete absence of periodontal diseases can be attributed to the fact that the majority of skulls examined originated from adolescent animals.

References

Abbott C., and F.J.M. Verstraete. 2005. The dental pathology of northern elephant seals (*Mirounga angustirostris*). Journal of Comparative Pathology 132: 169-178.

Konjević, D., V. Njemirovskij, M. Vuković, A. Slavica, Z. Janicki, K. Severin, and M. Sindičić (2011): Variations in shape, number and position of teeth in stone martens from island habitats (Croatia) – preliminary results. Natura Croatica 20: 215-223.

Kryštufek, B., and S. Polak. 1996. Dental and skull abnormalities in the Stone marten *Martes foina* (Erxleben, 1777) from Slovenia. Small Carnivore Conservation 14: 14-18.

Van Valkenburgh, B. 2009. Costs of carnivory: tooth fractures in Pleistocene and Recent carnivorans. Biological Journal of the Linnean Society 96: 68–81.

Pine marten abundance and potential impacts of habitat fragmentation in Northern Ireland-A case study in the Mourne Mountains

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In Ireland, the insular pine marten (*Martes martes*) population exists at the western edge of the species' global distribution in a landscape that has less than 10% forest cover. The population has undergone substantial historical population declines and reductions in range and distribution (O' Sullivan 1983), but in recent years some range expansion has occurred from relict populations (O' Mahony et al. in prep).

In Northern Ireland, recent broad-scale abundance estimates suggest that the total pine marten population may number less than 300 individuals (O' Mahony *et al*. in prep). Less than 7% (<9,000 hectares) of the land cover consists of forest habitat, the majority of which is highly fragmented conifer plantation. Pine marten distribution in Northern Ireland is also fragmented, with the main population existing in western regions that occupy less than 20% of the total land area (O' Mahony *et al*. in prep). Outside of this 'core-range', pine martens are largely extirpated, but some isolated populations do exist. One of the most important of these areas may be in the Mourne Mountains, an area of approximately 350 km^2 with 4,000 hectares of forest that exists in several discrete management units. It is critical that we understand the ecology and abundance of pine marten in these potentially isolated populations to ensure short- to medium-term population viability.

During 2011 a non-invasive survey is being undertaken in the Mourne Mountains, primarily relying on the use of hair tubes and genotyping to obtain population estimates. A grid of 125 hair tubes, spaced at intervals of 500 m, has been deployed, with 4 'capture' sessions to be undertaken between June and November 2011. Estimates of population abundance will be established using minimum number alive and spatially explicit capture-recapture models. The impact of habitat fragmentation on the population will also be assessed using genotyping techniques to relate animal 'capture' locations to the distribution of suitable habitat within the region.

This information will be used to evaluate the use of non-invasive survey methods as a potential large-scale population monitoring technique, and also to determine the conservation status of the pine marten in the Mourne Mountain region. It will also increase the profile of this species among the general public, which is generally poor due to their rarity and elusive behaviour.

References

O'Mahony, D., P. Turner, and C. O'Reilly. (in prep). Pine marten distribution and abundance in Ireland: Conservation in-action from a cross-jurisdictional perspective.

O' Sullivan, P.J. 1983. The distribution of pine marten (*Martes martes*) in the Republic of Ireland. Mammal Review 13: 39-44.

Research of genetic variability of beech marten from Croatia

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Beech (stone) martens (*Martes foina*, Erx. 1777) are found throughout Croatia, in both continental and Mediterranean parts of the country. This native carnivore also inhabits most of the larger islands. Beech martens are often found near human settlements, and although they play a role in controlling rodent populations, they are often treated as pests. In Croatia, the beech marten is a game species with an open hunting season; protection is ruled only during pregnancy and for females with offspring. Annual hunting bag is determined by game management plans, according to the estimated spring count and previously established biological minimum value.

Scientific data about the population size or mortality at the national level are not available. Published research has been limited to ecotoxicology (Bilandžić *et al*. 2010) and dental pathology (Konjević *et al*. 2011). Additional works include a master thesis on feeding habits on the island Cres (Baltic 2009) and a doctoral dissertation on character displacement when island habitat is shared with the introduced small Indian mongoose (*Herpestes auropunctatus*) (Barun 2011).

Probably due to stable and still growing populations throughout its habitat, studies on population genetics of beech marten are quite rare. Most of the data about sequence variation of beech marten mitochondrial DNA comes from research on molecular evolution and research on species-specific primers used for species identification, mostly based on cytochrome b, and less often on control region sequence variation.

The Faculty of Veterinary Medicine at the University of Zagreb has started research on genetic variability and population structure of beech marten from Croatia. This research is conducted in cooperation with the Centre for Environmental Biology at Lisbon University. Preliminary data on variability of mitochondrial DNA control region sequences has been presented on VIth European Congress of Mammalogy, held in Paris in July 2011.

Samples (*n*=22) collected in urban areas of central Croatia have been analyzed, and 28 polymorphic sites have been found on 302 base pair mitochondrial DNA control region sequences representing 8 haplotypes. A clear geographical pattern in the distribution of haplotypes in central Croatia was not found. Comparison of 8 Croatian mtDNA haplotypes found in this study with 3 control region sequences deposited in the GenBank (2 from Iberian Peninsula and 1 from an undefined European country) revealed no potential matches between haplotypes.

References

Baltic, M. 2009. The diet of the stone marten *Martes foina* (Erxleben, 1777) on the island of Cres. Master thesis. Faculty of Science, University of Zagreb.

Barun, A. 2011. The small Indian mongoose (*Herpestes auropunctatus*) on Adriatic Islands: impact, evolution, and control. Ph.D. dissertation, University of Tennessee.

Bilandžić, N., D. Dežđek, M. Sedak, M. Dokić, B. Solomun, I. Varenina, Z. Knežević, and A. Slavica. 2010. Concentrations of trace elements in tissues of red fox (*Vulpes vulpes*) and stone marten (*Martes foina*) from suburban and rural areas in Croatia. Bulletin of Environmental Contamination and Toxicology 85(5): 486-491.

Konjević, D., V. Njemirovskij, M. Vuković, A. Slavica, Z. Janicki, K. Severin, and M. Sindičić. 2011. Variations in shape, number, and position of teeth in stone martens from island habitats (Croatia) – preliminary results. Natura Croatica 20(1): 215-223.

Sindičić, M., T. Gomerčić, D. Kos, D. Dežđek, D. Konjević, T. Keros, and A. Slavica. 2011. Variability of mitochondrial DNA in beech marten (*Martes foina*) from central Croatia. Abstract Volume VI[th] European Congress of Mammalogy, Pariz, Francuska. P. 71.

RUSSIA

Changes of *Martes* species numbers in the Middle Urals over 20 years

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Pine martens (*Martes martes*) occur throughout the Ural Mountains region, but sables (*M. zibellina*) occur only in the northeast (Monakhov 2005). Winter transect counts, held regularly in February and March, are used to estimate the number of pine martens and sables living in the Ural Mountains jointly. The Department of the Sverdlovsk region gathers these data to facilitate the protection, control and regulation of wildlife use. From the annual estimates, multi-year averages of abundance for the periods 1987 – 1991 and 2005 – 2011 were calculated for all 47 municipal areas.

The territory of the Sverdlovsk region is intersected by the Ural Mountains from north to south. For this reason, habitats of commercial (harvested) species are very diverse. According to our research (Monakhov *et al*. 1997), the region supports 3 natural-hunting Zones, which include 6 game-economy counties (Figure 1A):

- The To-Urals Zone (prior to Urals, PU) includes a county with the same title.
- The Urals Zone (Ural Mountains, U) is divided into 3 counties: North-Urals (U1), middle-taiga-mountainous (U2), and Middle Urals (U3).
- The Trans-Ural range of the region is called the Western Siberian Zone (WS). It also encompasses 3 counties: plain middle-taiga (WS1), southern taiga (WS2), and forest-steppe (WS3).

Analysis of data on the number of *Martes*, in combination with the natural-hunting zoning, reveals regular features in the dynamics of species resources. In addition, this information allows us to evaluate the priority causes and factors of these changes.

The number of sables has increased significantly in the past 20 years throughout the region (Table 1, Figure 1). The increase in the different counties ranges from 1.6 to 3.02 times (average 2.7) (Table 1).

The data on pine marten are even more impressive (Table 1, Figure 2). In 1987 – 1991, the number of pine martens exceeded 1,000 only in 1 county (WS2), but did not exceed 500 in 4 counties (PU, U1, U3, and WS3). After 20 years, WS2 county supports more than 3,000 pine martens, and an additional 4 counties (U2, U3, WS1, and WS3) now support more than 1,000 martens. For the remaining 2 counties (PU and U1), the minimum number is now 500 martens. The average increase in the number of martens in the region is about 2.9 times (Table 1). The minimum increase among the individual counties was 2.3 times (PU1), and the maximum increase was 8.4 times (WS3). In 2 other southern counties (U2 and U3), the number increased by 3.3 and 4.4 times, respectively.

N.S. Korytin (2011) documented similar changes in the number of Uralian *Martes*. He attributed these changes to anthropogenic causes. Hunting pressure limited the number of martens and sables in the 1980 – 1990 period. When this pressure was removed in the 2000s, marten and sable abundances increased.

In our opinion, the relationship between hunting pressure and the abundance of marten and sables is undeniable. However, such a strong and sharp increase in marten and sable numbers may be explained by global warming too. This may explain the continuing growth of the marten population in the southern region of 3.3 – 8.4 times (Table 1, Figure 2).

Data indicate that warming is occurring in the Urals (an increase over the past 30 years of 1.5 – 2°C) and in Russia in general (1 – 1.5°C). Also, forests have expanded northward. This forest expansion is enhanced by the overgrowth of unused agricultural lands. As a result, some migratory birds are wintering in the Urals. In addition, the migration paths of birds are changing:
http://www.gazeta.ru/news/science/2008/12/15/n_1308432.shtml
http://www.svgimet.ru/index.php?page=about&pid=100101
http://ural.ria.ru/science/20061215/81526135.html

In the Urals, the greatest sable population growth occurred in commonly used habitats (district SW1, by 3 times). However, there is evidence that sable population growth is occurring in other western parts of its range (Korytin 2011). In addition, the sable has begun appearing in areas where it has previously been rare (e.g., in the U2 and SW3 counties, Monakhov 2010).

If we look at the abundance of *Mustela* species, we obtain a very different picture (Table 1). On average, in all districts, Siberian weasels (*Mustela sibirica*) and ermines (*Mustela erminea*) have decreased by 53% (range 34 – 128%), and 41% (range 16 – 80%), respectively. We believe that these declines are due to habitat reduction (overgrowing of fields, meadows and edges by deciduous and coniferous young forest), and an increase in other predator populations, including pine marten and sable. With the increase in forest cover due to uncultivated agricultural land more habitat may be created for sable and pine marten in the near future.

This work was supported by RFBR, project 10-04-96063.

References

Korytin, N.S. 2011. Changes in the numbers of predatory mammals in the Middle Urals caused by anthropogenic factors. Russian Journal of Ecology 42(3): 231–235.

Monakhov, V.G. 2005. Über den gegenwärtigen Zustand der Populationen von Arten der Gattung *Martes* in der Transgressionszone der Areale im Mittelural. Beitraege zur Jagd- und Wildforschung 30: 331-335.

Monakhov, V.G. 2010. Records of sable outside its range in southern Sverdlovsk region in winter of 2009–2010. Zoologicheskii Zhurnal 89:1394–1397 (in Russian with English summary).

Monakhov V.G., Yu.A. Kuzminikh, and S.P. Trushin. 1997. On the game-natural area zoning of Svepdlovsk province. Pp. 129-130 *in* G.A. Selitsky and Yu.G. Yaroshenko, eds. Problems of outside ambient conservation in the Urals region. Ekaterinburg.

Table 1. Multi-year averages of *Martes* and *Mustela* species abundances in the Middle Urals over the last 20 years.

County	Years	Sable	Pine marten	Siberian weasel	Ermine
PU	1987-1991		369	176	310
	2005-2011		850	68	50
	Variation (%)		230	39	16
U1	1987-1991	21	313	71	1006
	2005-2011	34	718	91	804
	Variation (%)	163	230	128	80
U2	1987-1991		670	800	2314
	2005-2011		2191	528	1053
			327	66	46
U3	1987-1991		286	505	862
	2005-2011		1271	273	369
	Variation (%)		444	54	43
WS1	1987-1991	1718	661	2342	7862
	2005-2011	5181	1561	1672	3244
	Variation (%)	302	236	71	41
WS2	1987-1991	664	1741	4467	6624
	2005-2011	1281	4148	1840	2318
	Variation (%)	193	238	41	35
WS3	1987-1991		174	1091	897
	2005-2011		1463	371	276
	Variation (%)		841	34	31

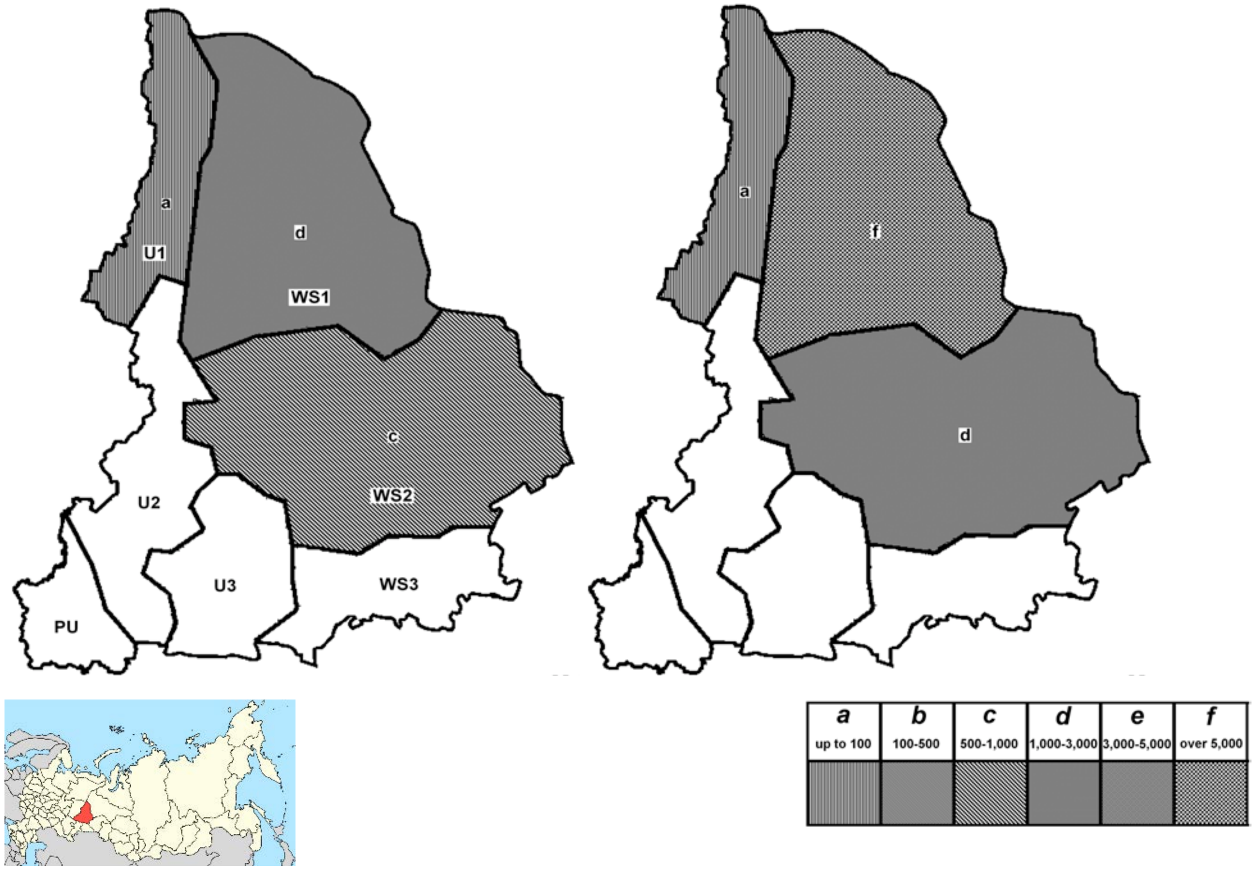

Figure 1. Changes of sable numbers in the Sverdlovsk region from 1987 – 1991 (A, left) to 2005 – 2011 (B, right). Designations of zones and districts in the text.

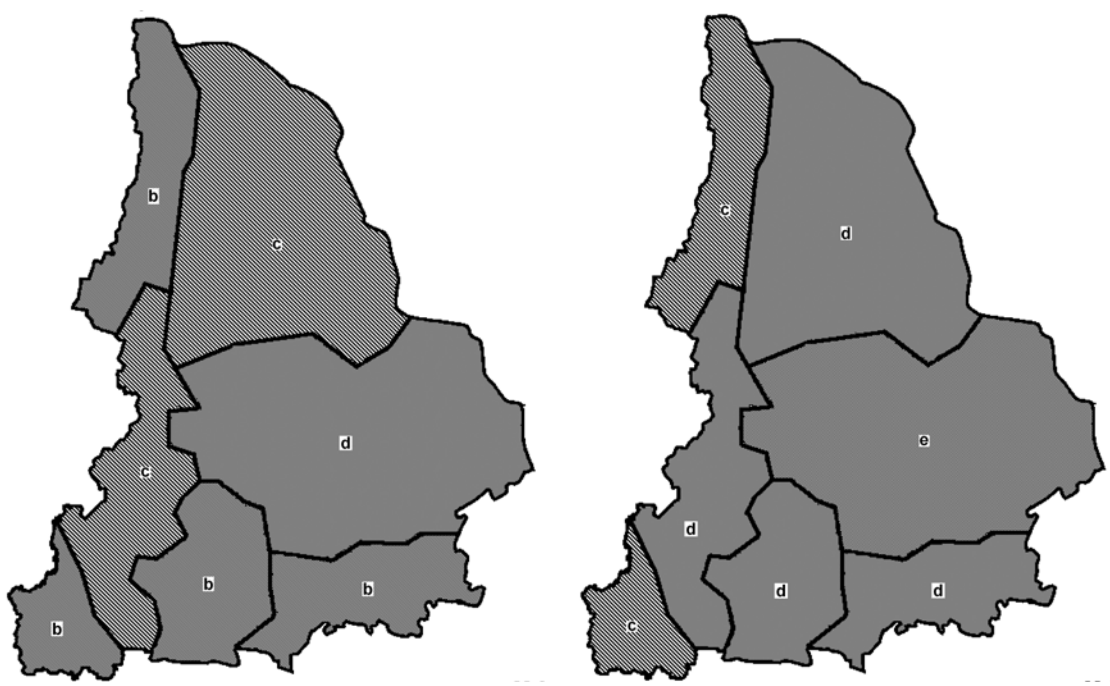

Figure 2. Changes of pine marten numbers in Sverdlovsk region from 1987 – 1991 (A, left) to 2005 – 2011 (B, right). Designations as in Figure 1.

Sable and marten population increase: Is it possible to raise game quotas?

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In Russian Hunting Rules, sable (*Martes zibellina*) and pine marten (*M. martes*) harvesting in Russia begins in October and ends in February. However, some hunting commercial farms cease catching sables and martens in January, assuming that in late winter the catch consists of more adult animals, especially females. Russian Hunting Rules allow a separate order and period for catching fur-bearing animals, as established by Regional Hunting rules.

Recent studies (Borisov and Laumanov 2006; Safonov et al. 2006; Monakhov 2010; Monakhov 2011, in this newsletter; Korytin 2011) showed increases in sable numbers in recent years. In the eastern part, especially in Yakutia, the increase in sable numbers was due to colonization of previously unoccupied areas due to intensive hunting. In the western part, the increase may be attributed to a reduction in hunting pressure due to socio-economic factors.

Population growth and the rationalization of exploitation raise the legitimate question of increasing the hunting quotas on sables. Currently, for sables and pine martens, the quota calculation is based on a rate of 25 – 30% of autumn numbers. Bakeyev (1971) considered it possible to increase the quota up to 33 – 35% when populations are stable, and to 40 – 42% during peak years of the cyclic abundance. Summarizing the data on population structure (Monakhov 2005), we can conclude that the average proportion of juveniles in the general population of the entire sable area is about of 35 – 40%, and that population growth is 54 – 60%. If the observed population growth is 38% from the autumn number, then the quota could be as high as 30 – 35%.

Of course, if we are to control the impact of hunting pressure, it is necessary to study the structure of hunting samples. Comparisons of basic demographic parameters (e.g., sex ratio, age distribution, fertility of females) at the beginning, middle, and end of the game season will provide the hunting manager information about the impact of exploitation on population structure.

In the case of *Martes* species, increasing quotas would result in an increase of profits. In contrast, an increase in beaver (*Castor fiber*) populations in the last 10 years has resulted in more problems for forestry, agriculture, and transport, due to the flooding, destruction of dams, roads, and embankments, and the felling of trees on roads and communication lines.

This work was supported by RFBR, project 10-04-96063.

References
Bakeyev, N.N. 1971. Sable economy of the USSR and its scientific basis of housekeeping. Materials for the scientific-industrial conference on sable. Kirov. 1971: 6-11. (in Russian)

Borisov, B.P., and I.K. Lomanov. 2006. Analysis of situations with protection and using of the resources of the sable in Russia. Vestnik Okhotovedeniya 3: 289–308 (in Russian with English summary).

Korytin N.S. 2011. Changes in the numbers of predatory mammals in the Middle Urals caused by anthropogenic factors. Russian Journal of Ecology 42: 231–235.

Monakhov V.G. 2005. Age distribution in sable *Martes zibellina* populations. Abhandlungen Berichte Naturkundemuseums, Gorlitz, Germany 76: 135–150.

Monakhov V.G. 2010. Records of sable outside its range in southern Sverdlovsk region in winter of 2009–2010. Zoologicheskii Zhurnal 89:1394–1397 (in Russian with English summary).

Safonov, V.G., A.A. Sinitsin, and S.I. Minkov. 2006. The sable problem made of bureaucrats. Pp. 188–205 *in* V.G. Safonov, ed. Problems facing sable management in Russia. All-Russian Institute of Hunting and Fur Farming, Kirov, Russia (in Russian).

ASIA

Diet of an opportunistically frugivorous carnivore, *Martes flavigula*, in subtropical forest

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The following is an abstract from a paper published in the Journal of Mammalogy 92(3) 2011, pp. 611-619.

Abstract – In response to foraging for foods that fluctuate in availability, generalists often exhibit the ability to switch between different food sources. Many of the Carnivora on an omnivorous–frugivorous diet display temporal dietary switching and specialism, but the mechanisms underlying this are incompletely understood. Here we studied the diet of the opportunistically frugivorous yellow–throated marten, *Martes flavigula*, with regard to food–resource exploitation in a subtropical forest of central China. Diet was determined through scat analyses combined with surveys to estimate local food abundance. Peak fruit consumption and the lowest utilization of small mammals occurred when fruit abundance reached its temporal maximum in the environment in synchrony with a concomitant peak in small mammal abundance. When both fruits and small mammals were least abundant in the environment, marten diet shifted to the maximum utilization of small mammals with no fruit consumption. This dietary switching could not be explained by the fluctuation in the abundance of principal prey in the environment, i.e. small mammals, but by the ease of procurement of fruit at peak fruiting season. Marten diet thus does not simply reflect primary resource abundance but is a function of the relative abundance and inferred availability of alternative food types. This case study of the yellow–throated marten provides insight into foraging strategies that depend on the relative, temporal, availability of food types, a phenomenon observed for other generalist omnivores (including several Carnivora).

Frugivory and seed dispersal by the yellow-throated marten, *Martes flavigula*, in a subtropical forest of China

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Yellow-throated marten, *Martes flavigula*.
Photo courtesy of You-Bing Zhou.

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The following is the first paragraph from a paper published in the Journal of Tropical Ecology 24 2008, pp. 219-223.

First Paragraph – The yellow-throated marten, *Martes flavigula*, is the only living species of the genus *Martes* found in subtropical and tropical forests (Harrison *et al*. 2004). It is distributed throughout central and southern Asia in a wide variety of habitats. Despite its extensive geographical range, the ecology and behaviour of this species has so far received little attention, aside from a study of habitat use (Grassman *et al*. 2005). Studies on other martens have shown that fruits are an important food resource (e.g. *M. martes*, Bermejo and Guitian 2000; *M. foina*, Pandolfi *et al*. 1996). Thus, they are considered to be important potential seed dispersers (Corlett 1998, Herrera 1989, Willson 1993), as confirmed by recent studies (*M. melampus*, Otani 2002; *M. americana*, Hickey *et al*. 1999; *M. foina* and *M. martes*, Schaumann and Heinken 2002). Although no systematic study of the diet of *M. flavigula* has been conducted (Harrison *et al*. 2004), it is known to be omnivorous and to consume fruit (Gao and Wang 1987). To date, however, there has been no comprehensive study of frugivory and seed dispersal by *M. flavigula* (but see Corlett 1998).

HELP WANTED

Request for collaboration: Cranial morphology in American and Eurasian *Martes*

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We invite American and Canadian scientists studying the species of the genus *Martes* living in North America (*Martes americana* and *Martes pennanti*), and who have access to the great craniological collections of these species, preferably from different parts of the continent, for a collaborative investigation of cranial morphology. Main subjects include: dimensional structure of populations, sexual size dimorphism (SSD), expression of non-metric cranial traits, and morphologic results of re-introductions. Please contact us if you are interested.

Eastern North America Regional Representative Needed

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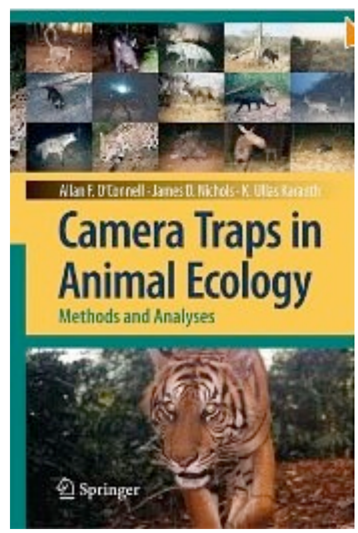
William B. Krohn, one of the founding members of the *Martes* Working Group, has recently retired, and can no longer serve as the Eastern North America Regional Representative. We appreciate his service and are sorry to see him go!

A *Martes* Working Group Regional Representative has only a few, but important, duties. Regional Representatives help recruit new MWG members, help contact potential newsletter contributors, and contribute to the international symposia.

If you are interested in serving as the Martes Working Group's new Eastern North America Regional Representative, please contact me directly at the email address given above. Thank you!

NEW BOOK ANNOUNCEMENT

Camera Traps in Animal Ecology
Methods and Analyses



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Hardcover ISBN 978-4-431-99494-7 $189
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About this Book
Remote photography and infrared sensors are widely used in the sampling of wildlife populations worldwide, especially for cryptic or elusive species. Guiding the practitioner through the entire process of using camera traps, this book is the first to compile state-of-the-art sampling techniques for the purpose of conducting high-quality science or effective management. Chapters on the evaluation of equipment, field sampling designs, and data analysis methods provide a coherent framework for making inferences about the abundance, species richness, and occupancy of sampled animals. The volume introduces new models that will revolutionize use of camera data to estimate population density, such as the newly developed spatial capture–recapture models. It also includes richly detailed case studies of camera trap work on some of the world's most charismatic, elusive, and endangered wildlife species. Indispensible to wildlife conservationists, ecologists, biologists, and conservation agencies around the world, the text provides a thorough

review of the subject as well as a forecast for the use of remote photography in natural resource conservation over the next few decades.

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NORTHERN FURBEARER CONFERENCE PROCEEDINGS AVAILABLE

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The proceedings of the 13th Northern Furbearer Conference, held in Whitehorse, Yukon, Canada, on 12-15 April 2011, are available online.
http://www.env.gov.yk.ca/huntingtrapping/documents/furbearerconf_proceedings2011.pdf

The proceedings feature abstracts and summaries for the 23 presentations and posters, including the several that focus on *Martes* species:

- The status of fisher (*Martes pennanti*) at the northwestern edge of their range: are they increasing and expanding in the Yukon? Thomas S. Jung, and Brian G. Slough.
- Got marten? Recent Harvest in Manitoba. Dean Berezanski and Jim Duncan.
- Abundance, survival and movements of martens in a contact zone – Kuiu Island, Southeast Alaska. Carl H. Koch, Rodney W. Flynn, and Natalie G. Dawson.
- Characterizing American marten (*Martes americana*) den sites in managed forests of Ontario, Canada. Stephen C. Mills, Philip A. Wiebe, Ian D. Thompson, James A. Baker, and John M. Fryxell.
- Home range size and habitat selection by American marten (*Martes americana*) in logged boreal forest of southeastern Yukon. Lea A. Randall, Todd Powell, Jan Z. Adamczewski, and Thomas S. Jung.

RECENT *MARTES* LITERATURE

This is not an exhaustive list. Please see previous Martes Working Group Newsletters and the MWG website for additional literature.

Balestrieri, A., L. Remonti, A. Ruiz-Gonzalez, M. Vergara, E. Capelli, B.J. Gomez-Moliner, and C. Prigioni. 2011. Food habits of genetically identified pine marten (*Martes martes*) expanding in agricultural lowlands (NW Italy). Acta Theriologica 56(3): 199-207.

Barja, I., G. Silván, L. Martínez-Fernández, and J.C. Illera. 2011. Physiological stress responses, fecal marking behavior, and reproduction in wild European pine martens (*Martes martes*). Journal of Chemical Ecology 37(3): 253-259.

Basto, M.P., M. Rodrigues, M. Santos-Reis, M.W. Bruford, and C.A. Fernandes. 2010. Isolation and characterization of 13 tetranucleotide microsatellite loci in the stone marten (*Martes foina*). Conservation Genetics Resources 2(1): 317-319.

Belant, J.L., D.R. Etter, P.D. Friedrich, M.K. Cosgrove, B.W. Williams, and K.T. Scribner. 2011. Comparison of techniques for sex determination of American martens. Journal of Wildlife Management 75(1): 256-260.

Benetka, V., M. Leschnik, N. Affenzeller, and K. Moestl. 2011. Phylogenetic analysis of Austrian canine distemper virus strains from clinical samples from dogs and wild carnivores. Veterinary Record 168(14): 376-U39.

Bilandžić, N., D. Dežđek, M. Sedak, M. Đokić, B. Solomun, I. Varenina, Z. Knežević, and A. Slavica. 2010. Concentrations of trace elements in tissues of red fox (*Vulpes vulpes*) and stone marten (*Martes foina*) from suburban and rural areas in Croatia. Bulletin of Environmental Contamination and Toxicology 85(5): 486-491.

Burki, S., T. Roth, K. Robin, and D. Weber. 2010. Lure sticks as a method to detect pine martens *Martes martes*. Acta Theriologica 55(3): 223-230.

Chen, L., H-H. Zhang, and J-Z. Ma. 2010. Morphological characteristics and regional distribution of endocrine cells in the digestive tract of *Martes zibellina*. Journal of Beijing Forestry University 32(2): 127-132.

Cheveau, M. 2010. Multiscalar effects of forest fragmentation by timber harvesting on American marten in the boreal forest of eastern Canada. Ph.D. Dissertation, Université du Québec en Abitibi-Témiscamingue, 226 p.

Colli, L., R. Cannas, A.M. Deiana, and J. Tagliavini. 2011. Microsatellite variability of Sardinian pine martens, *Martes martes*. Zoological Science 28(8): 580-586.

Cushman, S., M. Raphael, L. Ruggiero, A. Shirk, T. Wasserman, and E. O'Doherty. 2011. Limiting factors and landscape connectivity: the American marten in the Rocky Mountains. Landscape Ecology 26(8): 1137-1150.

Dinkel, A., S. Kern, A. Brinker, R. Oehme, A. Vaniscotte, P. Giraudoux, U. Mackenstedt, and T. Romig. 2011. A real-time multiplex-nested PCR system for coprological diagnosis of *Echinococcus multilocularis* and host species. Parasitology Research 109(2): 493-498.

Gabriel, M.W., G.M. Wengert, S.M. Matthews, J.M. Higley, J.E. Foley, A. Blades, M. Sullivan, and R.N. Brown. 2010. Effectiveness of rapid diagnostic tests to assess pathogens of fishers (*Martes pennanti*) and gray foxes (*Urocyon cinereoargenteus*). Journal of Wildlife Diseases 46(3): 966-970.

Gerrikagoitia, X., M. Barral, and R.A. Juste. 2010. *Angiostrongylus* species in wild carnivores in the Iberian Peninsula. Veterinary Parasitology 174(1-2): 175-180.

Godbout, G., and J-P. Ouellet. 2010. Fine-scale habitat selection of American marten at the southern fringe of the boreal forest. Ecoscience 17(2): 175-185.

Grünewald, C., N. Breitbach, and K. Böhning-Gaese. 2010. Tree visitation and seed dispersal of wild cherries by terrestrial mammals along a human land-use gradient. Basic and Applied Ecology 11(6): 532-541.

Hapeman, P., E.K. Latch, J.A. Fike, O.E. Rhodes, and C.W. Kilpatrick. 2011. Landscape genetics of fishers (*Martes pennanti*) in the Northeast: dispersal barriers and historical influences. Journal of Heredity 102(3): 251-259.

Hiller, T.L., D.R. Etter, J.L. Belant, and A.J. Tyre. 2011. Factors affecting harvests of fishers and American martens in northern Michigan. Journal of Wildlife Management 75(6): 1399-1405.

Hosoda, T., J. J. Sato, L-K. Lin, Y-J. Chen, M. Harada, and H. Suzuki. 2011. Phylogenetic history of mustelid fauna in Taiwan inferred from mitochondrial genetic loci. Canadian Journal of Zoology 89(6): 559-569.

Inoue, T., T. Murakami, A.V. Abramov, and R. Masuda. 2010. Mitochondrial DNA control region variations in the sable *Martes zibellina* of Hokkaido Island and the Eurasian continent, compared with the Japanese marten *M. melampus*. Mammal Study 35(3): 145-155.

Kashtanov, S.N., G.A. Rubtsova, and O.E. Lazebny. 2011. Analysis of the genetic structure of a farm-bred sable (*Martes zibellina* Linnaeus, 1758) population using microsatellite markers. Russian Journal of Genetics: Applied Research 1(3): 217–220.

Kosintsev, P.A., and V.V. Gasilin. 2011. Historical changes in the northeastern border of the stone marten (Carnivora, Mustelidae, *Martes foina* Erxleben, 1777) area. Doklady Biological Sciences 436(1): 29-32.

Larkin, J.L., M. Gabriel, R.W. Gerhold, M.J. Yabsley, J.C. Wester, J.G. Humphreys, R. Beckstead, and J.P. Dubey. 2011. Prevalence to *Toxoplasma gondii* and *Sarcocystis* spp. in a reintroduced fisher (*Martes pennant*) population in Pennsylvania. Journal of Parasitology 97(3): 425-429.

Larkin, J.L., J.C. Wester, W.O. Cottrell, and M.T. DeVivo. 2010. Documentation of the rabies virus in free-ranging fisher (*Martes pennanti*) in Pennsylvania. Northeastern Naturalist 17(4): 523-530.

Lau, M. W-N., J.R. Fellowes, and B.P.L. Chan. 2010. Carnivores (Mammalia: Carnivora) in South China: a status review with notes on the commercial trade. Mammal Review 40(4): 247-292.

Li, B., Y.C. Xu, Y. Ma, M. Elmeros, T.M. Lan, and S.Y. Bai. 2011. A PCR-RFLP-based method to distinguish sable (*Martes zibellina*) and pine marten (*Martes martes*). Acta Theriologica 56(3): 283-288.

Lofroth, E.C., C.M. Raley, J.M. Higley, R.L. Truex, J.S. Yaeger, J.C. Lewis, P.J. Happe, L.L. Finley, R.H. Naney, L.J. Hale, A.L. Krause, S.A. Livingston, A.M. Myers, and R.N. Brown. 2010. Conservation of fishers (*Martes pennanti*) in south-central British Columbia, western Washington, western Oregon, and California, Volume I: Conservation assessment. USDI Bureau of Land Management, Denver, Colorado, USA.

Lofroth, E.C., J.M. Higley, R.H. Naney, C.M. Raley, J.S. Yaeger, S.A. Livingston, and R.L. Truex. 2011. Conservation of fishers (*Martes pennanti*) in south-central British Columbia, western Washington, western Oregon, and California, Volume II: Key finding from fisher habitat studies in British Columbia, Montana, Idaho, Oregon, and California. USDI Bureau of Land Management, Denver, Colorado, USA.

Long, R.A., T.M. Donovan, P. MacKay, W.J. Zielinski, and J.S. Buzas. 2011. Predicting carnivore occurrence with noninvasive surveys and occupancy modeling. Landscape Ecology 26(3): 327-340.

Lyman, R.L. 2011. Paleoecological and biogeographical implications of late Pleistocene noble marten (*Martes americana nobilis*) in eastern Washington State, USA. Quaternary Research 75(1): 176-182.

Matthews, S.M., J.M. Higley, J.S. Yaeger, and T.K. Fuller. 2011. Density of fishers and the efficacy of relative abundance indices and small-scale occupancy estimation to detect a population decline on the Hoopa Valley Indian Reservation, California. Wildlife Society Bulletin 35:69-75.

Mergey, M., R. Helder, and J-J. Roeder. 2011. Effect of forest fragmentation on space-use patterns in the European pine marten (*Martes martes*). Journal of Mammalogy 92(2): 328-335.

Millan, J., S. Zanet, M. Gomis, A. Trisciuoglio, N. Negre, and E. Ferroglio. 2011. An investigation into alternative reservoirs of Canine Leishmaniasis on the endemic island of Mallorca (Spain). Transboundary and Emerging Diseases 58(4): 352-357.

Moinet, M., C. Fournier-Chambrillon, G. Andre-Fontaine, S. Aulagnier, A. Mesplede, B. Blanchard, V. Descarsin, P. Dumas, Y. Dumas, C. Coic, L. Couzi, and P. Fournier. 2010. Leptospirosis in free-ranging endangered European mink (*Mustela lutreola*) and other small carnivores (Mustelidae, Viverridae) from southwestern France. Journal of Wildlife Diseases 46(4): 1141-1151.

Monakhov V.G. 2010. Productivity of habitats and resource efficiency of sable and squirrel in the Northern Krasnoyarsk Krai and the Republic of Sakha (Yakutia). Geography and Natural Resources 3: 105-110. (In Russian).

Monakhov, V.G. 2011. *Martes zibellina* (Carnivora: Mustelidae). Mammalian Species 43(1): 75-87. (www.bioone.org/loi/mmsp; http://www.asmjournals.org/doi/abs/10.1644/876.1.)

Monakhov V.G., M.N. Ranyuk, and V.M. Safronov. 2011. Size structure of introduced and native populations of sable in Yakutia. Contemporary Problems of Ecology 4(4): 451–456. http: (www.springerlink.com/content/t376236w26476p66)

Mortelliti, A., G. Amori, D. Capizzi, C. Rondinini, and L. Boitani. 2010. Experimental design and taxonomic scope of fragmentation studies on European mammals: current status and future priorities. Mammal Review 40(2): 125-154.

Naney, R.H., L.L Finley, E.C. Lofroth, P.J. Happe, A.L. Krause, C.M. Raley, R.L. Truex, L.J. Hale, J.M. Higley, A.D. Kosic, J.C. Lewis, S.A. Livingston, D.C. MacFarlane, A.M. Myers, and J.S. Yaeger. 2011. Conservation of fishers (*Martes pennanti*) in south-central British Columbia, western Washington, western Oregon, and California, Volume III: Threat assessment. USDI Bureau of Land Management, Denver, Colorado, USA.

Natali, C., E. Banchi, C. Ciofi, E. Manzo, P. Bartolommei, and R. Cozzolino. 2010. Characterization of 13 polymorphic microsatellite loci in the European pine marten *Martes martes*. Conservation Genetics Resources 2(1): 397-399.

Oliveira, R., D. Castro, R. Godinho, G. Luikart, and P.C. Alves. 2010. Species identification using a small nuclear gene fragment: application to sympatric wild carnivores from south-western Europe. Conservation Genetics 11(3): 1023-1032.

Pauli, J.N., J.P. Whiteman, B.G. Marcot, T.M. McClean, and M. Ben-David. 2011. DNA-based approach to aging martens (*Martes americana* and *M. caurina*). Journal of Mammalogy 92(3): 500-510.

Pedersen, A.O., R.A. Ims, N.G. Yoccoz, V.H. Hausner, and K.H. Juell. 2010. Scale-dependent responses of predators and their prey to spruce plantations in subarctic birch forests in winter. Ecoscience 17(2): 123-136.

Piao, Z.J., L.N. Tang, R.K. Swihart, and S.X. Wang. 2011. Human-wildlife competition for Korean pine seeds: vertebrate responses and implications for mixed forests on Changbai Mountain, China. Annals of Forest Science 68(5): 911-919.

Proulx, G. 2009. Conserving American Marten *Martes americana* winter habitat in sub-boreal spruce forests affected by Mountain Pine Beetle *Dendroctonus ponderosae* infestations and logging in British Columbia, Canada. Small Carnivore Conservation 41: 51-57.

Proulx, G. 2011. Verification of a forest rating system to predict fisher, *Martes pennanti*, winter distribution in sub-boreal forests of British Columbia, Canada. Canadian Field-Naturalist 125: 7-11.

Proulx, G, and B. Genereux. 2009. Persistence of a reintroduced fisher, *Martes pennanti*, population in Cooking Lake-Blackfoot Provincial Recreation Area, Central Alberta. Canadian Field-Naturalist 123: 178-181.

Puzachenko, Yu. G., A.S. Zheltukhin, and R.B. Sandlerskiy. 2010. Analyzing spatial-temporal dynamics of the ecological niche: a marten (*Martes martes*) population case study. Zhurnal Obshchei Biologii 71(6): 467-487.

Puzachenko, Yu. G., A.S. Zheltukhin, and R.B. Sandlerskiy. 2011. Analyzing space–time dynamics of the ecological niche: a case study with the pine marten (*Martes martes*) population. Biology Bulletin Reviews 1(3): 245–264.

Ranyuk, M.N., and V.G. Monakhov. 2011. Variability of craniological characteristics in acclimatized sables (*Martes zibellina*) populations. Zoologicheskii Zhurnal 90(1): 82-96. (In Russian with English summary)

Rosalino, L.M., S. Rosa, and M. Santos-Reis. 2010. The role of carnivores as Mediterranean seed dispersers. Annales Zoologici Fennici 47(3): 195-205.

Rozhnov, V.V., I.G. Meschersky, S.L. Pishchulina, L.V. Simakin. 2010. Genetic analysis of sable (*Martes zibellina*) and pine marten (*M. martes*) populations in sympatric part of distribution area in the northern Urals. Russian Journal of Genetics 46(4): 488-492.

Salek, M., J. Kreisinger, F. Sedlacek, and T. Albrecht. 2010. Do prey densities determine preferences of mammalian predators for habitat edges in an agricultural landscape? Landscape and Urban Planning 98(2): 86-91.

Sarmento, P.B., J. Cruz, C. Eira, and C. Fonseca. 2011. Modeling the occupancy of sympatric carnivorans in a Mediterranean ecosystem. European Journal of Wildlife Research 57(1): 119-131.

Sathyakumar, S.S., T. Bashir, T. Bhattacharya, and K. Poudyal. 2011. Assessing mammal distribution and abundance in intricate eastern Himalayan habitats of Khangchendzonga, Sikkim, India. Mammalia 75(3): 257-268.

Sato, J., S. Mikuri, Y. Yamaguchi, and T. Hosoda. 2010. Polymorphisms in the neutral and adaptive genetic loci of the Japanese marten (*Martes melampus*). Genes and Genetic Systems 85(6): 408.

Spencer, W., H. Rustigian-Romsos, J. Strittholt, R. Scheller, W. Zielinski, and R. Truex. 2011. Using occupancy and population models to assess habitat conservation opportunities for an isolated carnivore population. Biological Conservation 144(2): 788-803.

Strimbu, B., and J. Innes. 2011. An analytical platform for cumulative impact assessment based on multiple futures: The impact of petroleum drilling and forest harvesting on moose (*Alces alces*) and marten (*Martes americana*) habitats in northeastern British Columbia. Journal of Environmental Management 92(7): 1740-1752.

Svishcheva, G.R. and S.N. Kashtanov. 2011. Reproductive strategy of the sable (*Martes zibellina* Linnaeus, 1758): an analysis of litter size inheritance in farm-raised populations. Russian Journal of Genetics: Applied Research 1(3): 221–225.

Thompson, C.M., W.J. Zielinski, and K.L. Purcell. 2011. Evaluating management risks using landscape trajectory analysis: a case study of California fisher. Journal of Wildlife Management 75(5): 1164-1176.

Veine-Smith, A.M., J. Bird, and J.L. Belant. 2011. Patterns of endoparasite infections in American martens (*Martes americana*) of the Upper Peninsula of Michigan, USA. Comparative Parasitology 78(2): 225-232.

Virgos, E., S. Cabezas-Diaz, J.G. Mangas, and J. Lozano. 2010. Spatial distribution models in a frugivorous carnivore, the stone marten (*Martes foina*): is the fleshy-fruit availability a useful predictor? Animal Biology 60(4): 423-436.

Xu, C-Z., H-H. Zhang, and J-Z. Ma. 2010. Organization of the complete mitochondrial genome and its evolution in sable. Journal of Beijing Forestry University 32(1): 82-88.

Yamada, C., and R. Masuda. 2010. Molecular phylogeny and evolution of sex-chromosomal genes and SINE sequences in the family Mustelidae. Mammal Study 35(1): 17-30.

Yamato, T., T. Shiraishi, and S. Miura. 2011. Gastrointestinal passage time of seeds ingested by captive Japanese martens *Martes melampus*. Acta Theriologica 56(4): 353-357.

Yamato, T., T. Tatewaki, and E. Kanda. 2011. Endozoochorous seed dispersal by sympatric mustelids, *Martes melampus* and *Mustela itatsi*, in western Tokyo, central Japan. Mammalian Biology 76(5): 628-634.

Zhou, Y-B., C. Newman, C.D. Buesching, A. Zalewski, Y. Kaneko, D.W. Macdonald, and Z-Q. Xie. 2011. Diet of an opportunistically frugivorous carnivore, *Martes flavigula*, in subtropical forest. Journal of Mammalogy 92(3): 611-619.

Zhou, Y-B., C. Newman, W-T. Xu, C.D. Buesching, A. Zalewski, Y. Kaneko, D.W. Macdonald, and Z-Q. Xie. 2011. Biogeographical variation in the diet of Holarctic martens (genus *Martes*, Mammalia: Carnivora: Mustelidae): adaptive foraging in generalists. Journal of Biogeography 38(1): 137-147.

Zielinski, W.J., A.N. Gray, J.R. Dunk, J.W. Sherlock, and G.E. Dixon. 2010. Using forest inventory and analysis data and the forest vegetation simulator to predict and monitor fisher (*Martes pennanti*) resting habitat suitability Gen. Tech. Rep. PSW-GTR-232. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 31 pp.