

## USING A WIDE-SCALE LANDBIRD MONITORING NETWORK TO DETERMINE LANDBIRD DISTRIBUTION AND PRODUCTIVITY IN THE KLAMATH - SISKIYOU REGION

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### Abstract

The Klamath Bird Observatory and U.S. Forest Service's Redwood Sciences Laboratory have developed the Klamath Demographic Monitoring Network, a comprehensive bird-monitoring network in southern Oregon and northern California. The Network integrates bird conservation objectives into the ecosystem management process by incorporating academic, scientific, management, and conservation interests to inform the management and conservation process with science. We present examples of how our approach to studying bird populations in the Klamath-Siskiyou Region provides information about bird distribution and demographics. We demonstrate how the Network provides a tool for generating management-related hypotheses and resulting studies.

### Introduction

**W**e have developed a comprehensive bird-monitoring network in southern Oregon and northern California, the Klamath Demographic Monitoring Network. This Network promotes a science-based approach to integrating bird conservation objectives into the ecosystem management process. Through partnership development we incorporate academic, scientific, management, and conservation interests to produce information that informs the management process and conservation of birds.

Network cooperators (e.g., Ralph and Hogboom, in review) study bird populations and provide information about bird distribution, population trends at various scales, and population demographic factors that drive population change. Birds are an effective tool for monitoring biological change because: (1) there are many species in a region, each of which are easily and inexpensively detected using standardized sampling protocols; (2) these species respond to a wide variety of habitat conditions and climatic perturbations; and (3) accounting for and maintaining many species with different ecological requirements can be used to implement landscape-scale conservation strategies (Hutto 1998). Landbird monitoring provides excellent data on the effects of past and present manipulations on a watershed basis as birds can be site specific and show associations with measurable habitat characteristics (Alexander 1999; Hutto and Young 1999; Drapeau et al. 2000; Dettmers et al. 2002).

We have successfully engaged voluntary participation from academics, federal and state agencies, non-government organizations, and private landowners. We promote the use of

standardized bird monitoring methods that contribute to the Network's GIS-based regional data center.

### Study Area and Methods

The Network covers the Klamath-Siskiyou Ecoregion and the Upper Klamath Basin (Klamath-Siskiyou Region). Both stand out nationally as areas of conservation concern (USBR 1998; DellaSala et al. 1999; Shuford 2000). Our study area encompasses this region, transcending state, agency and ownership boundaries. The Network (Figure 1) extends from the Eel and Russian Rivers in northern California north to the Rogue River in southern Oregon, and from the Pacific Coast east to the headwaters of the Sacramento, Trinity, Rogue, and Klamath Rivers.

The Network is made up of a multi-layered system for inventory and monitoring of landbirds on a watershed basis. The specific methods have been codified in Ralph et al. (1993). The Partners In Flight Monitoring Working Group and the U.S. Forest Service have set these methods as standards for monitoring landbirds in North America (Manley et al. 1993). The methods are implemented throughout the year, and are especially concentrated during the summer breeding season (May-June) and during the late summer and fall dispersal and migration seasons (July-October). The Network's monitoring strategy uses several monitoring methods applied at multiple spatial and temporal scales. Bird census techniques are used to provide information about species presence/absence, richness, relative abundance, breeding status, population trends, seasonality, and habitat associations (e.g., Nur et al. 1999). Demographic monitoring

using constant-effort mist netting and nest finding compliments the census techniques adding information about productivity, survivorship, and cause of population change (Nur et al. 1999).

#### *Bird Census*

Breeding season bird censuses involve conducting point count surveys at two scales (Ralph et al. 1993). Extensive scale censuses are done over multiple watersheds, using on- and off-road counts in both upland and riparian habitats, thus providing information at a landscape level. Intensive censuses are usually conducted with the demographic methods described below, and are concentrated in the riparian zones or meadow edges, or in association with specific management efforts. These intensive efforts compliment the extensive dataset with site-specific information. Area search censuses involve a person searching two to three small areas for 20 minutes in each area (Ralph et al. 1993). The method is especially applicable during the non-breeding season.

#### *Constant Effort Mist Netting*

Demographic measures are primarily collected using constant-effort mist netting (e.g., Ralph et al. 1993). The method involves permanent stations, usually placed in a water-associated or meadow riparian zone to maximize capture rate and to monitor birds in these sensitive habitats. Nets are operated at least once every 10 days during breeding, dispersal and migration seasons. By capturing birds at mist-netting stations, we are able to determine the age and sex of individuals, providing information about population demographics and thus the potential causes of changes in abundance.

Both point counts and mist netting have been thoroughly investigated in the past few years and have been the subject of two international symposia (Ralph et al. 1995; Ralph and Dunn in press) with the objective of determining the statistical power of specific applications of the techniques. As a partial result of these symposia, specific standard protocols are now in place, along with area search protocols, and are incorporated into the handbook on methods (Ralph et al. 1993).

## Results and Discussion

#### *Bird Distribution and Habitat Relationships*

Over 15,000 census stations have been established throughout the Klamath-Siskiyou Region providing baseline information about the regional distribution of birds. For example, the Green-tailed Towhee (*Pipilo chlorurus*) is an abundant breeder in the eastern portions of our study area, in contrast to the Swainson's Thrush (*Catharus ustulatus*), a common breeder in the western segment of the study area (Figure 2). Habitat data collected at each census station provide us with an opportunity to develop and begin testing the hypothesis that general habitat relationships in part, drive the landscape distribution for these species. The towhee is associated with Pine and Juniper habitats that dominate our eastern landscapes and the thrush breeds in the

mixed-conifer hardwood forests of the western portions of the area (Figure 3).

This information is of interest to the scientific community who study similarities and differences of bird communities and bird diversity across the landscape. The Green-tailed Towhee and Swainson's Thrush examples begin to demonstrate how differences in bird communities across the region represent the a gradient of habitat types, from the eastern pine and shrub-steppe systems, through the mixed conifer/hardwood forests, and into the major watersheds of coastal Douglas fir and redwood forests.

Understanding general bird distribution patterns and habitat relationships is the first step to understanding the effects of habitat condition on birds, a topic of interest to land managers and the conservation community. In the case of the Swainson's Thrush, a Forest Service "Management Indicator Species," that is declining in the northwestern U.S. and Canada, our distribution data inform managers about the importance of a species of conservation concern with regards to the probability of its occurrence on particular management units. The habitat relationships data help managers understand which Management Indicator Species are of potential concern in a particular project within their management unit.

#### *Effects of Management*

To illustrate how our data apply to adaptive management we consider the Northwest Forest Plan (USDA and USDI 1994) and Late Successional Reserve (LSR) management. Federal land management plans use diameter at breast height (DBH), canopy height, and canopy cover to describe current and desired conditions. Here we consider bird species that have been identified as old-growth associates by the Forest Ecosystem Management Assessment Team (USDA et al. 1993). They include: Hairy Woodpecker (*Picoides villosus*), Northern Flicker (*Colaptes auratus*), Pileated Woodpecker (*Dryocopus pileatus*), Hammond's Flycatcher (*Empidonax hammondii*), Pacific-slope Flycatcher (*Empidonax difficilis*), Chestnut-backed Chickadee (*Parus rufescens*), Red-breasted Nuthatch (*Sitta canadensis*), Brown Creeper (*Certhia americana*), Golden-crowned Kinglet (*Regulus satrapa*), Hermit Thrush (*Catharus guttatus*), Warbling Vireo (*Vireo gilvus*), Hermit Warbler (*Dendroica occidentalis*), and Wilson's Warbler (*Wilsonia pusilla*). We hypothesized that these old growth associated birds would show a relationship with habitat characteristics used to describe forest conditions. Forest point count census stations where the old-growth bird abundance is greater are characterized by taller canopy heights (Figure 4). Hermit Warblers show a positive correlation with canopy cover (Figure 5).

This example illustrates our efforts to guide management by focusing analyses of Network data down to a watershed scale to predict the effects of specific actions on species of conservation concern. By basing analyses on variables used to describe current and desired conditions in federal land management plans we provide managers with information to inform management decisions and establish ecologically based targets. These data

provide information to help determine if management actions benefit the species assemblages they are supposed to protect.

Our data also can provide information to managers helping to assure proper documentation of the potential negative effects of management actions on species of conservation concern. Within the adaptive management and ecosystem management frameworks our data identify "Indicator Species" (species that represent specific management related habitat conditions) and can be used to develop tools for effectiveness monitoring. To promote the development of old-growth characteristics in LSRs, and to reduce the threat of stand replacing fires land managers are implementing various forest thinning projects (USDA and USDI 2004). By examining the relationship of birds of management concern with natural variations in DBH, canopy height, and canopy cover we make predictions with regards to the effects of management.

Our results can then be used to set thresholds for thinning projects to ensure forests are not over-thinned, causing a reduction of canopy cover that would be detrimental for old-growth associated landbird species. With our standardized bird monitoring techniques we can implement efficient and cost-effective monitoring programs. By monitoring the abundance of indicator species we can test predictions within an adaptive management framework, and if species begin to decline, management targets can be revised fulfilling mandates to monitor the effects of management on species of concern within the Ecosystem Management Framework.

### *Demographic Monitoring*

Using Network mist-netting data collected in riparian habitats in the watersheds of the Klamath, Trinity, and Rogue rivers, Ralph and Hollinger (2003) reported adult Willow Flycatchers breeding in and migrating through the Klamath-Siskiyou Region. During the breeding season they are captured in relatively small numbers, as compared to the much higher numbers in the dispersal and migration seasons when many young birds are captured (Figure 6).

By using constant-effort mist netting throughout the Network, we are providing data that increase our understanding about breeding season productivity, over-winter survivorship, as well as age- and sex-specific distribution and abundance during the breeding, dispersal, and migration seasons. By recapturing previously banded birds we are calculating survivorship estimates.

Willow Flycatchers are receiving management attention in the Klamath Siskiyou Region due to population declines that have been documented in the Southwestern U.S. (Sogge et al. 2003). With a look at data regarding migrant bird distribution we get a better appreciation of the influence of how management in our region can have effects that reach well beyond this area. Young Willow Flycatchers that were hatched outside of the Region concentrate along the main rivers and are dependent on riparian habitats during dispersal and migration seasons. By focusing monitoring efforts during migration, as well as the breeding seasons, the Region's Network is broadening management

considerations beyond the traditional focus on breeding populations.

### *Science-Based Conservation*

The data presented have been derived from implementing monitoring plans that were developed as part of the Partners In Flight International Land Bird Conservation Program. In implementation we have integrated our monitoring strategy with regional land management programs. The draft *Coniferous Forest Bird Conservation Plan: A Strategy For Protecting and Managing Coniferous Forest Habitats and Associated Birds in California* (CalPIF 2002) is an example of how Klamath Demographic Monitoring Network efforts have resulted in products that further the integration of bird conservation and land management by providing management recommendations in an easily referenced format. As a result of the development of bird conservation plans a recent Presidential Executive Order (Federal Register 2001) has mandated a series of Memoranda of Understanding (MOUs) between the Fish and Wildlife Service and various land management agencies. These MOUs obligate agencies to the International Migratory Bird Treaty Act and challenge them to integrate Partners In Flight bird conservation plans, such as CalPIF (2002), and their objectives.

## Conclusions

In developing and maintaining a conservation-based bird monitoring network, and to better understand the dynamics between demographic parameters and distribution at various scales, it is critical that multiple methods be employed at multiple spatial and temporal scales. The Klamath Demographic Monitoring Network provides an additional tool for generating management related hypotheses and studies to inform the land and wildlife management. As a result we can use the birds as indicators of current and desired conditions and use the network as an effectiveness monitoring tool within the adaptive management framework.

The Network uses a science-based approach to further conservation in our region by involving the key interests on which successful conservation depends. The Network engages academic and scientific interests as it provides a tool for studying patterns of biodiversity across landscapes. Management interests are engaged as it provides a tool for studying the effectiveness of management actions. Conservation interests are engaged as it provides a tool for integrating bird conservation objectives into land management.

The Network has developed a partnership that links the educational resources of academic community with the needs of the neighboring community-at-large. It brings scientific and educational resources to the table with community participants to inform land management decision processes with excellent science. Through this partnership we connect theoretical studies to the practical world of land and wildlife management to promote bird conservation with an understanding that stable bird populations represent sustainability at the local, regional and

global scales. The Network brings all interests to the table to demonstrate the power of human knowledge and collaboration, providing models for appreciating endangered ecosystems and building sustainable communities and industries. Through hypothesis testing and effectiveness monitoring we can learn from experience to better understand how to practice stewardship of our landscape.

### Acknowledgements

The Klamath Demographic Monitoring Network has resulted from the contribution of various partners that represent federal and state land management agencies, corporations, and private contributors and land owners. Countless volunteer intern students have been a critical force in the development of the Network. This manuscript benefited from reviewer comments from Joel Pagel, Dennis Vroman and Nathaniel Seavy.

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Figure 1. The Klamath Demographic Monitoring Network and location of coordination organizations: Klamath Bird Observatory (KBO), Humboldt Bay Bird Observatory (HBBO) and USDA Forest Service Pacific Southwest Research Station Redwood Sciences Laboratory (RSL).

### Klamath Bioregion of Northern California and Southern Oregon

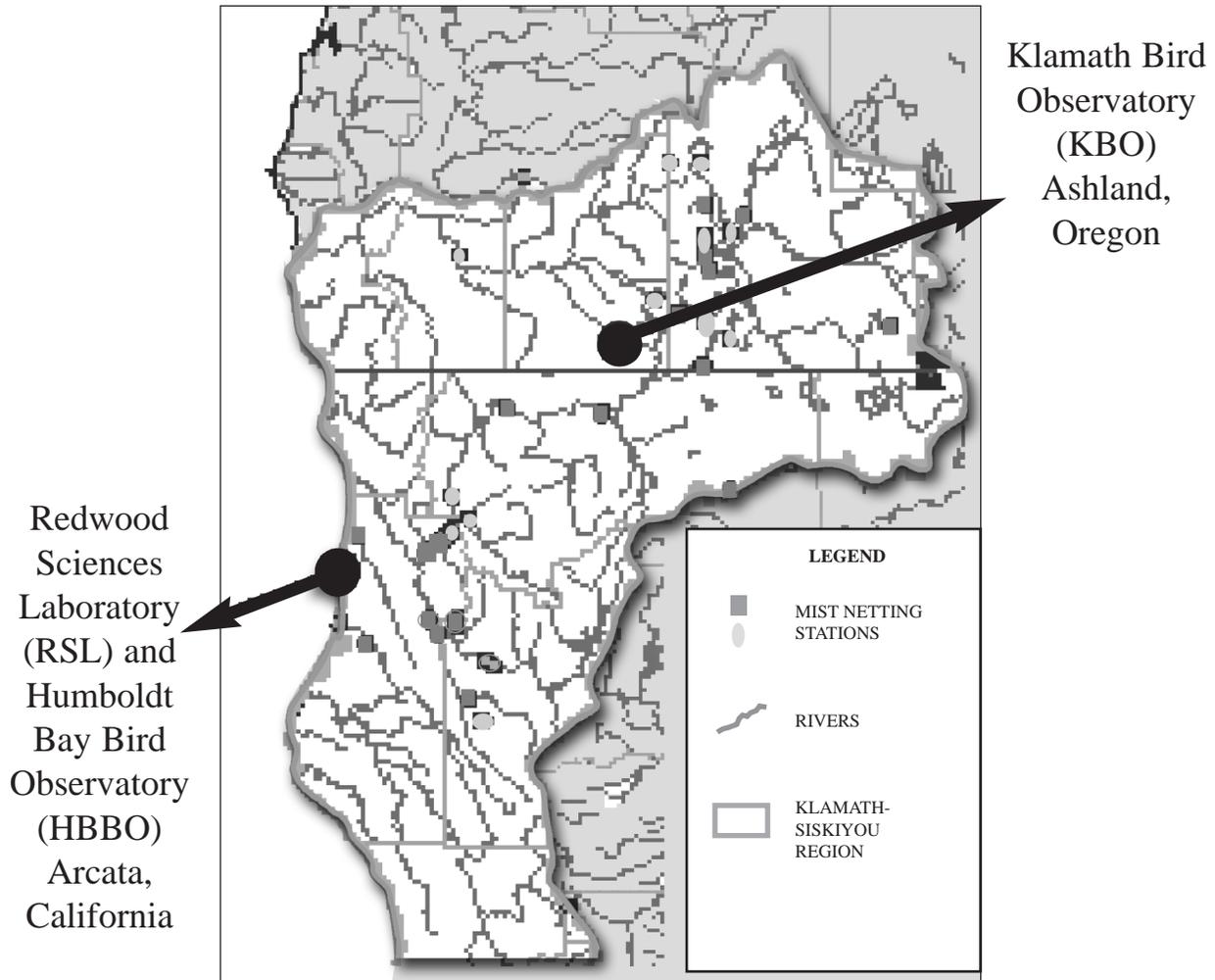


Figure 2. Percent of bird census stations within 15 Klamath Demographic Monitoring Network study areas where Green-tailed Towhees and Swainson's Thrushes were detected.

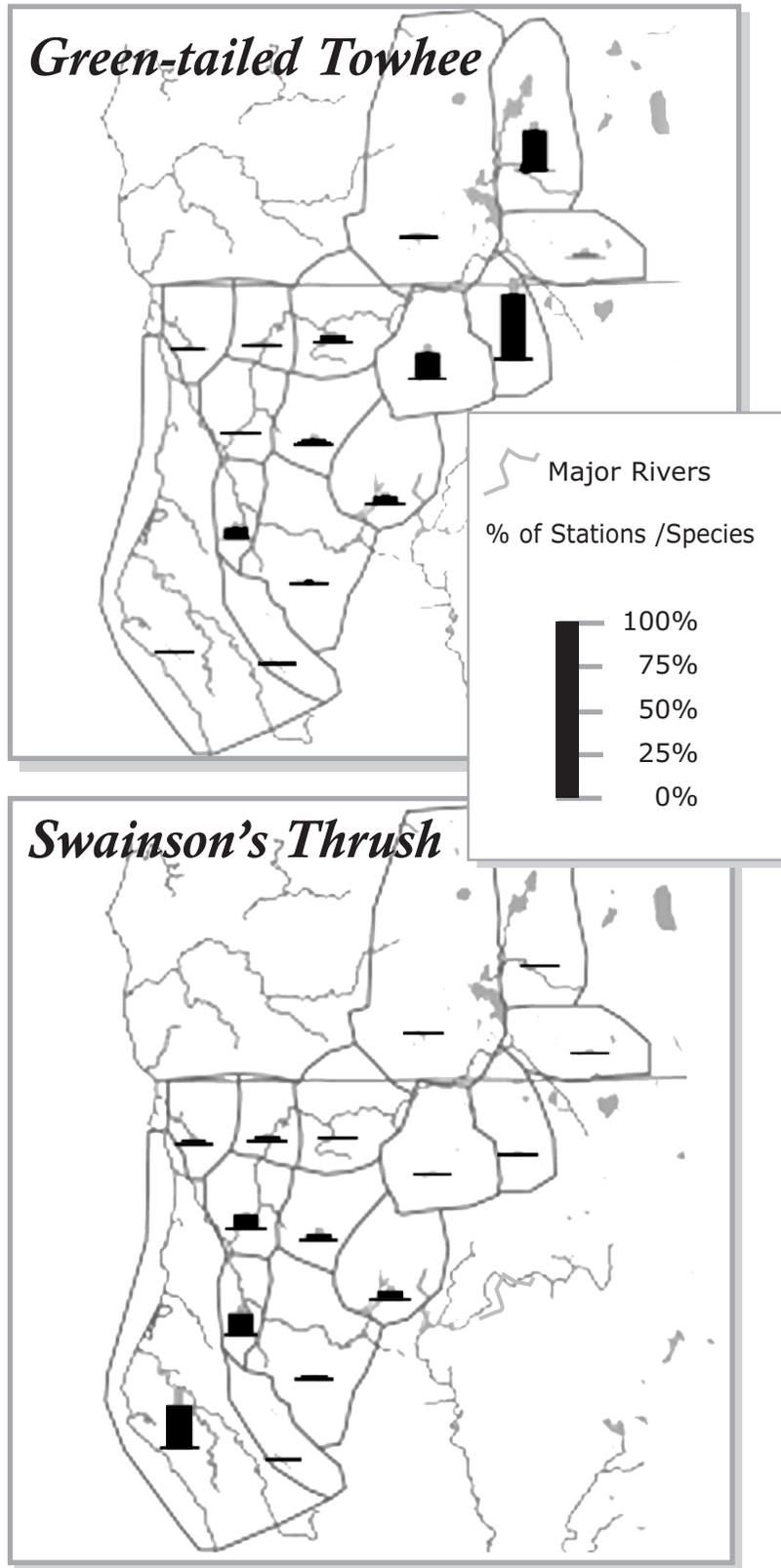
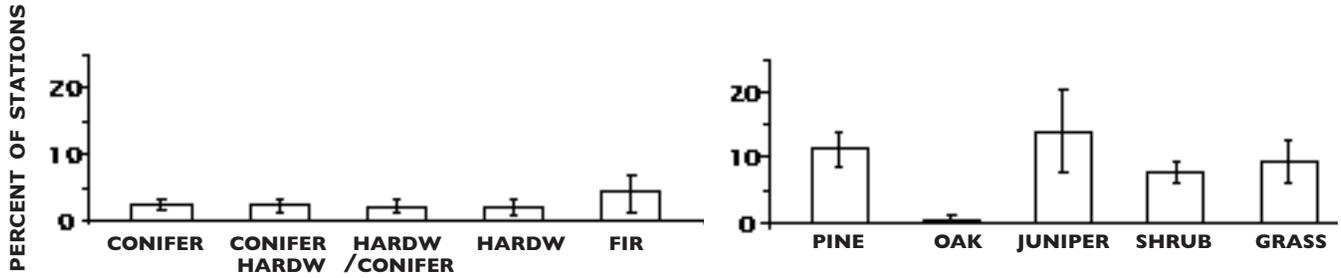


Figure 3. Distribution of bird census stations where Green-tailed Towhees and Swainson's Thrushes among 10 habitat type classifications.

*Green-tailed Towhee*



*Swainson's Thrush*

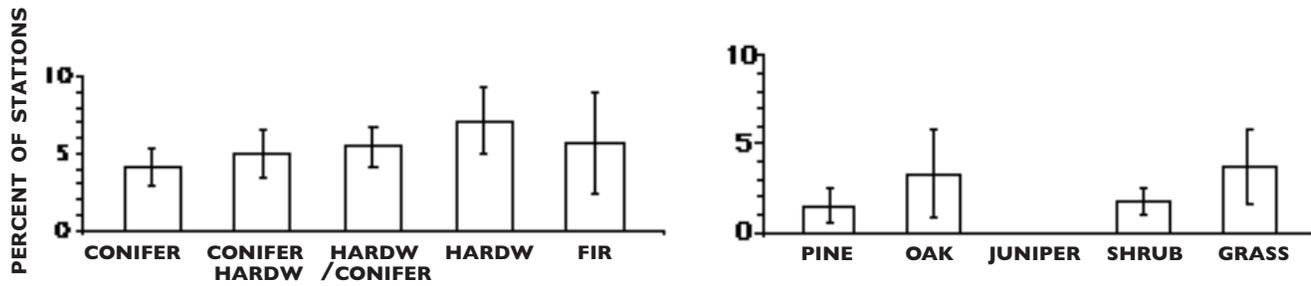


Figure 4. Average tree height at bird census stations where 0-6 old-growth associated bird species were detected.

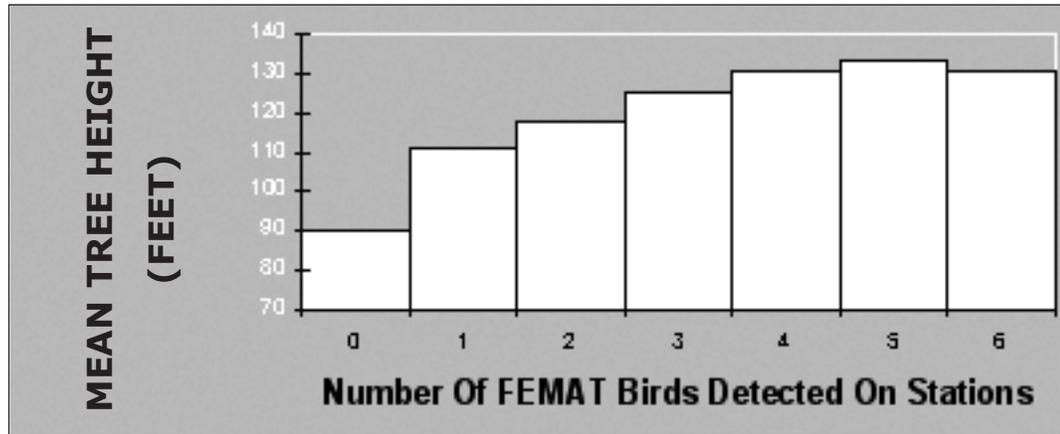


Figure 5. Average number of Hermit Warblers detected at bird census stations classified into 4 canopy cover groups.

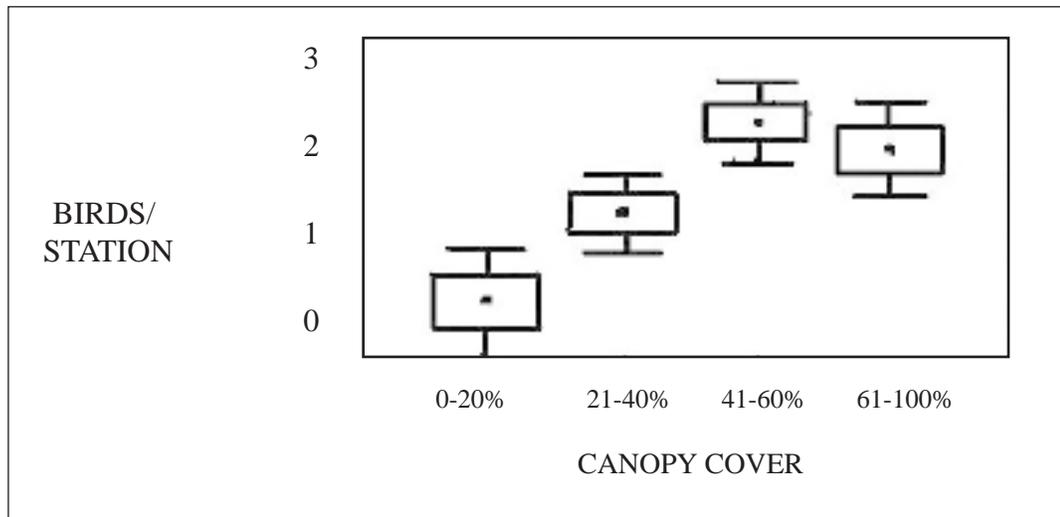


Figure 6. Relative abundance of Willow Flycatcher age and sex classes (UU-unknown age and sex, HY-hatching year unknown sex, and AF-adult female, AM-adult male,) at constant effort mist netting stations in 4 Klamath Demographic Monitoring Network study areas as reported in Ralph and Hollinger (2003).

