CONSERVATION STATUS OF AMERICAN MARTENS AND FISHERS IN THE KLAMATH-SISKIYOU BIOREGION

Keith M. Slauson and William J. Zielinski

Redwood Sciences Lab, Pacific Southwest Research Station, USFS, 1700 Bayview Drive
Arcata, CA 95521
Emails: kslauson@fs.fed.us; bzielinski@fs.fed.us

Abstract

The American marten (*Martes americana*) was historically distributed within coastal and high elevation fir forests of the Klamath-Siskiyou Bioregion (KSB) and was represented by three recognized subspecies (*M. a. caurina*, *M. a. sierrae*, and *M. a. humboldtensis*). The fisher (*Martes pennanti pacifica*) was historically distributed throughout interior and near-coast forests of the KSB. Over the last 8 years we have conducted systematic surveys, using baited track plate stations, at 497 locations within the KSB, resulting in >35,000 days of survey effort. Survey results demonstrate that martens are absent from portions of their historical range, with the most severe loss within the range of the Humboldt marten. Martens are absent from areas of the historical range of *M. a. caurina* on the Siskiyou National Forest. The status of *M. a. sierrae* within the Salmon and Marble mountains is uncertain. The fisher remains well distributed within most of its historical distribution within the KSB, but its status north of Highway 199 is uncertain. Conservation of marten populations will require protection of areas currently occupied and evaluation of whether strategic restoration of additional habitat is warranted. The population of fishers within the KSB represents the largest native fisher population within the western U.S. and has substantial potential to contribute to fisher restoration to adjacent bioregions. Maintenance and restoration of functional landscape connectivity from the KSB to adjacent bioregions to the North and East currently lacking native fisher populations will be critical for fishers to recolonize them.

Introduction

The American marten is a house-cat sized carnivorous mammal and a member of the weasel family (Mustelidae). Martens measure from 500 to 680 millimeters from nose to tail tip in length and weigh between 500 and 1400 grams (Buskirk and Ruggiero 1994, Powell et al. 2003). They are long and thin, with tan to chocolate brown fur, and have a fox-like face due to a pointed snout and large pointed ears. Martens also have an irregular yellowish-orange throat patch that may extend to the chest. The diet of the marten varies by season, year, and geographic location (Martin 1994). In general the diet of the marten includes mammals, birds, reptiles, insects, carrion, and fruits, and becomes most limited during the winter when it is restricted largely to small mammals (Martin 1994). The marten is designated as a species of special concern by the California Department of Fish and Game, a vulnerable species by the Oregon Department of Fish and Wildlife, a sensitive species by the U.S. Forest Service in Region 5 (includes California), and has no special designation by the U.S. Forest Service in Region 6 (includes Oregon).

The fisher is also a carnivorous mammal and a member of the Mustelidae. It is approximately twice the length of martens, measuring 900-1200 millimeters from nose to tail tip (Powell and Zielinski 1994). Fishers weigh from 2,000 to 5,500 grams (Powell et al. 2003). Fishers are also long and thin, but have dark brown fur that appears black in the field; grizzled fur around the head and neck often gives them a gray-headed appearance. Fishers also have a pointed snout and large, but well-rounded ears. Fishers have white or cream patches on the chest and the inguinal region. The diet of the fisher is dominated by small and medium sized mammals and birds, but also includes some reptiles, carrion, fruits, and insects when available (Martin 1994). The fisher is designated as a species of special concern by California Department of Fish and Game, a critical species by the Oregon Department of Fish and Wildlife, and is designated a sensitive species by the U.S. Forest Service in both Regions 5 and 6. The fisher has been petitioned for listing under the Federal Endangered Species Act three times in the western U.S., with a decision on whether to list the fisher in the Pacific states currently pending.

The marten and fisher have always been highly valued for their fur and both species are easily trapped (Powell 1983; Strickland and Douglas 1987). The fisher brought one of the highest pelt prices of any terrestrial furbearer in North America during the early 1900s (Lewis and Zielinski 1996). Records of trapping for their fur began to be kept in the late 1700s in North America (Novak et al. 1987). No laws establishing seasons or bag limits on the trapping of martens and fishers existed before the 1920s, consequently trapping was virtually unregulated until that time (Strickland 1994). As a result, populations of both species were severely reduced on a continental scale by the early 1900s (Strickland 1994). In the Klamath-Siskiyou region trapping records for martens and fishers begin to appear in the late 1800s in California (Merriam 1890; Grinnell et al. 1937) and the early 1900s in Oregon (Anonymous 1914). Trapping records for both

species within the Klamath-Siskiyou region and adjacent areas of the Pacific states show relatively high harvests during the late 1800s and early 1900s followed by strong declines (Grinnell et al. 1937; Seymour 1980; Verts and Carraway 1998; Zielinski et al. 2001; Aubry and Lewis 2003). Precipitated by concerns from authorities that populations of martens and fishers were threatened by trapping (Jewett 1915; Dixon 1925; Grinnell et al. 1937), the legal trapping of fishers concluded in 1937 in Oregon and 1946 in California. Martens were protected in northwestern California in 1946 and statewide by 1956. In Oregon the legal season on martens was closed from 1937-1937, 1941-1944, and 1947-1949, following the sharpest declines in the numbers of animals trapped during previous seasons (Marshall 1994; ODFW unpubl. records). Martens can still be legally trapped in western Oregon.

The marten and fisher both share several life history traits that make them sensitive to the alteration of the forest habitats in which they live. Martens and fishers both avoid open areas that are devoid of both overhead and escape cover (Powell 1983; Drew 1995). Removal of these two forms of cover by logging results in these areas being avoided until suitable cover regenerates (Buskirk and Ruggiero 1994; Jones and Garton 1994; Raphael 1984). Between foraging bouts, martens and fishers select areas to rest. These sites typically occur in cavities or on platforms provided by large diameter live trees, snags, and downed logs. The loss of these elements can reduce the suitability of forested areas as habitat for both species. Both species have large area requirements for mammals of their body sizes, with martens occupying home ranges from 1-15 km^2 (Buskirk and McDonald 1989) and fishers from 16 - 85 km^2 (Powell 1993). Both species are sensitive to the loss and fragmentation of mature and late-successional forest at the landscape scale (Rosenburg and Raphael 1986). The marten is particularly sensitive to the loss of late-successional forest and will avoid landscapes which have lost more than 30-35% of mature forest (Bissonette et al. 1997; Potvin et al. 2000).

There is considerable reason for concern about the status of American marten and fisher populations in the Pacific states. Fur harvests caused local and regional extirpations and declines and decades of protection from trapping have not resulted in the recovery of fisher populations in the Pacific states (Zielinski et al. 1995; Lewis and Stinson 1998; Aubry and Lewis 2003) or martens in coastal northwestern California (Zielinski et al. 2001). Additionally, both species show direct links to old forest attributes at multiple spatial scales and these attributes have and continue to be lost and altered due to the logging of mature and old growth forests. Multiple authorities have (Jewitt 1915; Dixon 1925; Grinnell et al. 1937) and continue (Zielinski et al. 2001; Aubry and Lewis 2003) to voice concern about the status of marten and fisher populations in the Pacific states.

We take a bioregional-scale approach to assessing the conservation status of the marten and fisher within the globally outstanding Klamath-Siskiyou Bioregion. By comparing the historical and contemporary distributions of the marten and fisher, we will demonstrate that the changes in distributions of martens and fishers are paradoxical when compared to population trends in other regions in the Pacific states. Finally, we identify conservation opportunities that will help ensure marten and fisher persistence within the KSB and adjacent bioregions.

Methods

Historical Distribution

To determine the historical (prior to 1950) distribution of martens and fishers within the KSB we reviewed all the published and unpublished information on their distributions or occurrences within California and Oregon. We included only records that we considered verifiable, i.e., museum or trapping records with specific location information.

Contemporary Surveys

We used several methods of systematic sampling to determine the contemporary distribution of martens and fishers. Most data were derived from regional-scale surveys based on either 5-km or 10-km survey grids. At each point on these grids we established a 'sample unit' comprised of six track plate stations in a pentagonal array with one station in the center and five around the perimeter with 1-km between adjacent stations. We have also included Klug's (1997) survey effort on private timberlands in coastal northwestern California. Klug (1997) used a grid with approximately 5 km spacing, composed of six track plate stations spaced at 1-km intervals along roads at each grid point. In three locations we used a 2-km survey grid because this helped us address a special need for fine-scale information in northwestern California (Zielinski unpubl. data; Slauson 2003). In these grids there were either one or two track plate stations at each grid point.

Each track plate station consisted of a covered enclosure open on one end. Animals enter the enclosure crossing an aluminum plate coated with carbon-soot and and sticky contact paper before they could reach a piece of chicken (Zielinski 1995). Animals that crossed the soot and contact paper on the way to the bait left high-resolution positive impressions of their feet. Once established, each track plate station was run for 16 consecutive days and checked every other day to collect tracks, replace bait and sooted plates as necessary. A commercial trapping lure was applied to a nearby tree when each station was established and re-applied after eight days if a marten or fisher had not yet been detected. Klug (1997) ran each track plate station for 22 consecutive days; visits to check each station occurred every other day. Lure was not used at these track plate stations.

Results

Historical Distribution: Marten

The historical distribution of the American marten in the Pacific states was recently summarized by Zielinski et al. (2001). Zielinski et al. (2001) identified 29 verifiable historical records of marten occurrence within the KSB. In the KSB martens were

historically distributed in the coastal forests of the western portion of the bioregion and in the higher true fir (*Abies* sp.) forests in the Marble-Salmon-Trinity Mountains in the southeastern portion of the bioregion (Figure 1; Grinnell et al. 1937; Bailey 1936; Zielinski et al. 2001). This distribution was shared by three recognized subspecies of martens, *M. a. humboldtensis* (Grinnell and Dixon 1926), *M. a. caurina* (Merriam 1890), and *M. a. sierrae* (Grinnell and Dixon 1926; Figure 1). The boundary between *M. a. humboldtensis* and *M. a. caurina* in the Oregon Coast Range occurs at or near the border between California and Oregon and is not readily supported by the presence of any biogeographical boundary or by preliminary genetic results (K. Stone, unpublished data). Records of marten occurrence are absent from most of the interior forests of the KSB. The narrow gap between the interior boundary of the range of *M. a. humboldtensis* and the eastern edge of *M. a. sierrae* is occupied by the Klamath River Canyon. While the river itself may be a barrier to movement for martens, the canyon is occupied by more xeric forest types than the near-coast forest types or high-elevation true fir forests historically occupied by martens to the West and East, respectively. Molecular investigation is currently underway to determine whether there is genetic support for this subspecific boundary.

Historical Distribution: Fisher

We found 36 verifiable historical records of fisher occurrence within the KSB representing a single subspecies, *M. p. pacifica* (Bailey 1936; Grinnell et al. 1937; Sherrell 1970; Verts and Carraway 1998). The fisher had a more contiguous historical distribution than the marten within the KSB, occupying almost all of the bioregion, except the most near-coastal areas (Figure 2). The lack of records of occurrence for the fisher in Oregon is a bit misleading, as many trapping records are available, however only at the resolution of each county they were trapped in (ODFW unpubl. data). Importantly, the KSB is at the crossroads of several peninsular portions of the distribution of the fisher in California and Oregon. It links to the Coast and southern Cascade-Sierra Nevada ranges of California and to the Coast and Cascade ranges of Oregon.

Contemporary Surveys

From 1994 to 2002, a total of 497 sample units (2,130 stations) were surveyed within or adjacent to the KSB, representing 35,520 days of survey effort (Figure 3). Of these, 457 were surveyed during the summer and fall periods from 1996-2002 (Zielinski et al. 2000, Slauson and Zielinski 2003, Slauson 2003) and 40 during the summer and winter of 1994 and 1995 (Klug 1997). Most surveys were within the western half of the KSB. Very few (< 20) of the sample units surveyed were within any of the seven Wilderness areas within the KSB.

Martens

American martens were detected at 39 of 497 (7.8%) sample units (Figure 4). Detections of martens were clumped in three separate populations. Martens were not detected in much of their historical coastal distribution in California and were not detected in many areas surveyed on the Siskiyou National Forest in coastal Oregon. The two coastal populations are separated by 52 km. No surveys occurred in the true fir forests of the Marble-Salmon-Trinity mountains within the historical range of *M. a. sierrae*.

Fishers

Fishers were detected at 101 sample units (20.3%) distributed across much of the area surveyed in the KSB (Figure 5). Detections were uncommon in interior Del Norte County in California and rare in Curry, and Josephine counties in Oregon. Fishers were detected on both sides of Highway 5 on the Shasta-Trinity National Forest in the southeastern portion of the bioregion. These results are encouraging; however they do not confirm whether fishers have been able to move across Interstate Highway 5 or if it represents a barrier to movement. Fishers were detected frequently in the near coast areas within redwood forest types, areas that lack historical information to support their past occurrence in these areas.

Discussion

The results of the contemporary surveys demonstrate that American martens have declined within the coastal forests of the KSB, with the most severe decline in coastal northwestern California. The coastal California population in the KSB represents the only known population in coastal California, currently occupying an area equivalent to less than 5% of its historical range (Zielinski et al. 2001; Slauson 2003). The distribution of detections is more spatially extensive in Oregon than in California, but occurrences are patchier.

Additional surveys will be necessary to determine the fine-scale distribution pattern of this population. The coastal Oregon population of martens in the KSB is one of only two known to occur in coastal Oregon, the second is located >125 km north on the Siuslaw National Forest (Zielinski et al. 2001). The two coastal populations of martens in the KSB are separated by >50 km. These are considerable distances for martens to travel. Long-term viability of these populations may require the exchange of individuals and genetic material to avoid the loss of genetic variation (Nei et al. 1975). The range of dispersal distances for 26 juvenile martens in Maine (Phillips 1994) was 4.9 to 35.1 km for males (n = 13; median = 14.3) and 5.5 to 27.0 km for females (n = 13; median = 12.0) and in northeastern Oregon (Bull and Heater 2001) was 28 to 43.3 km for males (n = 2) and 33.3 km for females (n=1). The distance between the two populations in coastal Oregon is 3 times the maximum dispersal distance and 4 to 10 times the median dispersal distance for juvenile martens from either study. The distance between the two coastal marten populations in the KSB is 1.2 times larger than the maximum dispersal distances and is 1.5 to 4 times the median dispersal distances for juvenile martens from these studies. We

have serious concerns about the viability of these coastal populations of martens. They are small, patchily distributed populations, due to both natural distribution of suitable habitat and to the effects of logging, and they are separated by substantial distances (Slauson 2003).

The situation for the population of martens on the Siskiyou National Forest may have been exacerbated by the recent Biscuit Fire in 2002. Wildlife is a natural and essential component of these coastal forests and plays a role in developing important habitat elements for martens (e.g., snags). However, given that late-seral conifer habitat is already reduced in coastal Oregon, the fire may have caused a short-term loss and fragmentation of suitable habitat. In the coastal forests of California and Oregon martens use stands with dense, spatially extensive shrub cover (Slauson 2003; Slauson and Zielinski 2003). The shrub layers are dominated by Ericaceous species (e.g., *Rhododendron macrophylum, Gaultheria shallon*) which have waxy leaves and are highly flammable (Agee 1993). Significant loss of the shrub layer may reduce habitat suitability, due to reduction in prey abundance or improved access to these areas by competitors that may otherwise be limited by dense shrubs (Slauson 2003; Slauson and Zielinski 2003).

Few surveys occurred near the historic distribution of *M. a. sierrae* in the Marble-Salmon-Trinity Mountains and consequently we do not know the status of marten populations in this area. We have received recent (2001-2003) verified evidence of the presence of martens within the Salmon (skull, J. Betaso pers. com.) and Trinity mountains (photographs, E. Wier pers. com.); however this information does not allow us to determine the current status of these populations. It is likely that these areas retain marten populations similar to their historical distributions due to their unroaded and rugged nature which would have made access difficult for trappers. These areas are also designated wilderness where habitat alteration by logging has been limited.

The fisher has fared far better than the marten in the KSB. The distribution of the fisher has remained similar to its historical extent in the areas surveyed. The KSB fisher population is the largest fisher population in the Pacific states (Aubry and Lewis 2003) and likely the largest within the western U.S. It appears that the fisher may have increased its distribution into the coastal redwood forests in northwestern California in recent times. Historical records in the redwood forests are rare and Grinnell et al. (1937) depicted the fisher's distribution as distinctly interior from the coast. Early trapping efforts were fairly extensive within the redwood region and many martens were trapped in redwood forests, but few fishers (Grinnell et al. 1937; Twinning unpubl. data). This suggests that detections along the redwood coast represent a recent expansion rather than an oversight in historical accounts. While few surveys were conducted north of Highway 199 in Josephine County, Oregon, we are not aware of any verifiable contemporary records of fishers in the interior northeastern portion of the KSB. The presence of Highway 199 combined with the community development along much of its route may act to discourage dispersal in the interior KSB. Fishers historically occurred in the northeastern portion of the KSB and there are potential linkage zones to the southern Cascades in this area north of Grants Pass. Additional surveys will be necessary to determine whether fishers still occupy this area. The lack of fisher detections in areas of Curry County included in our surveys is consistent with the predictions of the spatial habitat model for fishers developed by Carroll et al. (1999).

The temporal changes in distributions of martens and fishers in the KSB are contrary to that elsewhere in the Pacific states. In most interior mountain ranges where martens occur (e.g. Cascades, Sierra Nevadas) they remain fairly well distributed (Giblisco 1994; Sheets 1993; Zielinski et al. 2000), whereas fishers have severely declined or been extirpated in these areas (Aubry and Houston 1992, Marshall 1994, Zielinski et al. 1995; Aubry and Lewis 2003). This is likely due in large part to the unique distribution dynamics of the marten and fisher in the KSB, which is inconsistent with the pattern of their occurrences in the interior mountains. In these mountains fishers typically occur at lower elevations and within a narrow elevational band (Aubry and Houston 1992; Zielinski et al. 1995; Zielinski et al. 1997). These areas were historically more accessible to trappers and logging, more vulnerable to wildfire, and their narrow linear arrangement was fragmented more easily (Aubry and Lewis 2003). Martens, conversely, occur at higher elevations in the interior mountain ranges which are consequently less accessible, less altered by logging, and composed of a larger proportion of well-connected wilderness reserves. In these areas marten populations appear to remain fairly well distributed. Within the KSB, martens have fared poorly in the narrow coastal forests which were more accessible to trappers, more accessible to logging, more rapidly affected by fragmentation of habitat and populations, and are composed of proportionately little late-successional reserves or wilderness areas. The distribution of the fisher in the KSB is extensive, occupies historically remote and rugged terrain, and is more resilient to the effects of fragmentation than the more linearly-arranged habitat areas in the Sierra Nevada or southern Cascades.

The KSB plays an important role in the conservation of martens and fishers in the Pacific states. It contains 2 of the 3 known populations of martens in the coastal forests of California and Oregon and it contains the largest population of fishers in the Pacific states. To ensure that martens persist in the KSB, efforts should be made to maintain all habitat currently occupied, initiate strategic restoration activities to increase and reconnect suitable habitat patches in the vicinity of these populations, and to restore functional connectivity where it has been lost between these two populations. Site- specific restoration activities should target restoration of the structural characteristics important to martens in coastal forests, such as dense shrub cover and late-seral conditions which include large diameter live trees, snags, and downed logs within stands (Slauson 2003). The KSB fisher population has the potential to recolonize adjacent areas where it has been extirpated, and if warranted, to act as a source population for translocations of individuals into other portions of its historical range in the Pacific states. To give this population the best opportunity to recolonize adjacent areas of its range, specific efforts to maintain,

enhance, and restore functional habitat connectivity to these regions will be required. Specific focus should be given to the natural areas of forest connectivity including: the Mount Ashland to Siskiyou National Monument corridor (Jackson County, Oregon; Siskiyou County, California), the area from Dunsmuir south to Lake Shasta (Siskiyou and Shasta Counties, California), and the Highway 199 corridor from Grants Pass (Josephine County, Oregon) southwest to Gasquet (Del Norte County, California). Attention should be given to identifying specific areas (e.g., forested ridges, riparian areas) that currently have suitable habitat, that are in need of habitat restoration, and areas where highway crossing structures may be required to enhance or facilitate safe travel of dispersing fishers. Conscious efforts to maintain and connect habitat will benefit populations of fishers and martens in the KSB and will also facilitate the recolonization of portions of the geographic range that were formerly occupied in adjacent bioregions.

Acknowledgements

We would like to thank and acknowledge the following individuals and organizations who helped provide financial and logistical support: Esther Burkett, California Department of Fish and Game; Greg Holm, Redwood National and State Parks; Region 5, USDA Forest Service; Redwood Sciences Lab, U.S.D.A. Forest Service-Pacific Southwest Research Station; Brenda Devlin and Tony Hacking, Six Rivers National Forest, U.S.D.A. Forest Service; Lee Webb, Dave Austin, Collin Dillingham, Siskiyou National Forest, U.S.D.A. Forest Service; Shasta-Trinity National Forest, U.S.D.A. Forest Service ; Amedee Brickey, Arcata Office of the U.S.D.I. Fish and Wildlife Service. Rich Klug, Keith Hamm, Lowell Diller, Simpson Timber Company. We would also like to thank Jan Werren of the Redwood Sciences Lab for providing GIS support and training and Ric Schlexer and Chet Ogan for logistical support. And finally we must especially thank and acknowledge all the field crew members.

Literature Cited

Agee, J. K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington, D.C.

Anonymous. 1914. Report of fur-bearing animals. Oregon Sportsman 2(6):20.

Aubry, K.B., and D. B. Houston 1992. Distribution and status of the fisher in Washington. Northwestern Naturalist 73: 69-79.

Aubry, K.B. and J.C. Lewis. 2003. Extirpation and reintroduction of fishers (*Martes pennanti*) in Oregon: implication for their conservation in the Pacific states. Biological Conservation 117:79-90.

Bailey, V. 1936. The mammals and life zones of Oregon. North American Fauna 55:1–416.

Beyer, K.M., and R.T. Golightly. 1995. Distribution of Pacific fisher and other forest carnivores in coastal Northwestern California. CDFG contract # FG-3156-WM.

Bissonette, J.A., D.J. Harrison, C.D. Hargis, and T.G. Chapin. 1997. The influence of spatial scale and scale-sensitive properties on habitat selection by American marten. Pages 368-385 in, J.A. Bissonette, eds, Wildlife and Landscape Ecology, Springer-Verlag, New York.

Bull, E.L., and T.W. Heater. 2001. Home range and dispersal of the American marten in northeastern Oregon. Northwest Naturalist. 82:7-11.

Buskirk, S.W. and L.L. McDonald. 1989. Analysis of variability in home-range size of the American marten. Journal of Wildlife Management 53:997-1004.

Buskirk, S. W. and R. A. Powell. 1994. Habitat ecology of fishers and American martens. Pages 283-296 in, S. W. Buskirk, A. S. Harestad, M. G. Raphael and R. A. Powell, eds. Martens, sables, and fishers. Cornell University Press, Ithaca, New York.

Buskirk, S.W., and L.F. Ruggiero. 1994. The American marten. Pages 7-37, L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, eds. American marten, fisher, lynx, and wolverine in the western United States. General Technical Report, RM-254. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado.

Carroll, C., W.J. Zielinski, and R.F. Noss. 1999. Using presence-absence data to build and test spatial habitat models for the fisher in the Klamath Region, U.S.A. Conservation Biology 13 (6):1344-1359.

Dixon, J. 1925. A closed season needed for fisher, marten, and wolverine. California. California Fish and Game 11:23–25.

Douglas, C.W. and M.A. Strickland, 1987. Fisher. Pages 511-529, M. Novak, J.A. Baker, and M.E. Obbard.

Drew, G.S. 1995. Newfoundland: Why old growth? Dissertation. Utah State University, Logan, Utah.

Giblisco, C.J. 1994. Distributional dynamics of modern *Martes* in North America. Page 484, S. W. Buskirk, A. S. Harestad, M. G. Raphael and R. A. Powell, eds. Martens, Sables, and Fishers: Biology and Conservation. Cornell University Press, Ithaca, New York.

Grinnell, J., and J.S. Dixon. 1926. Two new races of the pine marten from the Pacific Coast of North America. Zoology 21(16):411-417.

Grinnell, J., J.S. Dixon, and J.M. Linsdale. 1937. Fur-bearing mammals of California. Volume 1. University of California Press, Berkeley, California.

Jewett, S.G. 1915. The fur-bearing animals of Oregon. Oregon Sportsman 3: 5–6.

Jones, J. L. and E.O. Garton. 1994. Selection of successional stages by fishers in north-central Idaho. Pages 377-387. S.W. Buskirk, A.S. Harestad , M.G. Raphael, R.A. Powell, eds. Martens, Sables and Fishers: Biology and Conservation. Cornell University Press. Ithaca, New York.

Klug, R.R. 1997. Occurrence of Pacific fisher (*Martes pennanti*

pacifica) in the Redwood Zone of northern California and the habitat attributes associated with their detections. M.S. thesis. Humboldt State University, Arcata, California.

Lewis, J.C. and W. J. Zielinski. 1996. Historical harvest and incidental capture of fishers in California. Northwest Science 70:291–297.

Lewis, J.C. and D. W. Stinson. 1998. Washington State Status Report for the Fisher. Washington Department of Fish and Wildlife, Olympia, Washington.

Marshall, D.B. 1994. Status of the American marten in Oregon and Washington. Audubon Society of Portland.

Martin, S.K. 1994. Feeding ecology of American martens and fishers. Pages 297-315, S. W. Buskirk, A. S. Harestad, M. G. Raphael and R. A. Powell, eds. Martens, sables, and fishers. Cornell University Press, Ithaca, New York.

Merriam, C.H. 1890. Description of a new marten (*Mustela caurina*) from the Northwest coast region of the United States. North American Fauna 4:27-29.

Novak, M., J.A. Baker, M.E. Obbard, B. Malloch (Eds). 1987. Wild Furbearer Management and Conservation in North America. Ontario Ministry of Natural Resources, Toronto, Ontario..

Nei, M., T. Marayama, and R. Chakraborty. 1975. The bottleneck effect and genetic variability on populations. Evolution 29:1-10.

Phillips, D.M. 1994. Social and spatial characteristics, and dispersal of marten in a forest preserve and industrial forest. M.S. thesis. University of Maine, Orono, Maine.

Potvin, F., L. Belanger, and K. Lowell. 1999. Marten habitat selection in a clearcut boreal landscape Conservation Biology 14:844-857.

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

Powell, R.A., and W.J. Zielinski. 1994. Fisher. Pages 38-73, L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, eds. The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States. USDA Forest Service, General Technical Report GTR-RM-254.

Powell, R., S., S.W. Buskirk, and W. Zielinski. 2003. Fisher and Marten. Pages, 635-649, G. Feldhamer, B. Thompson, and J. Chapman, eds. Wild Mammals of North American. 2nd edition. Johns Hopkins University Press, Baltimore, Maryland.

Raphael, M.G. 1984. Wildlife populations in relation to stand age and area in Douglas-fir forests of northwestern California. Pages 259-274, W. R Meehan, T. R. Merrell, and T. A. Hanley, eds. Fish and wildlife relationships in old-growth forests. American Institute of Fisheries Research Biologists.

Rosenberg, K.V. and M.G. Raphael. 1986. Effect of forest fragmentation on vertebrates in Douglas-fir forests. Pages 263-272, J. Verner, M.L. Morrison, and C.J. Ralph, eds. Wildlife 2000: modeling habitat relationships of terrestrial vertebrates. University of Wisconsin Press, Madison.

Sheets, T. J. 1993. Washington State Pine marten distribution. Department of Wildlife, Olympia, Washington

Sherrell, P.E. 1970. An annotated checklist of the land mammals of Curry County, Oregon. M. S. thesis, Central Washington State College, Ellensburg.

Seymour, G. 1980. Traps and trapping, Part II. Commercial trapping in California today. Outdoor Calif. 41(1):15-17.

*Slauson, K. M. and W. J. Zielinski. 2003. Distribution and habitat associations of the Humboldt marten and Pacific Fisher in Redwood National and State Parks. Final Report. USDA Forest Service, Pacific Southwest Research Station, Arcata, California.

*Slauson, K.M. 2003. Habitat selection by a remnant population of American martens in coastal Northwestern California. M. S. thesis, Oregon State Universit, Corvallis.

Strickland, M.A. and C.W. Douglas. 1987. Marten. Pages 530-546, M. Novak, J. A. Baker, and M. E. Obbard, eds. Wild furbearer management and conservation in North America. Ontario Trappers Association, North Bay.

Strickland, M. A. 1994. Harvest management of fishers and martens. Pages 149-164, S. W. Buskirk, A. S. Harestad, M. G. Raphael and R. A. Powell, eds. Martens, sables, and fishers. Cornell University Press, Ithaca, New York.

Verts, B.J. and L.N. Carraway 1998. Land mammals of Oregon. University of California Press, Berekley.

*Zielinski, W.J., and T.E. Kucera. 1995. Track plates. American Marten, fisher, lynx, and wolverine: Survey methods for their detection. Pacific Southwest Research Station, United States Department of Agriculture, Forest Service, General Technical Report, PSW-GTR-157.

*Zielinski, W. J., T.E. Kucera, and R.H. Barrett. 1995. The current distribution of fishers in California. California Fish and Game 81:104-112.

*Zielinski, W.J., R.L. Truex, C.V. Ogan, K. Busse. 1997. Detection surveys for fisher and martens in California, 1989-1994: Summary and interpretations. Pages 372-392, Proulx, H. N. Bryant, and P. M. Woodard, eds. Martes: Taxonomy, ecology, techniques, and management. Provincial Municipal Museum of Alberta, Edmonton, Alberta, Canada.

*Zielinski, W.J., R.L. Truex, L.A. Campbell, C.R. Carroll, and F.V. Schlexer. 2000. Systematic surveys as a basis for the conservation of carnivores in California forests. USFS, Pacific Southwest Research Station, Redwood Sciences Lab. Unpublished Report.

*Zielinski, W.J., K.M. Slauson, C.R. Carroll, C.J. Kent, and D.K. Kudrna. 2001. Status of American marten populations in the coastal forests of the Pacific States. Journal of Mammalogy 82:478-490.

*Available at: http://www.rsl.psw.fs.fed.us/pubs/WILD90S.html

Figure 1. Historical distribution of the American marten in California and Oregon (modified from Zielinski et al. 2001). Black dots indicate verifiable historical (1919 – 1924 in California, mid 1800s to early 1900s in Oregon) records of marten occurrence. Solid black lines represent ranges of recognized subspecies, M.A.C. = *Martes americana caurina*, M.A.H. = *M. a. humboldtensis*, M.A.S. = *M. a. sierrae*. The dotted line represents the boundary of the Klamath-Siskiyou Bioregion.

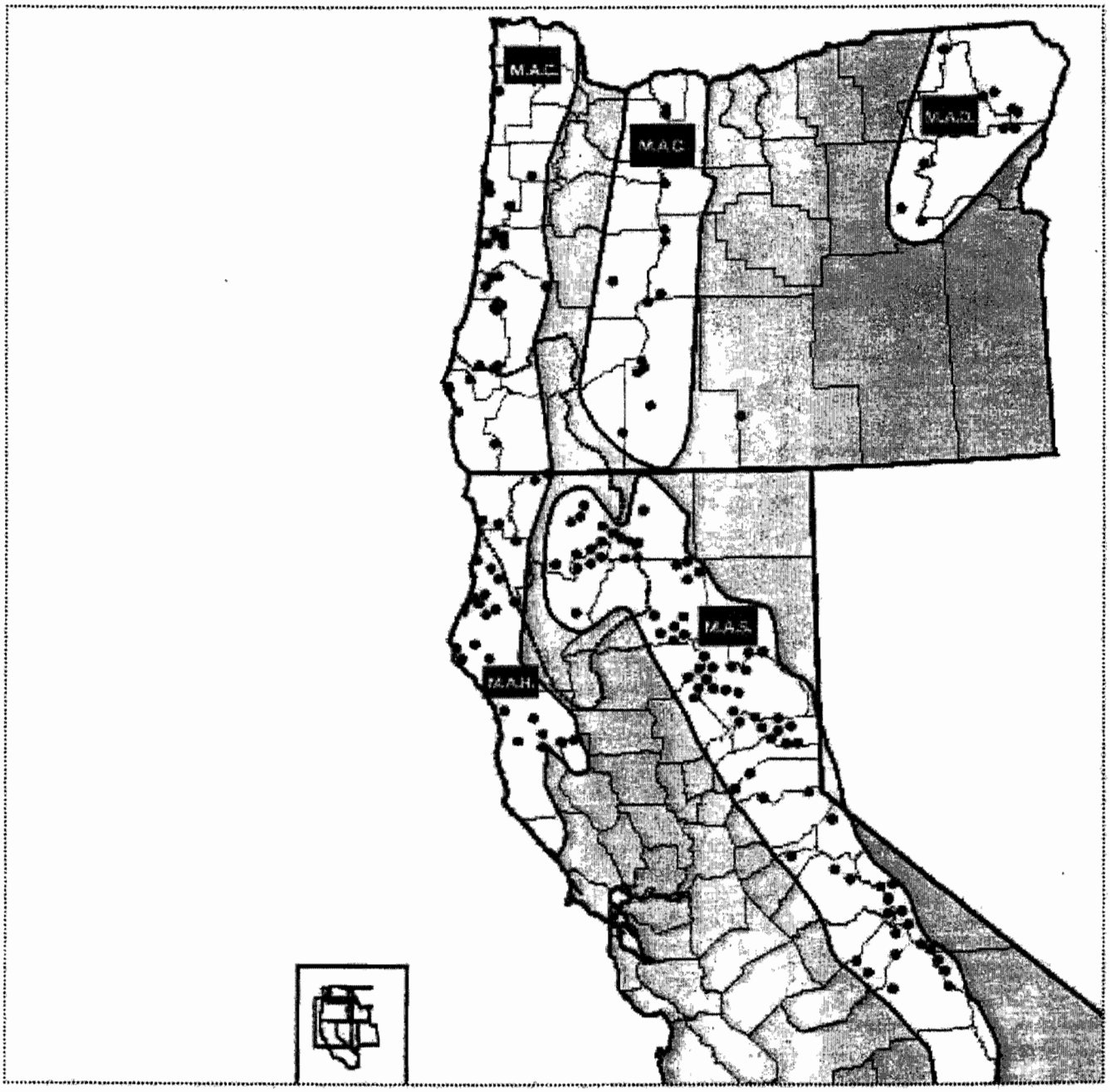

Figure 2. Historical distribution of the Pacific fisher in California and Oregon. Black dots indicate verifiable historical (1919–1924 in California, mid 1800s to early 1900s in Oregon) records of fisher occurrence. Solid black lines represents the margins of the range of *M. p. pacifica* (Bailey 1936; Grinnell et al. 1937). The dotted line represents the boundary of the Klamath-Siskiyou Bioregion.

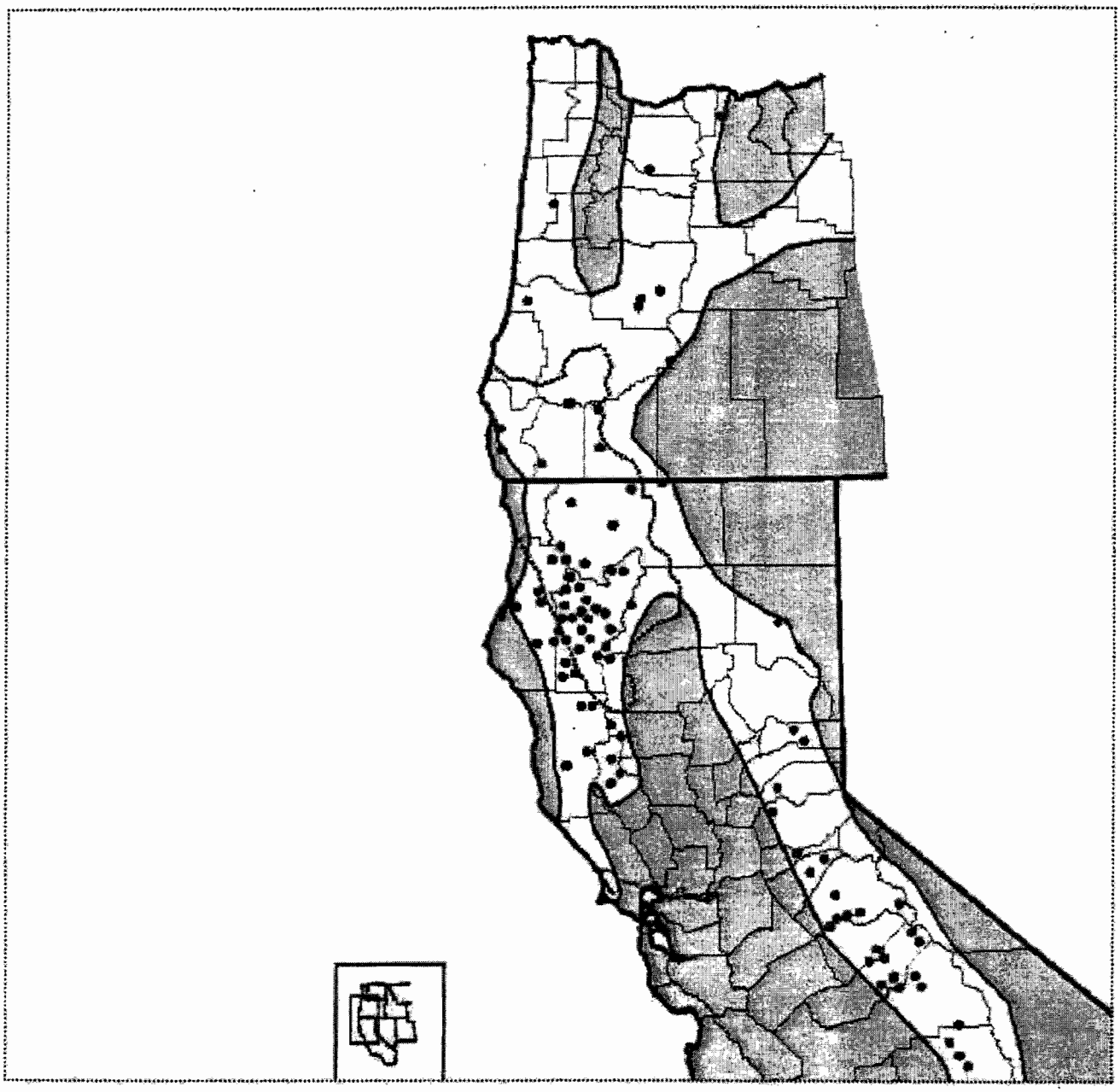

Figure 3. Survey locations within the Klamath-Siskiyou Bioregion, 1994-2002. Each black dot represents a sample unit. The three clumped areas of black dots represent 2-km spaced sample grids.

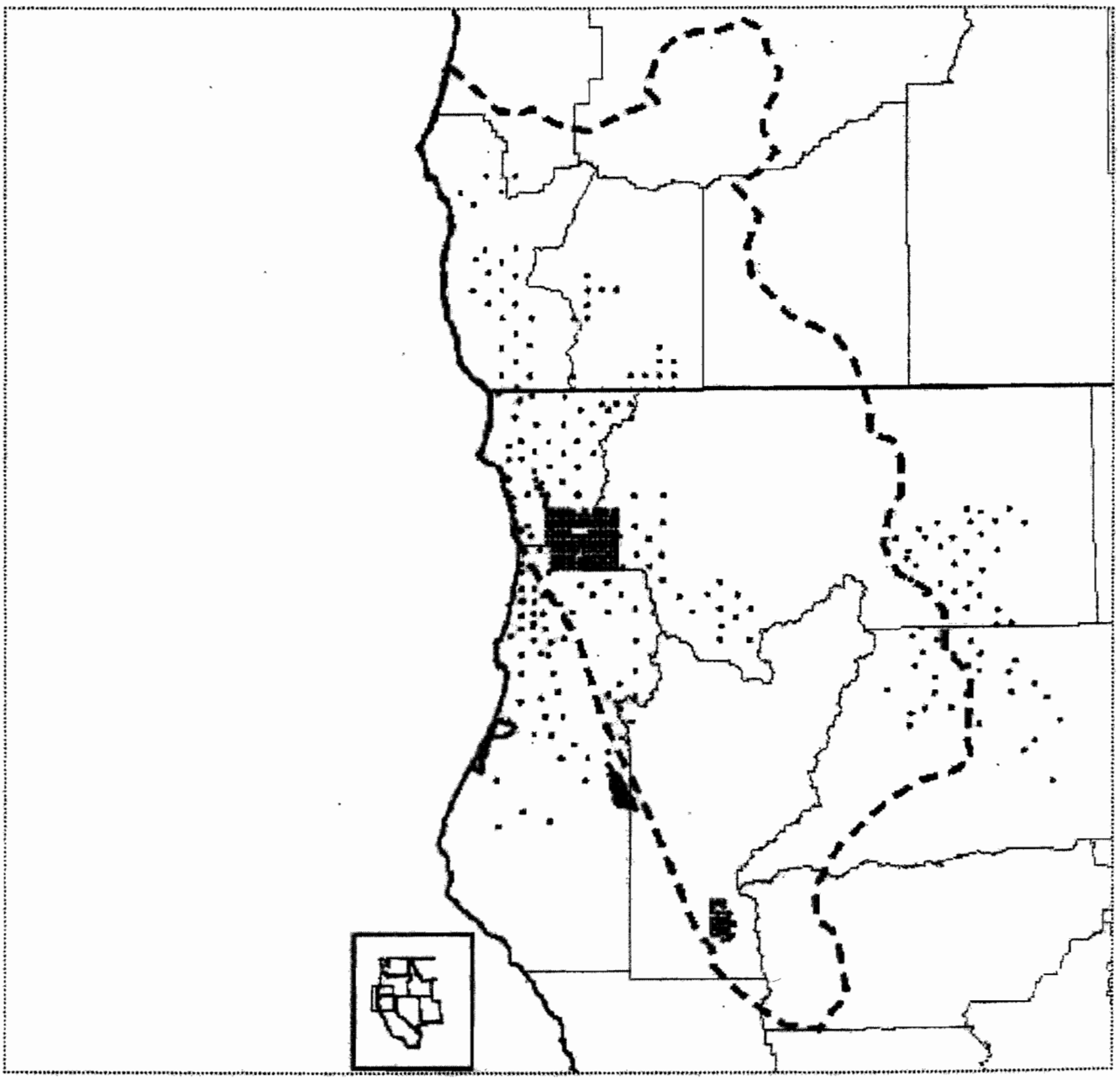

Figure 4. American marten detections within the Klamath-Siskiyou Bioregion, 1996-2002. Large black dots represent sample units where martens were detected; small dots represent those where martens were not detected.

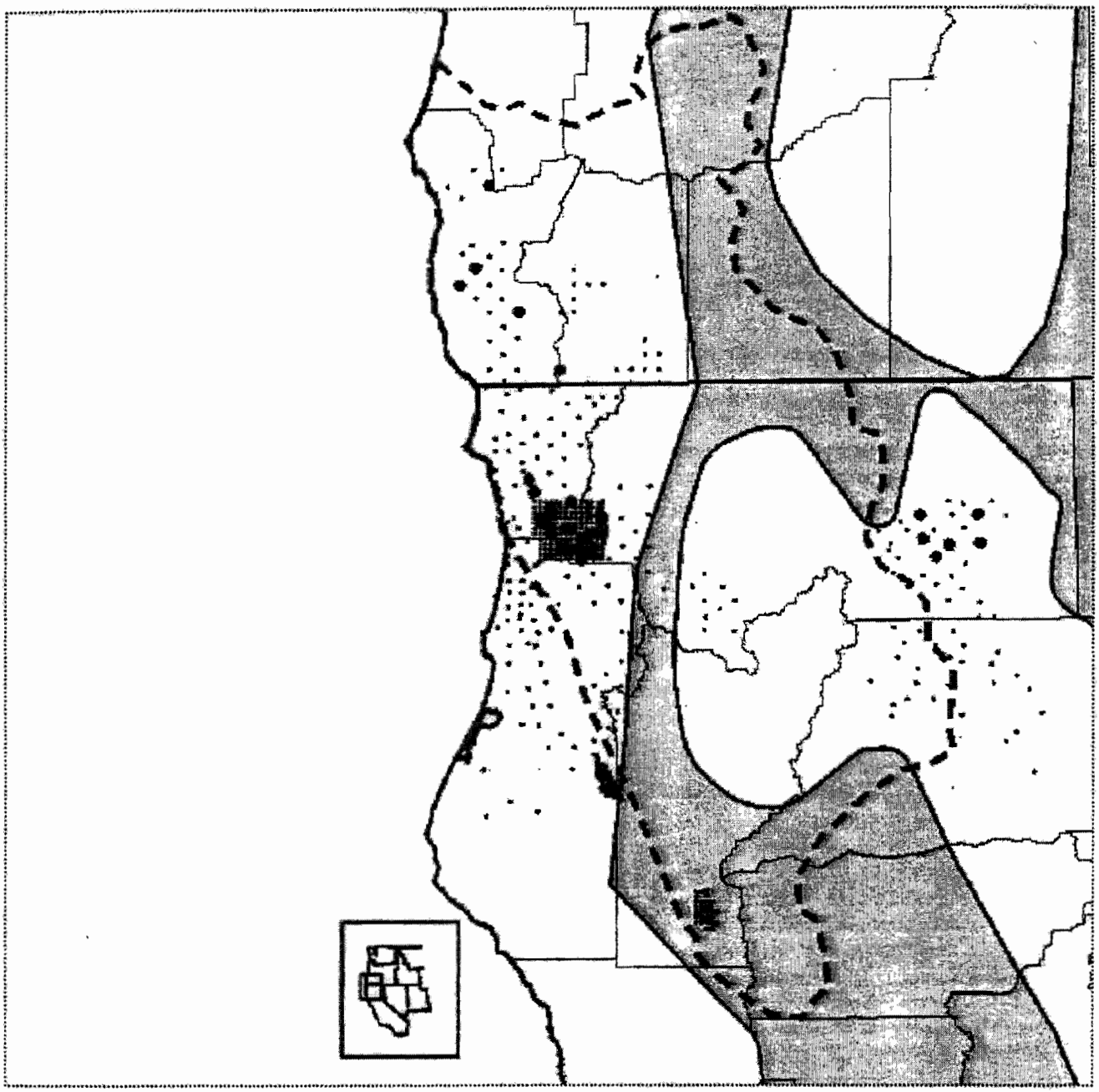

Figure 5. Fisher detections within the Klamath-Siskiyou Bioregion, 1996-2002. Large black dots represent sample units where fishers were detected; small dots represent those where fishers were not detected.