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"Science affects the way we think together."
Lewis Thomas

Martens, Sables, and Fishers: New Synthesis Informs Management and Conservation

Michael Schwartz

A fisher sniffing for prey: fishers are primarily carnivores, preying on small and medium-sized mammals and birds. They will also eat berries, insects, and mushrooms, as well as carrion killed by other animals or left by hunters.

IN SUMMARY

Martens, sables, and fishers are mid-sized carnivores belonging to the genus Martes. *Their silky coats have been valued in the fur trade for centuries, which has contributed to a marked decline in their numbers. Pacific Northwest* Martes *species depend on structurally complex forested ecosystems and specific climatic conditions for their existence. The marten is designated as a Management Indicator Species on many national forests in Washington, Oregon, and California. The fisher (*M. pennanti*) is a Management Indicator Species in California and a candidate for listing as a federally endangered species throughout the Pacific Coast states.*

A new, comprehensive synthesis provides the scientific foundation for management and conservation efforts designed to maintain or enhance populations and habitats of Martes *species throughout the world. The book, titled* Biology and Conservation of Martens, Sables, and Fishers: A New Synthesis, *includes 20 chapters that present the inter-disciplinary perspectives of 63 scientists from 12 countries, organized around five key themes: evolution and biogeography, population biology and management, habitat ecology and management, research techniques, and conservation.*

The synthesis covers recent developments in research technologies such as occupancy modeling and genetics, biological knowledge about pathogens and parasites, and concerns about the potential effects of global warming on the distribution and status of Martes *populations.*

"Whatever happens to the beasts also happens to the man."
~ Chief Seattle

Compared to spotted owls and marbled murrelets, mid-sized carnivores in the genus *Martes*—martens, sables, and fishers—don't get a lot of press. But like those famous owls and seabirds, most *Martes* species need structurally complex forests to survive and thrive.

Overtrapping, certain logging practices, and the general encroachment of human civilization has led to the marked decline or disappearance of some *Martes* species in many areas where they were previously abundant. They face significant conservation and management challenges throughout North America, Europe, and Asia.

Because *Martes* are among the species most sensitive to changes in their environment, they provide early warning signals about ecosystem health. For this reason, the marten is designated as a Management Indicator Species (MIS) on national forests in Washington, Oregon, and California. The

fisher is an MIS in California and a candidate for listing as a federally endangered species in all three Pacific Coast states. Species with the MIS designation are considered to be an indicator of the welfare of other species that favor similar habitat conditions; their status can be used to evaluate the impacts of management actions on the habitats they occupy.

A VALUABLE NEW RESOURCE ON *MARTES* SPECIES

Resource managers, applied ecologists, conservation biologists, and policymakers charged with making decisions about species conservation and management do their best work when they have the most current science available. In the past 20 years, major advances have been made in scientific understanding of *Martes* genetics, habitat relationships, and ecosystem functions. Recent studies can inform conservation strategies, including newer population monitoring techniques, how parasites and pathogens can affect the species' ability to flourish, the observed and anticipated effects of climate change on existing populations, and more.

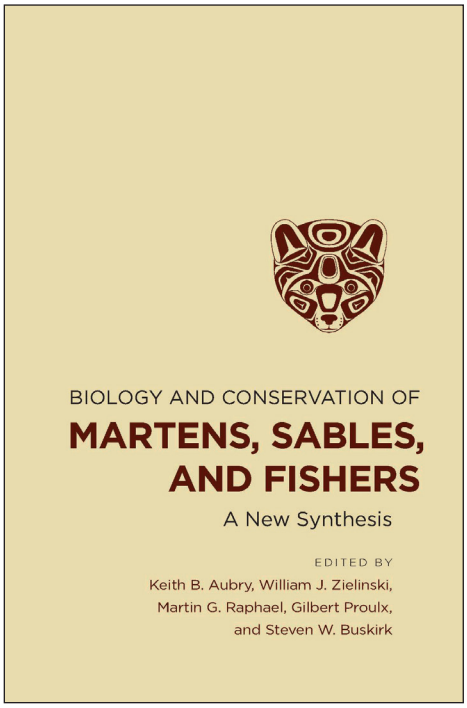
When Keith Aubry and Martin Raphael, research wildlife biologists with the Pacific Northwest Research Station in Olympia, Washington, realized that key resource materials on *Martes* were out-of-date, they decided it was time to review and synthesize the most current information about *Martes*. They worked with three other co-editors to review the latest international research, which resulted in the publication of a book titled *Biology and Conservation of Martens, Sables, and Fishers: A New Synthesis*.

The book is the most current reference volume on *Martes* available anywhere in the world. It combines data from numerous fields of study, including current research methods and techniques, basic biology, evolutionary biology, parasitology, genetics, landscape ecology, wildlife habitat relationships, habitat management, and conservation biology. It was named an Outstanding Academic Title by *Choice* magazine for books published in 2012.

"It presents in one place a really solid update on what we know about the ecology of these animals and what we know about new techniques available to understand the status and trends of populations," says Raphael. "It's a great resource for managers to draw on to help them do the best job they can to meet the habitat needs of these animals in their management activities."

Of the nine formally recognized species of *Martes*, American and Pacific martens (*M. americana* and *M. caurina*) and fishers (*M. pennanti*) have historically inhabited the northern portion and some mid-latitude regions in the western United States. Sables and other *Martes* species evolved in various regions throughout Europe and Asia. Although the published synthesis addresses *Martes* species throughout the world, the discussion here focuses on Pacific Northwest populations.

Fishers—which don't fish and are larger than martens—inhabited most of the Pacific Northwest's conifer forests prior to the mid-1900s. They have disappeared throughout most of the region, except in the southwestern corner of Oregon where native populations persist, and in two areas where they have been reintroduced: the southern Cascade Range in Oregon and the Olympic Mountains in Washington. Although Pacific marten populations in the Cascade Range appear to be stable, they have disappeared from large swaths of their historical range in the coastal forests of Oregon and Washington.



Choice *magazine identified this comprehensive synthesis as one of the "Outstanding Academic Titles" of 2012.*

KEY FINDINGS

- In North America, two distinct species of martens are now recognized: the American marten (*M. americana*) and the Pacific marten (*M. caurina*).
- American martens were translocated more than 50 times with a success rate of 50 percent. Fishers have been translocated about 40 times with a success rate of more than 75 percent.
- American and Pacific martens select habitat at three primary spatial scales: landscape, forest stands within home ranges, and individual structures. The landscape scale is the most important.
- North American *Martes* species are expected to be highly sensitive to climate change.
- Global warming is expected to alter species distribution, migratory patterns, and reproductive cycles, with cascading effects on ecological communities and ecosystem functions.

Purpose of PNW Science Findings

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HABITAT SELECTION

Historically, *Martes* habitat research has focused on forest stands and structures, where specific characteristics affect the availability of prey (primarily small mammals and birds) and provide resting sites and denning structures. Although martens and fishers occupy a mix of forest types, they primarily choose structurally complex, older forests to make their homes. They rely on tree cavities for their reproductive dens, and older forests tend to have an abundance of downed wood, snags, and decaying live trees, so these types of forests are optimal for establishing their home ranges as long as other habitat needs are met. For example, they also require relatively dense canopies to provide overhead cover that helps them escape predators.

Other considerations for suitable habitat include the availability of prey, but accessibility to that prey is equally important. "For example, some habitat conditions can prevent martens from effectively preying on tree squirrels, which are important prey species," says Aubry. "There could be a healthy, abundant population of squirrels, but if the forest structure is too dense, it can prevent martens from hunting as effectively as they would in other habitat conditions."

But this is only part of the habitat story. Recent models suggest that although individual forest stands and structures are important for *Martes*, multiple spatial scales must be considered when determining suitable habitat; otherwise, habitat analyses can result in misunderstandings about what *Martes* species need. "Any variables we use to describe habitat selection can be evaluated at all spatial scales—a few meters to kilometers," says Raphael. "Each variable is best assessed at a particular scale, and scientists must look for the appropriate scale at which to measure that particular variable."

Aubry says that it is not enough to provide structures or stands of a particular type. "In one chapter of the book, the authors conducted a single, comprehensive analysis of marten habitat relationships across multiple spatial scales, so they could compare apples with apples," he says. "Their results show that landscape context appears to be very important to martens in particular. You can't have a stand of trees sitting out in the middle of a clearcut and expect martens to use it."

Daniel Harrington

Martens prefer coniferous forest habitats where deep snow accumulates in the winter. Unlike fishers, martens are able to hunt under the snowpack.

Xu Li

Sables, which are similar in appearance to Pacific martens, are found primarily in Russia, but their range extends into northern portions of Mongolia, China, Korea, and Japan.

For fishers, the availability of individual structures is of primary importance, but landscape and stand composition also affect their ability to find suitable habitat.

For all species, the percentage of suitable habitat within a landscape matters, as does its configuration. "If the home range is really patchy, or if good habitat is widely scattered, a larger area may be required to get the resources they need," says Raphael.

So many variables affect a landscape's suitability that it can be an extremely challenging area of study. "Determining what the landscape scale represents is not as straightforward as identifying a forest stand or structure, because it's often not clear where one landscape ends and the next begins," says Aubry. "In addition, there are many things that influence landscape conditions that may or may not be beneficial to martens and fishers: climate, weather, forest management, human activities, you name it. The larger the spatial scale, the more complex the habitat relationships."

Exactly how a small animal like a marten or fisher selects its home range from within the larger landscape is still a mystery. However, one thing is clear—elevation and snowfall patterns are important. Fishers can't hunt under the snowpack like martens can, and the two species generally segregate based on elevation. Martens prefer higher elevations where deep snow accumulates.

Research into the details of *Martes*' habitat needs is ongoing, but the knowledge base has come a long way in the past few years. "We now have a better understanding of exactly what types of habitat these animals need, and that helps managers determine whether those habitat conditions are going to be available now and into the future," says Raphael.

NONINVASIVE SAMPLING AND OCCUPANCY MODELING

During the past few decades, major advances have been made in techniques used to track and monitor forest-dwelling animals. New technologies help scientists effectively address research questions that used to require invasive methods, costly equipment, and long-term studies.

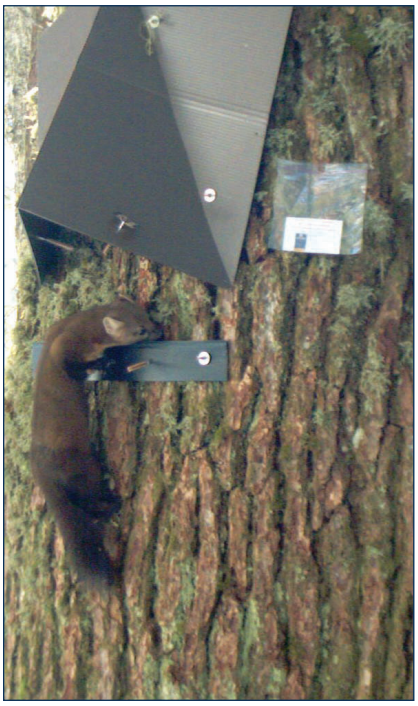
For instance, researchers can now gather occupancy data by placing cameras in targeted areas. The animal walks across a trigger and takes its own photo, creating a detection record. Also, scientists can mount ingeniously designed hair-collection devices on trees to passively snag fur without harming the animal. Researchers extract DNA from the samples to gather data on presence, geographic distribution, genetic affinities, and many other potential research questions.

"Occupancy modeling has been a revolution in wildlife biology," says Aubry. "It's an efficient, effective, and robust method of trying to understand what's happening with a population, especially for rare and difficult to sample species. It opens up a wealth of research opportunities that weren't available previously."

Perhaps as importantly, new technologies help scientists collect data without harming or

even disturbing the animals they are studying. "With these noninvasive techniques, you aren't affecting the behavior of the animal through your research activities," says Aubry.

The synthesis includes descriptions and assessments of new technologies and case studies where new monitoring techniques have been used.



Cascades Carnivore Connectivity Project/ Western Transportation Institute

A hair-snagging device is a noninvasive method for collecting DNA samples from wildlife. A remote camera captured this image of a Pacific marten in the Washington Cascades.

A NEW SPECIES

Scientists have disagreed in the past about certain *Martes* lineages, and current taxonomic lists recognize only one species of marten in North America: the American marten. Recent studies that employ new genetic monitoring tools, however, have shown that two distinct species are present. The American marten inhabits the northern and eastern portions of the North American continent, whereas the Pacific marten inhabits coastal portions of southeast Alaska and southwestern British Columbia and the western mountains of the contiguous United States.

"It's been many decades since the Pacific marten was first recognized, so this really represents a return to a previous taxonomic classification," says Aubry. "Most biologists didn't accept its status as a distinct species due to some papers published in the 1960s that argued against its recognition for invalid reasons. Hopefully, our chapter will change that for good."

Additionally, recent genetic studies show that the wolverine (*Gulo gulo*) and tayra (*Eira barbara*) are much more closely related to members of the genus *Martes* than previously thought and should be included in the same lineage. "It is likely that taxonomic authorities will eventually combine the genera *Martes*, *Gulo*, and *Eira* into a single genus, but it's uncertain when that would happen or what the final taxonomic designations would be," says Aubry.

TRANSLOCATING *MARTES*

Translocation is a generic term that relates to moving animals from one location to another; it can include introducing new populations to an area where they have never lived before, reintroducing them to areas where they have disappeared, or augmenting dwindling populations.

Many fisher translocations have been carried out across North America. The first unsuccessful attempt to move a breeding pair occurred in 1896 in Quebec, Canada. Subsequent attempts to reestablish populations throughout the northern regions of the continent took place beginning in the mid-20th century. In recent years, fishers have been translocated about 40 times with a success rate of more than 75 percent. "Because of that history, fishers are sometimes described as the 'poster child' for carnivore reintroductions," says Aubry.

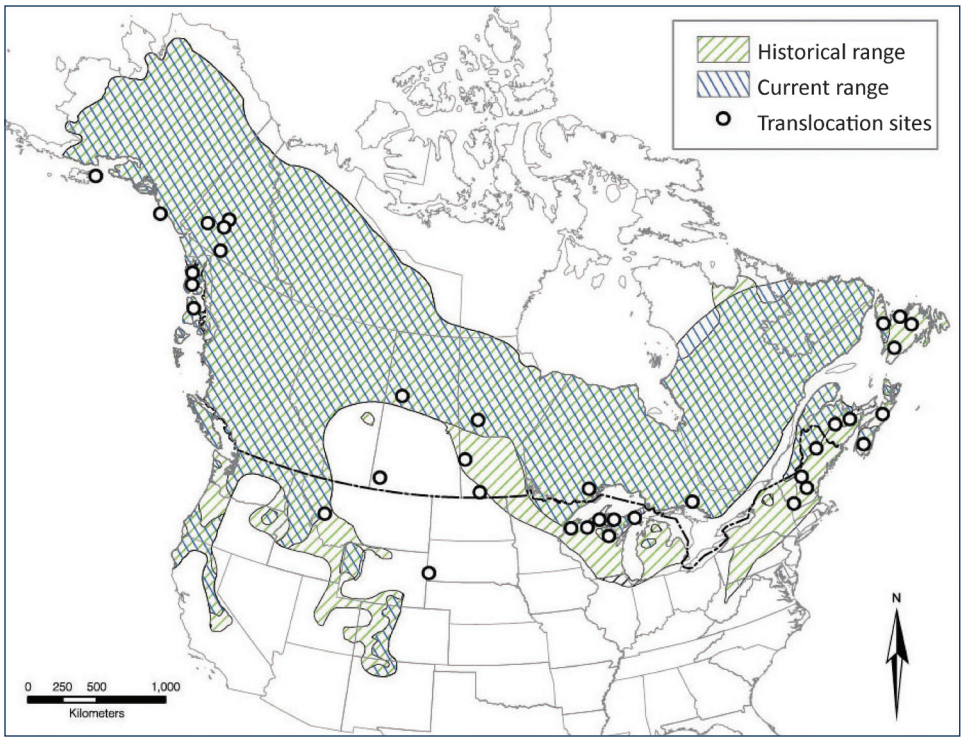
The first fisher translocations in the Pacific Northwest took place in 1961, when 38 individuals were moved from British Columbia to the Wallowa Mountains and the southern Cascade Range in Oregon. Both efforts failed.

In the late 1970s, timber companies in southwestern Oregon were becoming alarmed because porcupines were devastating their tree plantations by killing pine seedlings. Fishers are the only predator that can effectively prey on porcupines, so another attempt was made to reintroduce them to the southern Cascade Range. Forty-five individuals were moved, and a breeding population was finally reestablished in that region.

Between 2008 and 2010, 90 fishers were moved from central British Columbia to the Olympic Mountains in western Washington. "The survival rate is relatively high and reproduction is occurring, so this effort seems to be fairly successful so far," says Aubry.

American martens have been moved more than 50 times with a success rate of 50 percent. Populations were revived in several Alaska locations between 1934 and 1952.

The two variables most strongly linked with successful reintroductions among *Martes* species were the number of adult females released and the number of release sites used. *Martes* species are polygamous, and one dominant male can mate with several females. Also, distributing females across a landscape, rather than releasing large numbers of animals in one location, seems to increase the chances of establishing new populations.



Translocation sites for American and Pacific martens in relation to their historical and current ranges. Reprinted with permission from Cornell University Press.

CLIMATE CHANGE

Martens and fishers are expected to be highly sensitive to climate change, which will alter species distributions and phenologies (life-cycle events, such as breeding) in North America and have a cascading effect on ecological communities and ecosystem functions. Researchers expect northward shifts in suitable habitat for both species during the next century, with the largest impact at the southernmost latitudes and lowest elevations within their current geographic ranges.

Because fishers prefer the lower elevations with low or no snowfall, their habitat may actually increase as global temperatures warm. Martens, on the other hand, will see their range shrink if current trends in global warming continue. "Snow conditions will change fairly rapidly," says Raphael, "so for martens, climate change could have relatively rapid effects on habitat suitability." He says that climate change also will affect vegetation, but that will happen over longer time scales.

"...humans have the capacity to affect every aspect of the fisher's environment."

~ Roger A. Powell

FOR FURTHER READING

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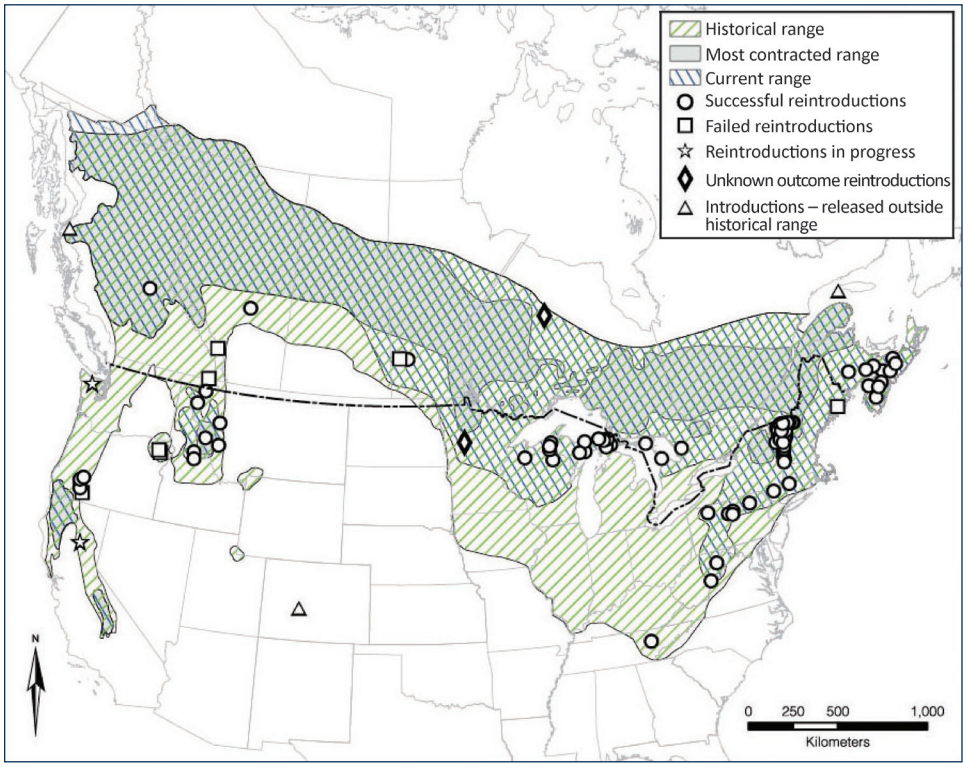
MANAGEMENT IMPLICATIONS

- Martens are designated as Management Indicator Species on many national forests in Washington, Oregon, and California; the information in this new synthesis provides updated information about their habitat relationships that can be used to support this designation.
- Land managers can use the synthesis as a primary reference as they create or maintain the habitat conditions needed to support populations of martens, fishers, and sables.
- Conservation biologists can use the findings to develop guidelines for managing *Martes* species and to characterize stressors and threats to their existence.
- Researchers can refer to the synthesis to explore advances in research methods, including state-of-the-art telemetry devices, methods for habitat and home range analysis, noninvasive detection techniques, and genetic methods for assessing landscape connectivity.



Translocation sites for fishers in relation to their historical, most contracted, and current ranges. Reprinted with permission from Cornell University Press.

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