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Science

FINDINGS

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“Science affects the way we think together.”

Lewis Thomas

Searching for Martens in Coastal Oregon



Mark Linnell

A Humboldt marten (*Martes caurina humboldtensis*) fitted with a miniature GPS collar. Fine-scale data transmitted by the device allow researchers to better understand the movement patterns of martens along the central Oregon coast.

“The possession of knowledge does not kill the sense of wonder and mystery. There is always more mystery.”

—Anaïs Nin, author

A solitary hunter not much bigger than a 10-week-old kitten is constantly on the move in search of prey among coastal forests of Oregon and California. Under the cover of dense forest understory, the Humboldt marten (*Martes caurina humboldtensis*), a subspecies of Pacific marten (*M. caurina*), may travel 3 to 5 miles per day, patrolling the boundaries of its hunting territory to ensure it has enough food to fuel its high-energy lifestyle.

Survival does not come easily for Humboldt martens. These rare carnivores depend on forests that are rich in biodiversity, and they face significant threats from human activities. They avoid open spaces, so from a marten’s point of view, removal of forest cover and understory is undesirable. In addition to habitat loss and fragmentation, martens face the perils of disease, trapping, and becoming roadkill.

Research led by Katie Moriarty, then a postdoctoral research wildlife biologist with the USDA Forest Service Pacific Northwest (PNW) Research Station, has established a new baseline for monitoring and managing Humboldt marten populations. This research has informed a status assessment completed

IN SUMMARY

The Pacific marten once ranged throughout coastal forests of the Pacific Northwest, but by the late 1940s, it was thought to be extinct. In 1996, however, a population was found in northern California. This member of the mustelid family, which includes weasels and fishers, depends on diverse, mixed-conifer forests with a dense understory of salal and other shrubs. Habitat loss, forest fragmentation, disease, trapping, and fatality from collisions with motor vehicles have contributed to the decline of the Humboldt marten, a subspecies found in limited areas of coastal Oregon.

Conservation efforts have been hampered by a lack of information on distribution, population size, habits, and habitat needs of the Humboldt marten. In the past 4 years, extensive research by scientists with the USDA Forest Service Pacific Northwest Research Station and partners has greatly increased basic understanding of the Humboldt marten, giving resource managers and policy-makers new information on which to base decisions.

Using a novel combination of survey techniques, scientists collected data about Pacific marten in Oregon and California, conducting the largest carnivore survey in Oregon. Their findings confirm that small populations of Humboldt martens persist but not only in late-successional forests as previously thought. On Oregon’s central coast, scientists projected that just two to three mortalities a year could lead to extinction of small local populations within 30 years.

by the U.S. Fish and Wildlife Service in 2018 that proposed listing coastal populations of the Pacific marten as threatened.

The Pacific marten once ranged throughout coastal forests of British Columbia, Washington, Oregon, and northern California. It currently occupies less than 5 percent of the range it did in the early 1900s. It wasn't seen for 50 years and was thought to be extinct until a population was found in northern California in 1996. Observations like this have prompted petitions to list coastal Pacific marten in Oregon and California as a federally designated threatened or endangered species.

"Martens are fascinating because they are uniquely predator and prey," Moriarty says. "They are voracious—they eat 25 percent of their body weight every day but they're also the size of a squirrel."

Martens are fast—faster than a squirrel—and agile. With legs that can swivel 180 degrees, they are equipped with the ultimate traction system.

"If you're a marten and want to go up a tree, imagine both of your front paws straight ahead and both of your hind paws facing the ground. Martens can literally dance up a tree and spin around," she says.

Collaborating to Ask the Right Questions

Moriarty first encountered the marten professionally when she worked as a wildlife technician in high school.

"I've thought about martens 365 days a year since 2004," she says.

That's when she began in earnest her 15-year career as a research wildlife biologist focused on the marten. Ten years later, Moriarty found herself at the center of a collaborative research project, and for 4 years she led a diverse group of collaborators in an effort to understand the basic ecology of coastal Pacific marten.

"The collaboration, stakeholder participation, and ownership, I think, were unprecedented," she says.

She recounted seven field crews from more than six different organizations: PNW Research Station, Oregon State University, Weyerhaeuser Company, Hancock Timber Resources Group, Oregon Department of Forestry, plus independent surveys conducted by tribal nations.

Collaborating turned out to be an important way to get feedback that the research was relevant to the people who make decisions about resource management. Moriarty helped the group focus their research questions on where



KEY FINDINGS



- The range of Pacific martens (*Martes caurina humboldtensis*) along the coast of central Oregon has decreased. Fewer than 87 adults persist in two subpopulations divided by the Umpqua River, and the population is vulnerable to extinction. Status and population size of the southern Oregon coast marten population are unknown.
- Humboldt martens are not solely located in late-successional and old-growth forests as previously thought. They inhabit diverse forested areas with dense shrub cover.
- Humboldt martens travel up to 5 miles a day to protect a small territory. They have a diverse diet that includes salal berries, songbirds, and red tree voles.
- If two to three Humboldt marten die per year on the central coast of Oregon, the probability of that subpopulation's extinction within 30 years is 32 to 99 percent, respectively.

the populations are, what they are doing, and how to go about designing and conducting a robust survey.

The effort produced the first large-scale exploration of Pacific marten distribution in coastal Oregon. Scientists documented the distribution, habits, diet, and habitat needs of marten in the area and calculated how close to extinction those populations might have been.

Policymakers, resource managers, and biologists depend on the most current science to make the best possible conservation and management decisions. In 2010, a petition was made to list the Humboldt marten under the Endangered Species Act as a distinct population segment of the Pacific Marten. In 2015, The U.S. Fish and Wildlife Service ruled against the petition but was later ordered by a court to revisit the decision. The finding was based on the best available science at the time but included two assumptions: (1) a high number of roadkill indicated that coastal martens were abundant, and (2) late-successional, old-growth forests on federal lands provide habitat for them. Moriarty's research questioned these assumptions. The findings have informed local management decisions as well as policy at the state and federal levels.

Mapping Humboldt Martens

Tracking these agile creatures is not easy, especially when it involves slogging in the rain through a dense understory of salal punctuated with devil's club, blackberry, and salmon berry—vegetation that Moriarty points out can cause considerable pain. But knowing where a population of a given species lives is crucial for resource managers tasked with balancing demands for conservation and resource use across the broader landscape.

Before Moriarty's extensive landscape-level survey, information about the distribution

of the Pacific marten was based on reported roadkill and trapping records. Through a series of surveys conducted from 2014 through 2017, she and her colleagues developed novel techniques to estimate the size and range of Humboldt martens and to describe their habits and habitat conditions.

In one effort, they surveyed within 3 miles of prior detection sites to confirm that martens still inhabited the areas where they existed historically, and within 3 to 30 miles to find the limits of their current distribution. They set up 348 sample units within a 9,780-square-mile area of the Klamath Mountains and the southern Oregon Coast Range. For 14 days, they collected data from 72 footprint tracking plates and 908 remote camera stations that

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resulted in 355,000 photographs. They complemented these methods with scent-detection dogs, which they found to be a cost-effective way to detect marten.

Using a combination of genetic confirmation and captured individuals, the team detected at least 28 individual marten among the two populations in coastal Oregon, which suggests stability in their distribution since the previous reporting more the 15 years ago.

“Given the extent of the survey effort, we expected the numbers to be higher,” Moriarty says. “The range is much more reduced than it was historically, as far as we can tell.”

The populations persisted in the areas expected, but the researchers didn’t find new populations or evidence that populations had expanded.



Bryce Peterson

Mark Linnell checks a camera set for Pacific marten in the Oregon Coast Range. The researchers placed 908 remote cameras throughout the study area to capture images of the small, elusive mammal.



Mark Linnell

A remote camera captured this image of a marten. In coastal Oregon, Humboldt marten use mixed-conifer forests with a dense understory for cover and consume a diverse diet of berries, songbirds, and voles.

Moriarty concluded that fewer than 87 martens inhabit the narrow strip of land in the central Oregon Dunes bounded on the east by Highway 101. This population is completely isolated from the populations in southern Oregon and northern California, and it is separated by the Umpqua River into two subpopulations. But marten likely once inhabited a larger area of similar habitat conditions along the coast.

In the early 1900s, nonnative beach grass was planted to stabilize sand dunes of the central Oregon coast. Over time, other types of vegetation filled in and resulted in habitat favored by the Humboldt marten today—a mixed-conifer forest of shore pine and Sitka spruce with an understory of evergreen huckleberry and salal in dry areas and sedge and willow in wet areas. Similar vegetation and structure existed historically along the Oregon coast where cities like Florence and Reedsport are today.

Josh Chapman is the wildlife program leader for the Forest Service’s Pacific Northwest Region. He says that the Siuslaw National Forest is developing a restoration program for the Oregon Dunes National Recreation Area to increase the amount of free-flowing sand to benefit the western snowy plover, an Endangered Species Act-listed shore bird. The program also aims to improve recreation access for the area, whose dunes are frequented by recreational off-road vehicle users.

“We were surprised to find out that the marten also inhabits the area,” Chapman says. “We didn’t realize that that’s really the only place along the Central Coast Ranger District they occur. We thought there were marten also east of Highway 101 in the interior forest.”

Moriarty’s research shows that this narrow strip of relatively new shore pine forest is really the only area occupied by marten in that region. Her findings present a “conservation conundrum,” Chapman says: the snowy plover needs open sand for nesting, the marten favors the forests, and recreationists value both environments.

Martens on the Move

Information about how martens move within a landscape helps resource managers understand the extent of the animals’ home range and how they use it. Fitting martens with mini GPS collars allowed the researchers to collect information about fine-scale movements of both montane (Lassen National Forest in California) and coastal (Oregon Dunes) martens from season to season, and traditional radio collars (VHF telemetry) provided data about annual movement patterns.

“We were able to show for the first time that martens are very consistent in how they’re

monitoring the perimeter of their territory,” Moriarty says.

She explains that martens are rigidly territorial, likely because their prey is very mobile and dispersed, and their energy needs are so high that they can’t afford to let others take their food.

“It would be like if you built the great wall around your neighborhood, you’re going through and making sure all the stones are placed and there’s no holes,” she says. “Martens are something the size of a squirrel, trying to maintain the Great Wall of China.”

Humboldt marten can cover 95 percent of their territory within 4 to 5 days. Moriarty suspects 5 days is about how long a scent mark that lets other martens know the area is occupied lasts. Despite their much smaller territories (about half a square mile compared to 2 to 3 square miles for other martens in North America), coastal martens are just as busy hunting, foraging, and scent marking to protect the perimeter of their territory as their mountain relatives.

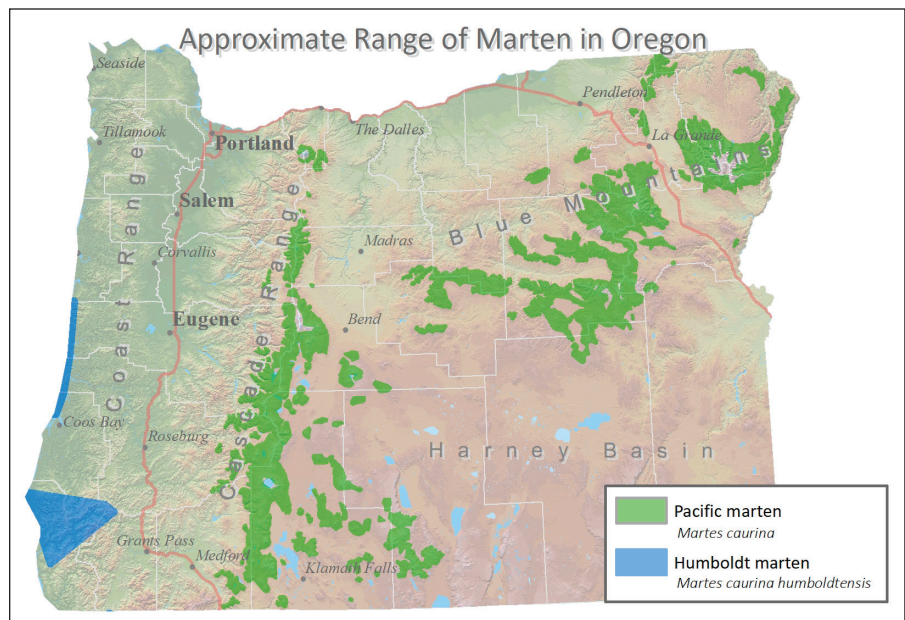
Populations in the Oregon Dunes and Lassen National Forest areas had similar daily movements and rotations around their ranges, although the territory of the coastal dunes population is the smallest reported for marten species in North America.

In the Oregon Dunes, the number of marten per square mile, or density, is the highest reported for any North American marten population (2.93 martens/1 mi²). At such high density, their population growth may be maxed out. Regardless, they seem to prefer the younger forest west of Highway 101 over the mature forest just east of the road.

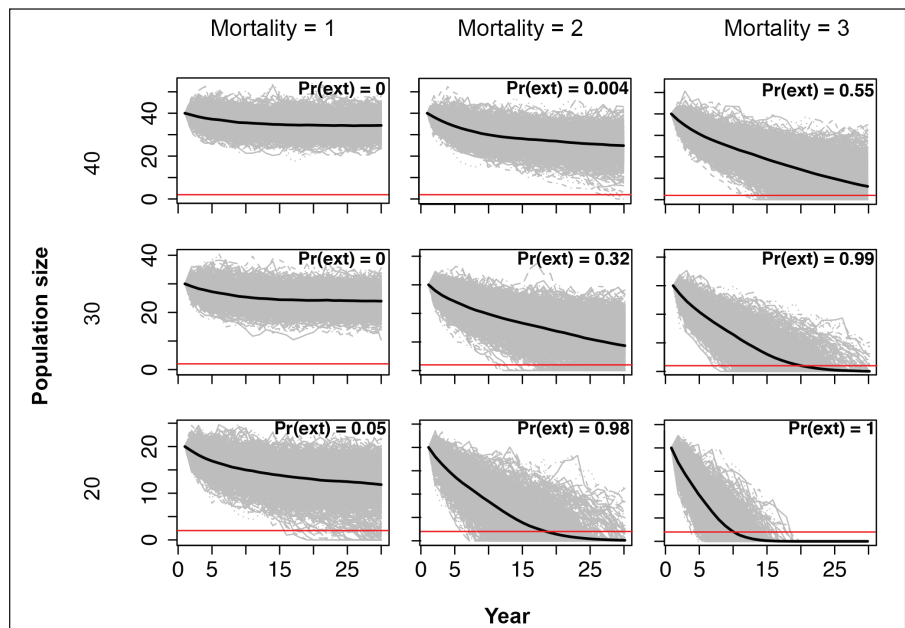
“There’s something about 70-year-old lodgepole, and dense salal and huckleberries that is allowing martens to thrive,” Moriarty says.

The dense understory provides cover and protection from predators, and shrubs like salal and evergreen huckleberry support an abundance of prey.

Martens that inhabit structurally complex, high-elevation forests with seasonal snow cover are fairly common, and they consume a narrow range of prey and therefore need to defend large territories to meet their needs. In contrast, the Humboldt marten, unique in part because it lives in snow-free environments year-round, is rare and isolated. Data collected about what they eat, suggest that their small territories may be explained by a much broader diet that includes foods like late-season berries and overwintering songbirds that are not available to montane martens.



Current approximate range of the Humboldt subspecies of Pacific marten and montane-residing Pacific marten in Oregon. Humboldt marten range is based on 2015–2018 survey data. Pacific marten range is estimated from generalized elevation (>4,900 ft) and forest cover (>40 percent canopy) masks and DataBasin watershed distribution information.



The estimated probability of extinction ($Pr(ext)$, black line) for a Humboldt marten population after averaging 1000 simulations (grey lines), assuming standard population growth. The population viability analysis shows that two or more marten mortalities within a year leads to substantial risk of extinction locally within 30 years, particularly for smaller populations.

Monitoring territory size and use over short time periods offers insights about how marten populations might be affected by changes in their environment. Martens don’t like exposure and avoid crossing openings, so patchworks of openings in their home range could make martens overextend themselves energetically or put themselves at risk, according to Moriarty.

“If you are a marten,” she says, “and either there’s a fire or a timber harvest that makes a gap of your home range, you’re going to notice it within a few days, even if it happens silently.” As little as 25-percent removal of the forest cover can cause a population to die off.

Improving the Odds for an Imperiled Species

In addition to habitat loss, legal trapping and motor vehicles are also threats. To find out just how vulnerable marten populations in the Oregon Dunes are to such risks, Moriarty and her colleagues conducted a population viability analysis. It turns out that it wouldn't take much to wipe out such a small population within 30 years. For a population of 30, about the size of the subpopulation south of the Umpqua River, research models show that if two martens die annually the risk of extinction is 32 percent, but if three die each year, that risk shoots up to 99 percent.

Trapping has been banned in California since the mid-20th century, and in 2018, California listed the Humboldt marten as threatened under the state's Endangered Species Act. That same year, the Oregon Fish and Wildlife Commission denied a similar petition but began developing restrictions on trapping in parts of western Oregon. If listed as threatened, as proposed by the U.S. Fish and Wildlife Service in the fall of 2018, trapping in Oregon would become illegal.

"The Siuslaw National Forest in their planning of the Oregon Dunes Restoration Project is considering short- and long-term approaches aimed at decreasing their risk of extinction," Chapman says.

New alternatives for dune restoration that accommodate both marten habitat and the restoration of free-flowing sands are under consideration. The alternatives include installing speed bumps to reduce roadkill. Project managers are also considering ways to maintain larger patches of closed-canopy forest so martens can travel from forest to forest without having to cross open areas as well as ways to improve connectivity under Highway 101.

Multiple agencies have come together to understand how imperiled the Humboldt marten in coastal Oregon is. "At the same time, land managers are hard pressed to deal with one extra species and one extra hurdle," Moriarty says. "Conservation will depend on all stakeholders working together to find creative solutions both in the short and long term."

"We are the only species which, when it chooses to do so, will go to great effort to save what it might destroy."

—Wallace Stegner, author and environmentalist



LAND MANAGEMENT IMPLICATIONS



- Given the small population and vulnerability of marten in coastal Oregon, eliminating fur harvest, exposure to rodenticides, and reducing fatal encounters with motor vehicles would decrease the immediate risk of marten extirpation.
- Because coastal martens exist in areas that include diverse conifer forests with dense shade-tolerant shrub cover, primarily salal and evergreen huckleberry, some forest management activities may reduce habitat quality in the short term.
- Survey techniques using miniature GPS collars, scent-detection dogs, and networks of remote cameras are useful for learning about the habits and habitat selection of marten and other carnivore species, and for informing management and policy decisions.



Mark Linnell

A marten captured by remote camera along the central coast of Oregon. With about 30 members in an isolated subpopulation, each marten counts when it comes to keeping the subpopulation from extinction.

For Further Reading

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