



**BIOLOGY AND CONSERVATION  
OF MARTENS, SABLES, AND  
FISHERS: A NEW SYNTHESIS**



The *Martes* Working Group welcomes you to  
Seattle, Washington and the 5<sup>th</sup> International  
*Martes* Symposium:

**BIOLOGY AND CONSERVATION  
OF MARTENS, SABLES, AND  
FISHERS: A NEW SYNTHESIS**

**September 8-12, 2009**

Greetings!! On behalf of the *Martes* Working Group, the Symposium Planning Committee is pleased to welcome you to the 5<sup>th</sup> International *Martes* Symposium!

It has been 5 years since we held our last Symposium in Lisbon, Portugal, and 18 years since we held our first Symposium in Laramie, Wyoming in 1991!! The first Symposium volume, published in 1994, provided a comprehensive review of our state of knowledge at that time about the biology and conservation of martens, sables, and fishers; it also served to identify critical gaps in that knowledge and generate new hypotheses for future study. Subsequent *Martes* Symposia were focused around major themes, including *Martes* taxonomy, ecology, techniques, and management (1997), martens and fishers in human-altered environments (2004), and *Martes* in carnivore communities (2006), and were not intended to provide a comprehensive review of existing knowledge on *Martes*.

Because it had been almost 2 decades since the initial review volume was published, the Planning Committee felt that *Martes* biologists would benefit most from the 5<sup>th</sup> *Martes* Symposium if we designed it to provide an updated review of our current state of knowledge on *Martes* biology and conservation. To create this "New Synthesis", we organized the Symposium around 5 major topic areas: (1) Evolution and Biogeography, (2) Management and Ecology of Populations, (3) Management and Ecology of Habitats, (4) Advances in Research Techniques, and (5) Conservation of Populations. We invited about 20 people to present review papers within each of these topic areas that would be as broad in geographic and taxonomic scope as possible. These are the papers that will form the bulk of the resulting Symposium volume; however, additional papers may be added to fill critical information gaps. Because of the breadth of material that invited speakers were asked to present, we have allocated 30 minutes for each invited oral presentation. To provide ample opportunities for other *Martes* biologists to participate in the Symposium, we have included 3 full days of oral presentations, and limited the length of contributed papers to 15 minutes each.

We hope you will approve of the approach we have taken to organizing this Symposium, and that it will provide you with a unique opportunity to reconnect with old friends and colleagues, and to meet *Martes* biologists from around the world. Thanks very much for joining us!!

Keith Aubry, Chair

Bill Zielinski, Marty Raphael, Gilbert Proulx, and Steve Buskirk



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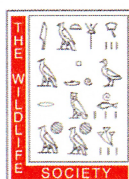
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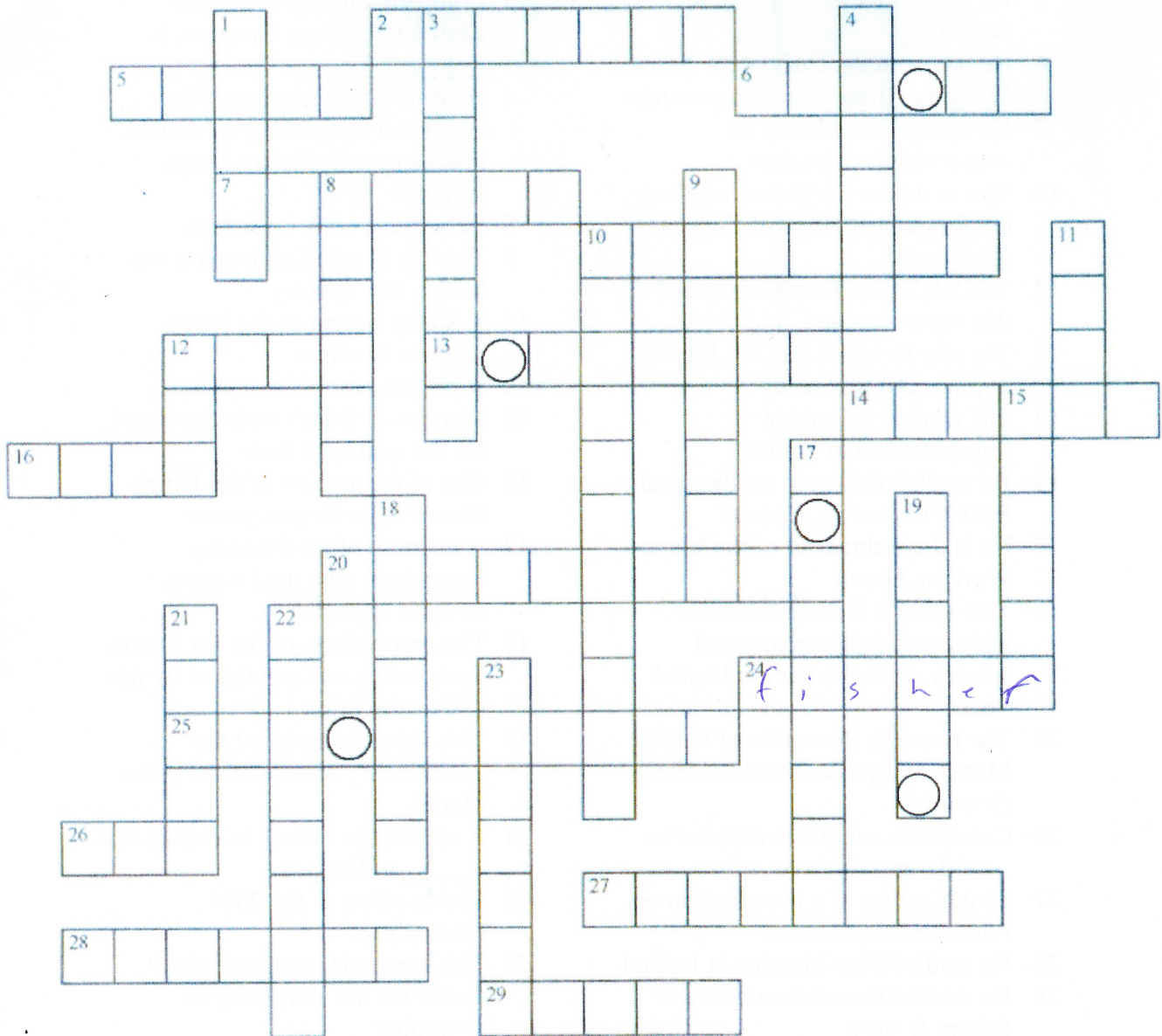


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# Martes Symposium 2009



**INSTRUCTIONS:** Please feel free to consult the symposium's abstracts and your colleagues for the answers. If you successfully complete the crossword puzzle, and if you find the hidden word, you may win a prize!

Please submit your completed puzzle to the Registration Desk before noon, Thursday September 10.

The Hidden Word – here's a clue: *It's a hybrid.*

*Thank you, and good luck!*

**ACROSS**

- 2 He presented information about the beech marten in Turkmenistan
- 5 He studied fisher in the Sierra Nevada
- 6 He has been the chair of the Martes Working Group over two centuries
- 7 He works with Marcot on conservation strategies
- 10 This is where Caryl et al. studied the foraging ecology of Eurasian pine marten
- 12 The 5th Symposium consists of this many sections
- 13 The city in which the 2nd Martes Symposium was held
- 14 She worked on habitat fragmentation in France
- 16 He studied fishers in northcentral British Columbia, Canada
- 20 He is the webmaster of the Martes Working Group
- 24 This species is a candidate for listing under the endangered species act in the Pacific United States
- 25 The Evening Reception of the 5th Martes Symposium was held here (2 words)
- 26 Cementum annuli are counted to \_\_\_ Martes
- 27 Senior author of a presentation on Pine & Stone Martens
- 28 He studied Pine Martens in Ireland
- 29 He studied the relation between fishers & snow

**DOWN**

- 1 He is the chair of the 5th Martes Symposium
- 3 Complete this list of authors: Cheveau, Imbeau, Drapeau, & \_\_\_\_\_
- 4 He is one of the authors who compared the ecology of fishers in eastern and western North America
- 8 He wrote a book on fishers
- 9 The 4th Martes Symposium was held in this country
- 10 It is also known as the beech marten (2 words)
- 11 A Martes has this many digits
- 12 Martens & fishers were harvested for the quality of their \_\_\_\_\_
- 15 One of the authors of the King's River Fisher Project poster
- 17 A member of the Planning Committee who used a meta-analytic approach
- 18 The proceedings of the 1st Martes Symposium was published by this University Press
- 19 This scientist revisited the evolutionary history of the genus Martes
- 21 A zibeline in French is known as a \_\_\_\_\_ in English
- 22 Senior editor of the 2004 Proceedings
- 23 This senior *Martes* biologist works for the University of Wyoming

- 4:00 - 4:15 pm Reproductive rates of fishers (*Martes pennanti*) in the managed forests of the Hoopa Valley Reservation, California – *Matthews, Higley, Green, Rennie, and Goddard*
- 4:15 - 4:30 pm Reintroducing fishers (*Martes pennanti*) to Olympic National Park: progress for years 1 and 2 – *Lewis, Happe, Jenkins, and Manson*
- 4:30 - 5:00 pm Maximizing success of *Martes* reintroductions: models, data, and a new hypothesis for mating patterns – *Powell, Lewis, Slough, Brainerd, Jordan, Abramov, Monakhov, Zollner, and Murakami*
- 5:00 pm Adjourn
- 5:00 - 7:00 pm Informal reception on the patio of MacMahon Hall

## Thursday, September 10

- 8:00 - 8:15 am General Information / Announcements
- 8:15 - 8:45 am Pathogens and parasites of the genus *Martes* – *Gabriel, Wengert, and Brown*
- 8:45 - 9:00 am Demographic rates of fishers (*Martes pennanti*) in the managed forests of the Hoopa Valley Reservation, California – *Higley, Matthews, and Carlson*
- 9:00 - 9:15 am Survival of adult American martens in northern Wisconsin – *McCann, Zollner, and Gilbert*
- 9:15 - 9:30 am Harvest dynamics of American martens and fishers relative to forest-tree seed crops and prey abundance – *Jensen, Demers, McNulty, Jakubas, and Humphries*
- 9:30 - 10:00 am Harvest management of *Martes* species: an update – *Robitaille*
- 10:00 - 10:30 am Morning break



### Section 3: Management and Ecology of *Martes* Habitat – Buskirk

- 10:30 - 10:45 am Ecological comparisons of home-range characteristics of American martens in Newfoundland and Maine: why are home ranges of threatened Newfoundland martens so large? – *Hearn and Harrison*
- 10:45 - 11:00 am Patterns of geographic variation in food habits of boreal martens – *Zalewski*
- 11:00 - 11:15 am Local adaptation in an insular marten: foraging ecology of Eurasian pine marten in Scotland – *Caryl, Quine, and Park*
- 11:15 - 11:30 am Ecological comparison between pine (*Martes martes*) and stone (*Martes foina*) martens in Italy – *Vercillo and Ragni*
- 11:30 - 11:45 am Responses of European pine marten populations to habitat fragmentation – *Mergey, Petit, Roeder, and Helder*
- 11:45 - 1:15 pm Lunch and viewing of posters
- 1:15 - 1:45 pm A review of marten habitat requirements in North America – *Thompson and Fryxell*
- 1:45 - 2:00 pm Marten response to fragmentation due to forest harvesting in eastern boreal forests of Canada – *Cheveau, Imbeau, Drapeau, and Bélanger*
- 2:00 - 2:15 pm Spatial responses to habitat loss in two populations of forest martens – *Fuller, Harrison, Hearn, and Hepinstall*
- 2:15 - 2:45 pm Comparative ecology of fishers in eastern and western North America – *Bowman and Lofroth*
- 2:45 - 3:00 pm Resource selection of a recolonizing fisher population in deciduous forests of southcentral Pennsylvania – *Gess, Ellington, Duchamp, Lovallo, and Larkin*
- 3:00 - 3:30 pm Afternoon break

an inherent trait at the species level, and argue that responses to changes in extent of suitable habitat result from morphological and behavioral adaptations of martens to local conditions of habitat and ecological community. Further, our results indicate that organisms may exhibit different threshold responses to habitat loss and fragmentation that may be expressed at the level of the population. Finally, ongoing changes in habitat and ecological community in Maine and Newfoundland are profoundly altering broad-scale patterns of habitat occupancy within these populations.

## PATHOGENS AND PARASITES OF THE GENUS *MARTES*

Gabriel, M.W.<sup>1,2</sup>, G.M. Wengert<sup>1,2</sup>, and R.N. Brown<sup>2,3</sup>

<sup>1</sup>Canid Diversity and Conservation Unit, Veterinary Genetics Laboratory, University of California, One Shields Avenue, Davis, California 95616 USA, [mwgabriel@ucdavis.edu](mailto:mwgabriel@ucdavis.edu);

<sup>2</sup>Integral Ecology Research Center, 102 Larson Heights Road, McKinleyville, California 95519 USA; <sup>3</sup>Humboldt State University, Wildlife Department, 1 Harpst Street, Arcata, California 95521 USA.

This presentation describes associations of pathogens and parasites with the genus *Martes*. However, little is directly known about the pathology caused by most of these agents in this genus. We briefly review the epidemiology and maintenance of selected pathogens thought to be most important to *Martes*, and report our ongoing disease-related research on ecology and population health. When appropriate, we discuss the potential fitness effects that selected pathogens and parasites might have on individuals or populations. Sampling protocols for the collection, transportation and storage of biological samples, including blood, other tissues, endoparasites and ectoparasites relevant to the determination of the health status of individuals and populations are described. We discuss potential implications of disease as well as management options related to prevention of pathogen spread, translocations and vaccinations. Lastly, we provide thoughts on potential directions for future disease-related research in *Martes*. The overall goal of this review is to inform wildlife biologists, wildlife veterinarians, and others concerned about the biology, management and conservation of species within the genus *Martes*.

## RESOURCE SELECTION OF A RECOLONIZING FISHER POPULATION IN DECIDUOUS FORESTS OF SOUTHCENTRAL PENNSYLVANIA

Gess, S.G.<sup>1</sup>, E.H. Ellington<sup>1</sup>, J. Duchamp<sup>1</sup>, M.J. Lovallo<sup>2</sup>, and J.L. Larkin<sup>1</sup>

<sup>1</sup>Department of Biology, Indiana University of Pennsylvania, 126 Weyandt Hall, Indiana, Pennsylvania 15705 USA, [S.W.Gess@iup.edu](mailto:S.W.Gess@iup.edu); <sup>2</sup>Bureau of Wildlife Management, Pennsylvania Game Commission, 2001 Elmerton Avenue, Harrisburg, Pennsylvania 17110 USA.

Limited information exists regarding fisher (*Martes pennanti*) resource selection in deciduous forests of the northeastern United States. We examined multiple scales of resource selection in a recolonizing fisher population in a landscape dominated by deciduous forest in southcentral

Pennsylvania. We captured and radio-collared 23 individual fisher (10M, 13F) from July 2006 through January 2007. We collected sufficient radio-telemetry locations ( $\geq 30$  locations per individual) to create fall/winter (15 October - 15 March) and spring/summer (16 March - 31 July) home ranges for 7 and 6 female fishers, respectively. We quantified resource selection at home range and landscape scales using the Euclidean distance approach. At the landscape scale, fisher resource selection did not differ between the 2 seasons, and fisher radiolocations were closer to deciduous forest than random points ( $P = 0.001$ ). At the home range scale, fisher habitat selection differed between fall/winter and spring/summer ( $P = 0.03$ ). During fall/winter fisher radiolocations were closer to open habitat than random locations ( $P = 0.03$ ). We also characterized 79 rest sites used by 15 fishers (4M 11F). Stand-level habitat data were collected at all 79 rest sites and compared with 80 random sites using multiple logistic regression (MLR). Fishers used a variety of structures as rest sites including live trees containing cavities or broken tops (69%), standing dead trees with broken tops or cavities (17%), and fossorial sites including burrows, rock piles, or root-balls (14%). Results from the MLR revealed at the stand-level, standard deviation of tree DBH ( $P = 0.005$ ), diversity of tree structural classes ( $P = 0.007$ ), and amount of coarse woody debris ( $P = 0.03$ ) influenced fisher rest site selection. While all 3 of these are characteristic of mature stands, they can be managed for in areas where timber harvest and fisher conservation are desired. Our results support the assertion that structurally diverse deciduous forests are important for fisher conservation in Pennsylvania.

#### ECOLOGICAL COMPARISONS OF HOME-RANGE CHARACTERISTICS OF AMERICAN MARTENS IN NEWFOUNDLAND AND MAINE: WHY ARE HOME RANGES OF THREATENED NEWFOUNDLAND MARTENS SO LARGE?

Hearn, B.J.<sup>1</sup>, and D.J. Harrison<sup>2</sup>

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The American marten (*Martes americana*) is a broadly distributed forest carnivore with highly variable spatial requirements. Previous work has suggested that the genetically distinct and threatened population of martens endemic to the island of Newfoundland, Canada (*M. a. atrata*) is larger bodied and may have greater spatial requirements than adjacent mainland populations of martens in eastern North America. We evaluated the hypothesis that martens in Newfoundland occupy disproportionately larger home ranges than predicted from allometry and that those differences may be explained by uniquely different prey abundances and landscape configuration in Newfoundland. We documented and compared body mass and home-range characteristics for a radiocollared sample of 92 resident, adult (>1 year of age) Newfoundland martens and for 226 martens from Maine, USA and compared the sex-specific relationship between home range and body weight among larger bodied Newfoundland martens and smaller bodied martens from Maine. We also compared availability of environmental resources among these 2 marten populations using 2 indices of small mammal prey abundance and 2 site-specific measures of habitat patchiness. Median annual home-range areas of adult resident martens in Newfoundland averaged 27.6 km<sup>2</sup> for males and 10.6 km<sup>2</sup> for females, and were disproportionately larger than

## USE OF REPRODUCTIVE DENS BY FISHERS IN NORTHCENTRAL BRITISH COLUMBIA

Weir, R.D.<sup>1</sup> and F.B. Corbould<sup>2</sup>

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In fishers (*Martes pennanti*), females invest considerable time and resources raising young, expending approximately 1/3 of their annual energy budget during the 2 months that they rear and care for their young. Despite this apparent high investment, the factors that affect use of reproductive dens by female fishers are poorly understood. By following a sample of radio-tagged female fishers in the Williston region of north-central British Columbia, we described the patterns of attendance by fishers at reproductive dens and assessed the influence of several factors on the likelihood of a female being present at her den. Breeding-age females did not exhibit whelping behaviour each year, however, the use of reproductive dens was initiated during a brief time period each spring ( $\bar{x}$  = 4 April, SD = 4 d, n = 12). Females used between 1 and 3 trees as reproductive dens during the rearing period, which generally lasted between early April and late May. Natal dens (i.e., whelping sites) were used between 30 and 49 d ( $\bar{x}$  = 41 d, SD = 7, n = 9). We observed females switching to maternal dens (i.e., secondary reproductive dens) on 5 occasions. Two parturient fishers spent, on average, 11 h each day (range: 3.9-24 h, n = 50 monitoring-days) at their reproductive dens during 2 reproductive seasons each. The total time spent at the den each day generally diminished as the denning period progressed. Our data supported the hypothesis that females timed the start of excursions away from their reproductive dens to coincide with peak daily temperatures. These results helped to identify factors that affect the survivorship of young, which ultimately affect recruitment into the population.

## CONFIRMING THE IDENTITY OF SUSPECTED PREDATORS OF FISHERS (*MARTES PENNANTI*) THROUGH MOLECULAR TECHNIQUES

Wengert, G.M.<sup>1,2</sup>, M.W. Gabriel<sup>1,2</sup>, J.M. Higley<sup>3</sup>, S.M. Matthews<sup>4,5</sup>, C.M. Thompson<sup>6</sup>, K.L. Purcell<sup>6</sup>, R. Green<sup>6</sup>, R.A. Sweitzer<sup>7</sup>, R.H. Barrett<sup>7</sup>, J.C. Lewis<sup>8</sup>, P.J. Happe<sup>9</sup>, K.J. Jenkins<sup>10</sup>, J.E. Foley<sup>11</sup>, and B.N. Sacks<sup>1,12</sup>

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<sup>9</sup>Olympic National Park, 600 E. Park Avenue, Port Angeles, Washington 98362 USA; <sup>10</sup>USGS-FRESC, 600 E. Park Avenue, Port Angeles, Washington 98362 USA; <sup>11</sup>Department of Veterinary Medicine and Epidemiology, University of California, One Shields Avenue, Davis, California 95616 USA; <sup>12</sup>Department of Biological Sciences, California State University, 6000 J Street, Sacramento, California 95819 USA.

The fisher (*Martes pennanti*) is a candidate for listing under the Endangered Species Act in the Pacific United States. Recovery of their populations requires an understanding of mortality factors, including predation. In most accounts of predation on fishers, observers have suspected potential predators based on puncture wounds and visual clues at the scene. Taken alone, these clues can be misleading in determining the predator species. Furthermore, DNA evidence of predation in any wildlife community is scarce in the literature. We generated a field protocol for documenting and collecting DNA evidence of predation on fishers for several research projects in California and Washington. In addition to physical evidence, such as bite wound measurements and carcass condition, we collected biological samples from which we extracted predator DNA. We have been able to identify predators of fishers through 3 types of samples: predator fur left at the carcass, predator saliva from matted fisher fur, and predator saliva collected by swabbing the interior of bite wounds. In conjunction with necropsies performed, we were able to confirm in most cases that bite wounds from which we collected DNA were inflicted ante-mortem, verifying that injuries from the predator led to the fisher's death and were not due to scavenging. To date, we have documented bobcats (*Lynx rufus*) and mountain lions (*Puma concolor*) as frequent predators of fishers, while only 1 fisher was killed by a coyote (*Canis latrans*). Currently, we are working on identifying the sex of the predator through its DNA, as well as the individual identity of each predator, to search for patterns in predation. This information coupled with knowledge of the trends in fisher predation, such as whether fishers of one sex sustain greater predation rates, will allow for a more thorough assessment of the impact that predation may have on fisher populations.

## PATTERNS OF GEOGRAPHIC VARIATION IN FOOD HABITS OF BOREAL MARTENS

Zalewski, A.

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Interactions between resource availability (mainly food) and physiological tolerances to abiotic conditions are often key factors that determine a species' geographical range. Sibling or other closely related species are expected to have similar physiological adaptations to environmental conditions, but their geographic ranges often are characterized by different climates. Given similar physiological characteristics, adaptation by sibling species to contrasting climates is expected to be largely behavioral, particularly in terms of foraging behavior. The genus *Martes* includes 8 species and 4 of them (pine marten, American and Japanese marten and sable) are "boreal forest martens" and exhibit very close taxonomic and ecological similarities. The boreal forest martens are distributed across the temperate, boreal and taiga zones where climatic conditions differ dramatically. In response to harsher environmental conditions, pine martens