ing baselines, and evaluating changes in bird populations through time?

Since 1975, a BBS has been done in the vicinity of Downieville, Sierra County, California. I took responsibility for the survey in 1982 and have continued the work through 1987. Because the BBS is a standardized method to collect time-constrained counts of birds yearly, the resulting information could be useful for inventories, baseline information, and monitoring on National Forests. The approach may also be useful on lands other than those administered by the National Forest System. The objective of this paper is to evaluate the usefulness of data from the Downieville BBS route for land managers.

METHODS

In late May 1982, prior to completing my first Downieville BBS, I registered all 50 survey points to specific, locatable features of the landscape along the route to ensure repeatability through time. I also classified the vegetation at each survey point to the most appropriate Wildlife Habitat Relationships System habitat (Mayer and Laudenslayer 1988) and listed the common plant species present.

All surveys followed standard procedures established by the U.S. Fish and Wildlife Service. The route consisted of 50 points spaced approximately 0.5 mi (0.8 km) apart. The survey was completed once each year at the height of the breeding season, generally in the first 2 weeks of June, to reduce variability induced by seasonality. Each survey was initiated 0.5 hr prior to sunrise (approximately 0500 hrs, PDT). Three minutes were spent at each point identifying all birds detected by sight and sound, while an assistant on each survey recorded the information on standard BBS forms. In all years, the survey was completed within 4.5 hrs to reduce variability resulting from increasing temperatures and time-of-day effects.

Following the field work, required forms were submitted to the U.S. Fish and Wildlife Service. I then assigned bird species to one or more of four management guilds to investigate single and multiple species' changes in abundance through time. These guilds included tree-canopy feeders, hole nesters, bole (tree trunk) feeders, and ground feeders (Verner 1984). Simple regression analyses for individual species and management guilds were done using Minitab at an alpha level of 0.05.

TRANSECT

The 25 mi (40 km) transect begins in downtown Downieville, proceeds south along California Highway 49 to Goodyear's Bar, south on Mountain House Road to Pliocene Ridge Road, then west on Pliocene Ridge Road to the terminus of the transect near Plum Valley. Elevations range from 2,736 ft (830 m) at Goodyear's Bar to 4,500 ft (1,375 m) at the town of Forest, about midway through the transect.

Overstory vegetation along the transect generally consists of Douglas-fir (*Pseudotsuga menziesii*), incense cedar (*Calocedrus decurrens*), white fir (*Abies concolor*), red fir (*A. magnifica*), ponderosa pine (*Pinus ponderosa*), canyon live oak (*Quercus chrysolepis*), bigleaf maple (*Acer macrophyllum*), dogwood (*Cornus nutallii*), Pacific madrone (*Arbutus menziesii*), and California black oak (*Q. kelloggii*). Generally the wildlife habitat on the transect was classified as montane hardwood-conifer (33 sites) or mixed-conifer (12 sites). Two sites were classified as montane riparian, one as montane chaparral, and one as ponderosa pine. Along the first 8 mi (13 km) of the transect, from Downieville past Goodyear's Bar, the North Fork of the Yuba River and Woodruff Creek provide montane riparian, mesic mixed-conifer, and montane hardwood-conifer habitats. Towards the end of the transect, from near the town of Forest to Plum Valley, tree plantations, areas dominated by shrubs, for example, deerbrush (*Ceanothus integerrimus*), prostrate ceanothus (*C. prostratus*), various manzanitas (*Arctostaphylos* spp.), and more xeric conditions provide montane chaparral, drier mixed-conifer, ponderosa pine, and montane hardwood-conifer habitats.

RESULTS

Over the 13 years of surveys, 89 species and 4,744 individual birds were recorded. The most common species were the American robin (scientific names are in Table 1), Steller's jay, and black-headed grosbeak. Less common species included the American dipper, spotted owl, and flammulated owl (Table 1).

The American robin showed a significantly increasing trend in abundance (Fig. 1) over the 13-year period, but counts of Steller's jays (Fig. 2) and mountain chickadees (Fig. 3) decreased slightly but not significantly. Counts of pileated woodpeckers (Fig. 4) showed a strong and statistically significant decline.

Regression analyses for each of the guilds showed similar patterns. The tree-canopy feeders (15 species including golden-crowned kinglet, solitary and warbling vireos, orange-crowned, Nashville, yellow-rumped, hermit, and MacGillivray's warblers, and northern oriole) had a combined count of 741 and showed a significant increasing trend (Fig. 5). The hole nesters (17 species including pileated, hairy, and downy woodpeckers, mountain chickadee, plain titmouse, white- and red-breasted nuthatches, and Bewick's wren) had a combined count of 616 with no significant yearly trend (Fig. 6). Bole feeders (15 species including most of the hole nesters) had a combined count of 607 and no significant trend (Fig. 7). Finally, ground feeders (9 species including California thrasher, American robin, green-tailed,

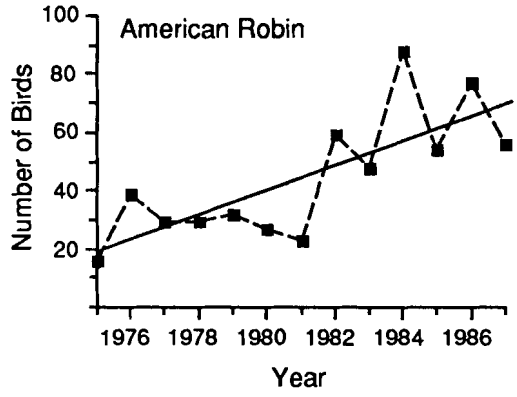

Fig. 1. Trend in counts of American robins from 1975 through 1987 (Y = 14.73 + 4.24x, P < 0.01).

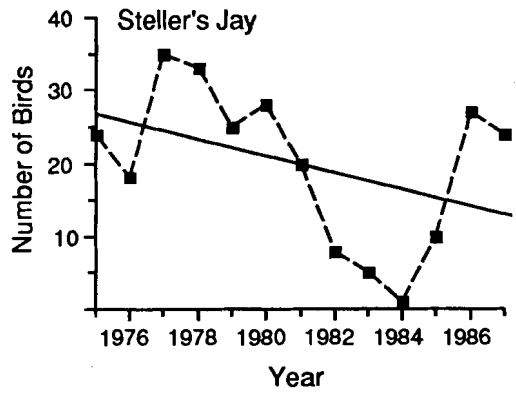

Fig. 2. Trend in counts of Steller's jays from 1975 through 1987 (Y = 27.96 - 1.16x, P > 0.10).

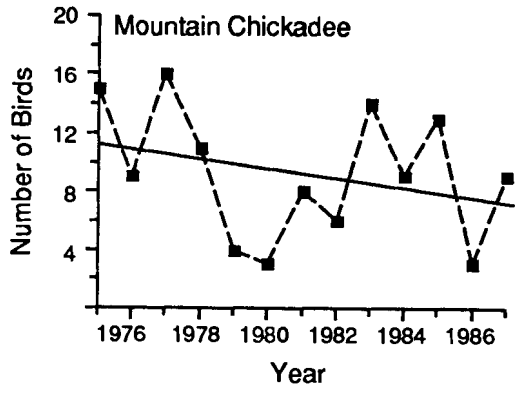

Fig. 3. Trend in counts of mountain chickadees from 1975 through 1987 (Y = 11.58 - 0.34x, P > 0.10).

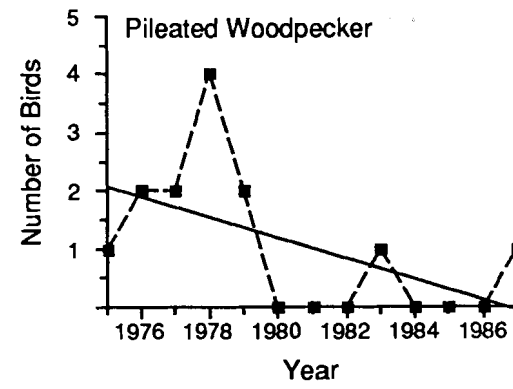

Fig.4. Trend in counts of pileated woodpeckers from 1975 through 1987 (Y = 2.23 - 0.18x, P < 0.05).

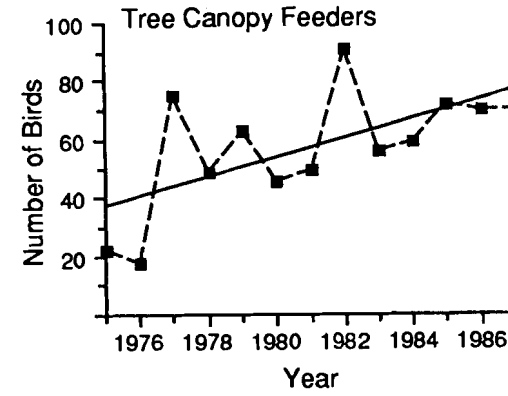

Fig. 5. Trend in pooled counts of tree-canopy feeders from 1975 through 1987 (Y = 34.04 + 3.28x, P < 0.05).

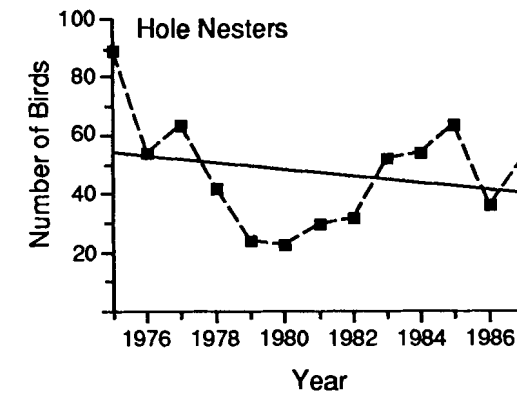

Fig. 6. Trend in pooled counts of hole nesters from 1975 through 1987 (Y = 55.5 - 1.16x, P > 0.10).

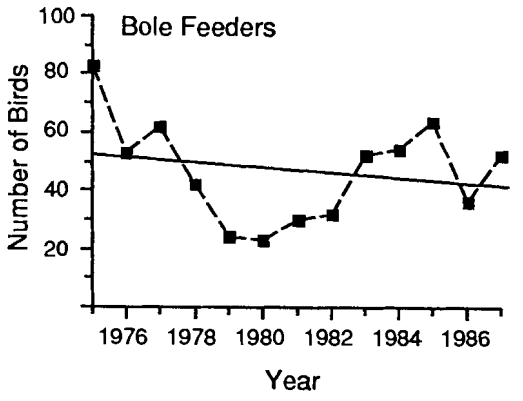

Fig. 7. Trend in pooled counts of bole feeders from 1975 through 1987 (Y = 52.92 - 0.89x, P > 0.10).

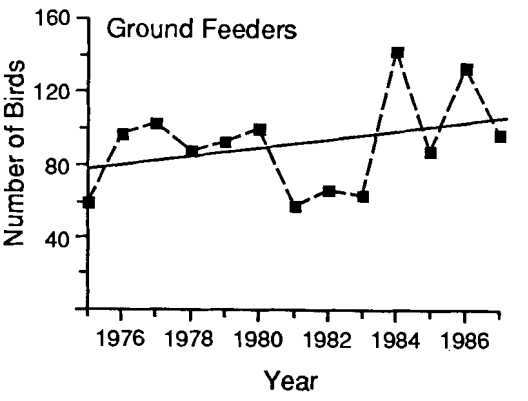

Fig. 8. Trend in pooled counts of ground feeders from 1975 through 1987 (Y = 75.08 + 2.33x, P > 0.10).

some of the perceived patterns for individual species in this study were really the result of differences between observers. For example, the first 7 years of the Downieville Survey were done by one observer and the last 6 years were done by myself. In general, I found fewer Steller's jays (Fig. 2) and pileated woodpeckers (Fig. 4) than did the previous observer.

Is the BBS approach useful in forest management? I think it is a useful approach for some species, and the cost of conducting the surveys is negligible. Information collected using BBS protocols is useful for providing general inventories of passerine birds. The system is designed to survey only diurnal birds, so it produces little information about nocturnal ones, such as owls. It also is not very useful for species with large home ranges, such as turkey vultures (*Cathartes aura*) and red-tailed hawks (*Buteo jamaicensis*), or those with restrictive habitat requirements, such as great blue herons (*Ardea herodias*). It also is not a suitable technique for surveying uncommon or rare birds, such as pileated woodpeckers.

Perhaps the greatest value of this approach is for establishing a baseline of inventory information through time. The BBS is the only approach, to my knowledge, that is standardized to a substantial degree and that has been done regularly at yearly intervals. The surveys do supply historical information, perhaps even 20 years or more for some survey routes.

As a tool for monitoring, BBSs may have some use, although trends suggested from a single route may be inaccurate. Counts tend to be low, especially of species about which information is urgently needed. They could be increased by adding survey routes in areas of interest, by increasing the number of counting points per route, or counting longer at each point. According to J. Verner (pers. comm.), adding routes would be the best strategy, followed by increasing the number of counting points per route.

The problem of observer variability cannot be overcome without a large increase in funding. Perhaps guilding procedures will help improve the utility of this technique, assuming user caution in the interpretation of results to avoid declines or losses of guild members. For example, habitat capability for the majority of cavity nesters might be maintained, yet certain members, such as pileated woodpeckers, may actually decline. Pileated woodpeckers generally use larger snags for nesting than do other species (Bull and Meslow 1977, Bull 1987). Thus, under intensive timber management, where rotation ages may preclude development of suitable snags for pileated woodpeckers, using a guild approach alone may not provide all the information needed for informed decisions.

In conclusion, BBSs are useful for inventorying birds present in an area. However, if used for developing baselines or as monitoring tools, they must be used with caution, especially for monitoring at a local level. Perhaps, as Robbins et al. (1986) suggest, BBSs should be used only for monitoring at relatively broad scales, where problems due to observer variability, weather, small chances of encounter, and other confounding factors are minimized.

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