MAPS Stations on National Wildlife Refuges in the USFWS Pacific Region

Current Status and Future Direction

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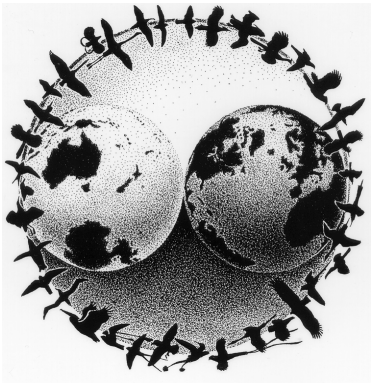

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INTRODUCTION

Several National Wildlife Refuges in USFWS's Pacific Region have operated bird banding stations during one or more of the past 14 years (1989-2002) as part of the Monitoring Avian Productivity and Survivorship (MAPS) Program, as coordinated through The Institute for Bird Populations (IBP; http://www.birdpop.org). The MAPS Program uses a standardized protocol of constant-effort mist netting (DeSante et al. 2003) at a continent-wide network of over 500 stations operated by federal and state agencies, private organizations, and individual bird banders. MAPS has proven to be a valuable tool for indexing productivity and estimating adult survival rates of landbirds at several geographic scales, ranging from the local landscape to nationwide. Patterns that emerge from tracking these demographic parameters can be related to ecological characteristics and population trends of the target species (DeSante 2000, DeSante et al. 1999, 2001), and to landscape-level habitat conditions (Nott et al. 2003, DeSante et al. in press a) and climatic cycles (Nott et al. 2002). The data and patterns resulting from MAPS can help focus research and management efforts for landbirds, efforts that are critical for their effective conservation.

It is the goal of the USFWS, Pacific Region, to contribute to this database to help meet the conservation goals of the Service and its partners in the west, both at site-specific levels and at larger geographic scales. Until now, however, MAPS stations on FWS lands in the Pacific Region have been established opportunistically, with little coordination at the regional or landscape level. The Pacific Region Migratory Bird and Habitat Programs (MBHP) branch supports six stations on Pacific Region NWRs, and there are a number of other stations on Pacific Region refuges that are operated without regional support. Both the USFWS and IBP believe that the usefulness of MAPS data can be enhanced by the thoughtful selection of target species and the critical siting of stations with respect to 1) habitats of special concern, 2) geographic areas where gaps exist in MAPS data, and 3) NWR units where substantial numbers of individuals of the target species can be captured in appropriate habitat types and geographic areas. This project, therefore, represents the first step toward a greater coordination of MAPS development within the USFWS Pacific Region and on NWR lands, and will be used to guide future MAPS efforts for the MBHP.

The overall goal of this report is to provide an overview of the MAPS Program on Pacific Region NWR lands by providing an assessment of existing and discontinued stations,

and suggestions as to where additional stations should be sited across the five-state area of Washington, Oregon, Idaho, California, and Nevada. This goal is to be achieved by accomplishing five main objectives:

1. Provide advice and recommend targets for optimum station longevity, continuity, and capture rates.
2. Determine the utility of existing MAPS stations on National Wildlife Refuges within the Pacific Region states of WA, OR, ID, CA, and NV by:
    a. Comparing capture rates and habitats sampled among stations and evaluating the relative contribution of each station in the larger context of habitat- or landscape-level bird conservation.
    b. Suggesting which stations are most valuable and should be continued (from the standpoint of capture rates or other considerations), and which are least valuable and could be terminated with little consequence, or possibly replaced by new stations in more strategic locations.
3. Determine which USFWS Pacific Region National Wildlife Refuges should consider adding MAPS stations and why.
4. Suggest habitats most in need of additional MAPS stations in the west, should the FWS have the opportunity to establish MAPS stations on properties owned by others.
5. Comment on whether or not the FWS should consider efforts toward conservation of western migrants on their wintering grounds, and how this might be accomplished through MoSI or other efforts.

METHODS

Capture Rates of Adult Birds at MAPS Stations on NWR Lands in the Pacific Region

In order to determine the utility of existing MAPS stations on National Wildlife Refuges within the Pacific Region states of WA, OR, ID, CA, and NV, we calculated the mean capture rates of adult birds of each species captured at each station over all the years between 1989 and 2001 that the station was operated. In these calculations, each individual adult bird captured during a year (typically May 21-August 8, but beginning earlier or later at more southerly or northerly stations, respectively) was counted only once regardless of the number of times it was captured that year. These capture rates formed the basis for determining the monitoring potential of various species, and for evaluating the relative contribution of each station to the larger scheme. In order to assess the actual usefulness for management of MAPS data collected at an existing station, or the potential usefulness of such data from a proposed station, it was necessary to consider several other factors in addition to the number of species and numbers of individuals of each species that could be captured at the station. These additional factors include the importance for management of the habitat in which the station is sited, the importance for management of the bird species sampled at the station, and the geographic location of the station relative to other stations and to the overall MAPS coverage of the geographic area. These considerations led to four additional critical components of this analysis: 1) the identification of habitats of special concern, 2) the identification of target species for each habitat of special concern, 3) the identification of geographic areas where gaps exist in MAPS data, and 4) the identification of NWR units where substantial numbers of individuals of the target species could likely be captured in appropriate habitat types and geographic areas.

Identifying Habitats of Special Concern

We accessed all published PIF conservation plans for the five states in the USFWS Pacific Region and found that five of the plans (OR-WA West-Slope Coniferous Forests, OR-WA East-Slope Coniferous Forests, OR-WA Northern Rocky Mountains, CA Coniferous Forests, and Sierra Nevada Range) dealt primarily with habitat types that were well represented on Forest Service or Bureau of Land Management lands, but not well represented on National Wildlife Refuge (NWR) lands. These plans were excluded from consideration. We then

examined the remaining published PIF conservation plans for the five states in the USFWS Pacific Region (OR-WA Westside Lowlands & Valleys, OR-WA Columbia Plateau, Idaho, Nevada, CA Coastal Scrub & Chaparral, CA Oak Woodlands, CA Riparian, and CA Grasslands) to determine potential priority habitats of concern. We also examined MAPS data for the habitat types at each of the 29 MAPS stations that were ever operated on NWRs in the Pacific Region to determine which of the potential habitats of conservation concern should be considered actual habitats of special concern. We assumed that habitats present in the sample of 29 stations would be more or less representative of habitats available on the entire set of National Wildlife Refuges in the Pacific Region. We confirmed this by examining published bird species checklists from 35 of the 53 NWR units in the five states (Igl 1996) in light of our knowledge of habitat preferences in the species found on those checklists.

Target Species

We developed a list of target species associated with each of the identified habitats of special concern by considering *all* landbird species characteristic of each of those habitats and eliminating *only* those species that we believed could not be sampled effectively on Pacific Region NWRs by MAPS protocol. Thus, we eliminated species that were unlikely to be captured in sufficient numbers at multiple stations by mist nets operated during the morning hours. These included nocturnal species, raptors and other large landbirds with widely dispersed territories, highly colonial nesters, aerialist foragers (swallows and swifts), hummingbirds (that most MAPS operators are not permitted to band), grassland species, and rare or local species that we would be unlikely to capture at multiple NWR stations. We arbitrarily assigned species associated with more than one habitat to the habitat in which we considered their conservation to be most critical. For each of the target species, we then considered:

a) the direction (increasing or decreasing) of the species' BBS population trend (1980-2001; Sauer et al. 2002) in the USFWS Pacific Region, and the statistical significance ($0.10<P$, $0.05<P\leq0.10$, $0.01<P\leq0.05$, $P\leq0.01$) of negative population trends;
b) the number of MAPS stations on USFWS Pacific Region NWRs at which the species was captured with an average capture rate of at least 2.5 individual adults per year (i.e., how well represented the species was in the existing MAPS dataset from NWRs); and

c) whether or not the species was also a focal species or a species of special concern in one or more of the published PIF Bird Conservation Plans for the five-state region.

Importantly, a species did *not* need to have a significant negative population trend, or even a negative population trend, to be considered a target species in this report. Targeting species with positive population trends will allow us to compare demographic rates between those species and species with negative population trends in order to gain insight into the proximate demographic cause(s) of the population declines. We also allowed inclusion of target species that were *not* well represented in the existing MAPS database from NWR lands; these represent species which we believe could usefully be targeted in future MAPS efforts. Finally, because identification as a focal species or a species of special concern in a PIF Bird Conservation Plan was *not* required for a species to be identified as a target species in this report, and because the criteria used in the various PIF Bird Conservation Plans to identify focal species or species of concern were complex and inconsistent from plan to plan, these criteria are not repeated here; rather, the reader is referred to those plans for such criteria.

Identifying Gaps in the Distribution of MAPS Stations in the Pacific Region

We superimposed the locations of MAPS stations upon GIS layers of U.S. Fish and Wildlife Service National Wildlife Refuges (http://www.fws.gov/data/IMADS/imsdoc_refbnd.htm) for the five-state area covering Washington, Oregon, Idaho, California, and Nevada (Fig. 1a-e) in order to identify geographical gaps in MAPS coverage. The NWR location names or 3-character codes (shown on the figures in bold italics) correspond to state lists of NWR administrative units, associated refuges, or other federal properties presented in Table 1. Not all properties are labeled on Figure 1a-e because the NWR GIS layer did not provide codes for them.

Assessing the Monitoring Potential of the Refuges

We obtained bird checklists for 35 NWR units in all five states (Igl 1996) and assessed the landbird monitoring potential of each NWR. To do this we:

i) compared species lists from NWR bird checklists with our habitat-specific lists of target species, determined the number of species on our habitat-specific lists of target species that were reported as breeders on each unit, and assigned priority ranking to that habitat type if eight or more lowland riparian target species, four or more oak

woodland target species, or four or more shrubland target species, respectively, were recorded as breeders on that NWR unit;

ii) assigned a value to each of the species in common to the two lists based on the categories of relative abundance reported in the checklists – abundant (4), common (3), uncommon (2), occasional or rare (1) – and calculated a total sum (t) for each NWR unit. Because such categories of relative abundance can vary among refuges in terms of the criteria used, we pooled ranges of total scores into five overall categories of monitoring potential: I ($t \leq 20$), II ($21 \leq t \leq 40$), III ($41 \leq t \leq 60$), IV ($61 \leq t \leq 80$), V ($81 \leq t \leq 100$); and

iii) selected priority NWR locations based on the requirement that the NWR unit must have at least an overall category III ranking *and* have priority ranking for at least one habitat type (i.e., have at least eight breeding lowland riparian species, four breeding oak woodland species, or four breeding shrubland species).

From all of the information assembled regarding capture rates of species on existing refuges, priority habitats for monitoring, target species, geographical gaps in MAPS coverage, and monitoring potentials of the NWR units in the Pacific Region, we provide recommendations regarding the continued operation of existing MAPS stations associated with NWR locations and propose the establishment of additional MAPS stations on those NWR locations that offer the greatest monitoring potential in each state. Then, using information on locations and habitat types of all MAPS stations operated in the five-state area, we suggest geographic area/habitat combinations in need of additional stations, should the USFWS have resources to aid in that endeavor. Finally, we comment on whether or not the FWS should consider efforts toward conservation of western migrants on their wintering grounds, and how this might be accomplished through MoSI or other efforts.

RESULTS AND DISCUSSION

Years of Operation and Capture Rates Needed at MAPS Stations

Four consecutive years of data are needed to obtain initial estimates of adult survival rates from Cormack-Jolly-Seber mark-recapture analyses (Pollock et al. 1990) that employ a transient model to adjust for the negative bias on survival rates caused by including non-resident birds in the sample (Pradel et al. 1997, Nott and DeSante 2002). Although at least four years of data are necessary to obtain adult survival rate estimates using transient models, the precision of such estimates increases with increasing numbers of years of data. Using four years (1992-1995) of MAPS data, Rosenberg et al. (1999, 2000) estimated that about 12 years was needed to obtain maximum precision from time-constant mark-recapture models of MAPS data.

Because the breeding productivity of landbirds is very sensitive to weather conditions, including those on the wintering grounds just prior to the breeding season (Nott et al. 2002), a substantial number of years of data are also necessary to obtain mean annual productivity indices that are robust with respect to variation in weather conditions. Our experience is that, again, 10-12 years of data generally allow for the necessary wide range of weather conditions to occur at a station in order to obtain meaningful mean annual productivity indices. Thus, we consider 10-12 years to be the minimum number of years a MAPS station should be operated. Although missing years of data can easily be tolerated for population size and productivity indices, missing years of data make mark-recapture estimation of survival rates problematic. Finally, if one desires to obtain meaningful estimates of trends in vital rates, it appears that upwards of at least 20 consecutive years of data are needed, especially for estimating trends in survival rates (Rosenberg et al 1999, 2000).

We have found that a capture rate of 2.5 adults per year at a station appears to be the minimum average annual capture rate of adults needed to include data from the station in logistic regression analyses of spatial and temporal variation in productivity indices (proportion of young in the catch). We have also found that an annual average of seven or eight individual adults (from pooled stations) appears to be the minimum annual number of adult captures necessary to obtain an estimate of adult survival (φ) using 8-10 years of data; an average of about 12-13 adults per year (from pooled stations) is necessary to provide adult survival rate estimates with CV(φ) less than about 30%, which likely is the minimum precision

needed for reporting the estimate. Thus, the minimum requirement for a species to have some monitoring potential in an area is that it be captured at three or four stations at capture rates of at least 2.5 adults per year; a slightly stronger minimum requirement is that it be captured at five or more stations at capture rates of at least 2.5 adults per year.

It should be noted that significant differences in productivity indices among stations or groups of stations or among years at a group of stations can usually be obtained from logistic regression analyses of data that average about 4-8 adults (and perhaps half that many young) per station per year (DeSante and Kaschube, unpubl. data). This, of course, is because productivity often differs dramatically from station to station and from year to year. On the other hand, detecting small difference in adult survival rates takes much larger sample sizes. Power analyses currently underway suggest that, to detect about a 15% difference in the apparent annual adult survival rate of a species between two groups of stations (e.g., 0.45 vs. 0.52) with 80% power using 20 years of mark-recapture data, a total of between 70 and 140 (depending on the actual survival rates and recapture probabilities of the species) resident (non-transient) adults might need to be captured and released annually (DeSante and Kaschube unpubl. data). If about seven resident adults were to be captured and released per year per station, then a total of between 10 and 20 stations would be needed to achieve these results.

Capture Rates of Adult Birds at MAPS Stations on NWR Lands in the Pacific Region

A total of 29 MAPS stations were established and operated for at least one year between 1989 and 2002 on Pacific Region NWR lands (Tables 2 and 3). Eighteen of these stations were operated during 2002 (or were scheduled to operate during 2003) and are referred to as "current" stations (despite recent information that six of them were not planning on operating during 2003). The remaining 11 stations, referred to as "discontinued" stations, stopped their operations prior to 2002. The mean number of years of operation, during these 14 years, for the 18 current stations was 5.4 $\pm$ 2.5(SD) (range 2-10) years (although breaks in operation occurred at three of the stations; Table 3). The analogous mean number of years of operation for the 11 discontinued stations was 3.1 $\pm$ 2.4(SD) (range 1-8) years (Table 3). As of 2002, only 11 of the current stations and four of the discontinued stations had sufficient consecutive years of data (four) to contribute to survivorship analyses.

The 29 stations on NWR lands were not distributed evenly among the five states (Table 2): of the 18 current stations, seven were in Washington, two in Oregon, six in California, and

three in Nevada; of the 11 discontinued stations, two were in Washington, one in Oregon, seven in California, and one in Nevada. No stations have ever been operated on NWR lands in Idaho. Not surprisingly, most MAPS stations on NWR lands were at low elevations; 14 of the 25 stations for which elevation data were submitted were below 100m, seven were between 100 and 1000m, and four were above 1000m. Also not surprisingly, lowland riparian habitats were especially well represented at MAPS station on NWR lands; 13 of the 18 current stations and six of the 11 discontinued stations were located at least partially in lowland riparian habitat. Other habitats represented to a lesser extent were deciduous (mostly oak) woodland and various shrubland habitats.

MAPS monitoring potential of landbird species captured on NWR lands

Mean annual capture rates of adults (for species captured at rates of at least 2.5 adults per year) are presented by station for the 18 current stations and 11 discontinued stations in Tables 4 and 5, respectively. Adults of 15 species were captured at this rate or better *at ten or more* of the 29 stations. These 15 species (shown in bold in Tables 4 and 5) are considered to have "high" monitoring potential on NWR lands in the Pacific Region. They include *Western Wood-Pewee, Ash-throated Flycatcher, Bewick's Wren, House Wren, Swainson's Thrush, American Robin, Yellow Warbler, Common Yellowthroat, Spotted Towhee, Song Sparrow, Black-headed Grosbeak, Brown-headed Cowbird, Bullock's Oriole, House Finch,* and *American Goldfinch*. The total mean annual capture rate of adults pooled over the 18 current stations for these 15 species ranged from 33.47 (Ash-throated Flycatcher) to 303.23 (Song Sparrow) with a mean of 104.02 $\pm$ 75.16 adults per year, or about 5.78 adults per year per station (including all 18 stations, even those at which the species was not captured at a rate of at least 2.5 adults per year). Similarly, the total mean annual capture rate of adults pooled over the 11 discontinued stations for these 15 species ranged from 12.00 (Brown-headed Cowbird) to 101.50 (Yellow Warbler) with a mean of 42.79 $\pm$ 28.57 or about 3.89 adults per year per station (again including those stations at which the species was not captured at a rate of at least 2.5 adults per year). Clearly, species meeting this requirement have high monitoring potential on NWR lands.

Adults of nine additional species were captured at an annual rate of at least 2.5 adults per year *at five to nine* of the 29 stations (shown in italics in Tables 4 and 5) and are considered to have "medium" monitoring potential on NWR lands. These nine species are *Nuttall's*

Woodpecker, Willow Flycatcher, "Western" Flycatcher (includes both *Pacific-slope* and *Cordilleran* flycatchers), *Black-capped Chickadee, Oak Titmouse, Bushtit, Wilson's Warbler, Lazuli Bunting,* and *Lesser Goldfinch*. Finally, adults of 36 other species were captured at an annual rate of at least 2.5 adults per year *at less than five* of the 29 stations (shown in normal type in Tables 4 and 5) and are considered to have "low" monitoring potential on NWR lands.

MAPS monitoring potential of current and discontinued stations based on capture rates

The number species with mean capture rates of at least 2.5 adults per year ranged over the 18 current stations from six to 17 species and averaged 11.2 species (Table 4). The total annual capture rate of adults (for species captured at a rate of at least 2.5 adults per year) at the 18 current stations ranged from a low of 35.14 adults per year at Turnbull NWR to a high of 206.00 adults per year at the Snagboat Bend station on William L. Finley NWR and averaged 109.66 adults per year per station. This was quite similar to the mean annual capture rate of adults at all MAPS stations in the Northwest MAPS Region, which averaged 101.08 over the seven years, 1992-1998 (based on totals of 63-122 stations during the seven years; DeSante and O'Grady 2000, DeSante et al. 1996, 1998). Because the NWR rate only includes species captured at an average rate of at least 2.5 adults per year, we suggest that, overall, MAPS stations on NWR lands have shown a slightly better than average annual capture rates of adults compared to other MAPS stations in the Northwest MAPS Region.

Table 4 indicates that 11 of the 18 stations showed at least about average total capture rates (at least 90 adults per year) *and* numbers of species captured (at least nine); based on these criteria, their operation should be continued. These include the single stations on Julia Butler Hansen (11988), Ridgefield (11901), McNary (11215), and Modoc (11909) NWRs, the two stations on William L. Finley NWR (11217 and 11985), the two stations on Sacramento River NWR (12216, 12209), and the three stations on the San Luis NWR complex (12296, 12303, 12241). Unfortunately, the single stations on both Julia Butler Hansen and Ridgefield NWRs were discontinued after 2002; based only on capture rates and numbers of species captured, they perhaps should be restarted. Operation of four of the remaining seven stations (all three stations on Nisqually NWR and the single station on Ash Meadows NWR) was discontinued after 2002. Based only on capture rates and numbers of species captured, these discontinuances seem appropriate. Again based only on capture rates and numbers of species captured, the remaining three stations, Turnbull (11911) and both Mary's River Ranch (12266)

and Cave Creek (12243) associated with Ruby Lake NWR, also perhaps warrant being discontinued (but see below for other considerations regarding these stations). Again relying only on capture rates and numbers of species captured, the operation of several of the 11 discontinued stations (Table 5), including the single stations on Hart Mountain (11104, which was only operated for one year, 1989), Salinas River (12280, which also was only operated for one year, 1998), Pahranagat (12250) and, especially, Hopper Mountain (12206) NWRs might warrant being restarted. When we limit our consideration to total capture rates (at least 80 adults per year) and number of species captured (at least eight) of *target species only* (see below and Tables 6-8), we find that the only differences that we might suggest are that the Julia Butler Hansen NWR station not be restarted, the Modoc NWR station be discontinued, and the Elk Pasture station on the San Luis complex (12239) be restarted (Tables 4 and 5).

It must be pointed out, however, that both species richness and total bird densities generally tend to be higher in the more mesic habitats west of the Cascades and Sierra Nevada than in the more xeric habitats east of the Great Western Divide, and higher at the lower latitudes of California and Nevada than at the higher latitudes of Washington, Oregon, and Idaho. Thus, total capture rates and numbers of species captured provide a geographically biased predictor of a refuge's monitoring potential. Decisions regarding continuing or discontinuing (or restarting) a station must be based on other considerations in addition to capture rates and numbers of species captured; these other consideration should include habitat types of special concern, existence of target species, gaps in the geographical distribution of MAPS stations, and the overall monitoring potential of the refuge in which the station is located. We deal with these considerations below.

Habitats of Special Concern on NWR Lands

Based on PIF Bird Conservation Plans, we identified five priority habitats in the five-state area that we thought were likely to be well represented on multiple wildlife refuges in the Pacific Region. These were lowland (as opposed to montane) riparian habitat, oak woodland habitat (including both oak "savannah" and blue oak/gray pine woodland in California but excluding montane black oak/yellow pine forest), coastal scrub/chaparral habitat, sagebrush (primarily) shrub-steppe habitat, and grassland habitat. For the purposes of this report, we excluded grassland habitat because of the difficulty of successfully implementing MAPS protocol in such open, low habitat, although we believe that a different protocol, still using mist nets,

could successfully be implemented to monitor productivity and survival of grassland species. Because of the geographic complementarity of shrub-steppe habitat east of the Great Western Divide and coastal scrub/chaparral habitat west of the Divide, we merged these two habitats into a single broad shrubland habitat type. This provided us with three priority habitats of special concern for MAPS on NWR units in the Pacific Region: lowland riparian, oak woodland, and shrubland.

Various PIF plans in the Pacific Region that we did not consider identified certain types of coniferous forest that were found on at least a few NWRs in the Region as habitats of concern (e.g., Mesic Conifer Forest in the Northern Rocky Mountain Bird Conservation Plan, and Ponderosa Pine and Mixed-Conifer Forests in both the Northern Rocky Mountain and East-Slope Cascades plans). None of these habitats, however, were represented by significant acreage on the NWRs in the Region. Because both the Forest Service and Bureau of Land Management have many more acres of these coniferous forest habitats than are present on NWRs, they are considered to be of minor responsibility to the Fish and Wildlife Service in terms of bird conservation.

Target Species for Habitats of Special Concern on Pacific Region NWR Lands

Overall, we identified 47 breeding landbird species as target species for MAPS monitoring on NWR refuges (or refuge complexes) in the five-state area of Washington, Oregon, Idaho, California, and Nevada. We associated 18 of these species with lowland riparian habitats (Table 6), 14 with oak woodland habitats (Table 7), and 15 with shrubland or chaparral habitats (Table 8). These target species did *not* include species that could not be monitored easily by MAPS protocol, such as waterbirds, nocturnal species, raptors and other large landbirds with widely dispersed territories, aerialist foragers (swallows and swifts), hummingbirds (that most MAPS operators are not permitted to band), most grassland species, and rare or local species that we would be unlikely to capture at multiple NWR stations.

Fifteen of the 47 target species had significant ($P \leq 0.05$) negative 22-year (1980-2001) BBS population trends (of which eight were highly significant, $P \leq 0.01$) in the Pacific Region and are clearly of conservation concern in the region. Five of these were associated with lowland riparian habitats, five with oak woodland habitats, and five with shrubland habitats. With the exception of California Thrasher, all of these 15 species were focal species or species of special concern in at least one Bird Conservation Plan. Two of these species had high, five

had medium, and five had low MAPS monitoring potential, and three had never been captured at a mean annual rate of at least 2.5 adults per year at any refuge station.

Twenty species had non-significant negative population trends (of which four were $P \leq 0.10$) in the Pacific Region. All but two of these 20 species were either a focal species or species of concern in at least one Bird Conservation Plan, or had high or medium monitoring potential. The two species that met neither of these considerations were Lawrence's Goldfinch in oak woodland and Savannah Sparrow in shrubland. Lawrence's Goldfinch was retained as target species in oak woodland because the species' entire breeding range is virtually confined to that habitat (or chaparral) in the Pacific Region; and Savannah Sparrow was retained as target species because it is perhaps the only declining species associated with grassland habitats that can perhaps also be sampled effectively in shrubland habitats.

Twelve species that had positive population trends were also retained as target species for MAPS monitoring in order to provide critical vital rate data to compare against analogous data from declining species. Ten of these 12 species were also identified as focal species or species of concern in PIF Bird Conservation Plans and an eleventh species, Spotted Towhee, had high monitoring potential. Hutton's Vireo was the only non-declining species that met neither of these considerations; it was retained as a target species because, other than Western Scrub-Jay, it provided the only non-declining target species in oak-woodland habitats.

Thirty-four of the 47 target species were captured with mean annual capture rates of at least 2.5 adults per year at one or more of the 29 currently or previously active MAPS stations on NWR units in the USFWS Pacific Region. Of these 34 species, 14 were of high monitoring potential, nine were of medium monitoring potential, and 11 were of low monitoring potential. Thus, a group of 24 target species emerged as being underrepresented in MAPS data collected on NWR lands; of these, 13 species were not represented at all and 11 were underrepresented because of low capture rates. All but one of the 24 species in the underrepresented group were associated with either oak woodland habitat (10 species) or shrubland habitats (13 species). Previously published work indicates that we have been able to obtain apparent survival rate estimates for the Northwest and/or Southwest MAPS Regions for 34 of the 47 target species using seven years (1992-1998) of MAPS data (DeSante and O'Grady 2000). This number of species will likely increase some with the inclusion of 10-12 years of data. Notably, however, we were unable to obtain survival rate estimates during the 1992-1998 period for five of the oak woodland species and eight of the shrubland species. It is clear, therefore, that oak

woodland and, especially, shrubland habitats are priority habitats for additional MAPS monitoring efforts.

Overall, 37 of the 47 target species were listed as focal species or species of conservation concern on PIF regional and state bird conservation priority lists. Moreover, 20 of these 37 species also emerged as priority species for new monitoring efforts because they were underrepresented in the MAPS dataset on NWR lands (i.e., had a MAPS monitoring potential of L or -). Thirteen of these 37 species (of which only one was underrepresented in MAPS data from NWR lands) are associated with lowland riparian habitats, 11 (of which eight were underrepresented in MAPS on NWR lands) are associated with oak woodland habitats, and 13 (of which 11 were underrepresented in MAPS on NWR lands) are associated with shrubland habitats. Below we present our target species lists for each of the three habitats of special concern and discuss the prioritization of species by state.

Lowland riparian habitat target species

We identified 18 target species for monitoring in lowland riparian habitat on NWRs in the USFWS Pacific Region (Table 6). Five of these species showed significant population declines, nine showed non-significant declines, and four showed population increases. All but one (California Thrasher) of these 18 species are relatively well represented in current MAPS datasets from stations associated with NWRs; 12 and five species were given high and medium monitoring potential, respectively, and adult survival-rate estimates have been obtained for all 18 species. Altogether, 13 of the 18 species have been identified as focal species or species of special concern in various regional PIF efforts (*Western Wood-Pewee, Willow Flycatcher, Black-capped Chickadee, Bushtit, House Wren, Swainson's Thrush, Yellow Warbler, Common Yellowthroat, Wilson's Warbler, Yellow-breasted Chat, Song Sparrow, Black-headed Grosbeak, and Bullock's Oriole*). Nine are focal species in the Oregon/Washington Westside Lowland Valleys plan (all but Common Yellowthroat, Wilson's Warbler, Song Sparrow, and Black-headed Grosbeak), four in the Oregon/Washington Columbia Plateau plan (Willow Flycatcher, Yellow Warbler, Yellow-breasted Chat, and Bullock's Oriole), two in the Idaho (Willow Flycatcher and Yellow Warbler) and three in the Nevada (Willow Flycatcher, Wilson's Warbler, and Yellow-breasted Chat) plans, and eight in the California Riparian Habitat Bird Conservation Plan (Willow Flycatcher, Swainson's Thrush, Yellow Warbler, Common Yellowthroat, Wilson's Warbler, Yellow-breasted Chat, Song Sparrow, and Black-

headed Grosbeak). Although 13 of the 18 lowland riparian target species were identified as focal species or species of concern in the various PIF plans, they were not always target species for riparian habitats in those plans; e.g., Bushtit and Western Wood-Pewee are focal species in oak woodland, not riparian habitat, in the OR-WA Lowlands plan, and Black-capped Chickadee is a focal species in the Umpqua Valley for oak/chaparral cavities, although it occurs in a wide variety of other habitats including riparian in other parts of the states. Importantly, however, only one (Yellow-breasted Chat) of the 13 focal species were underrepresented in MAPS data on NWR lands; additional stations to target this species are warranted.

Oak woodland habitat target species

We identified 14 target species for monitoring in oak woodland habitat on NWRs in the three coastal states of USFWS Pacific Region (Table 7). Five of these species showed significant population declines, seven showed non-significant declines, and two showed population increases. Only four of these species were relatively well represented in MAPS datasets from stations currently associated with NWRs; one and three species were rated with high and medium monitoring potential, respectively. Regional adult survival-rate estimates have been obtained for nine of the 14 species from 1992-1998 MAPS data. Altogether, 11 of the 14 species have been identified as focal species or species of special concern in various regional PIF efforts (*Ash-throated Flycatcher, Western Scrub-Jay, Oak Titmouse, White-breasted Nuthatch, Blue-gray Gnatcatcher, Western Bluebird, Orange-crowned Warbler, California Towhee, Chipping Sparrow, Lark Sparrow, and Lesser Goldfinch*). Seven (all but Western Scrub-Jay, Western Bluebird, Orange-crowned Warbler, and Lark Sparrow) are focal species in the Oregon/ Washington Westside Lowland Valleys plan, and Lark Sparrow is a focal species in the Oregon/Washington Columbia Plateau plan. The Idaho PIF Bird Conservation Plan lists Lark Sparrow as a focal species and the Nevada PIF Bird Conservation Plan lists Ash-throated Flycatcher, Western Bluebird, and Orange-crowned Warbler as focal species, but neither of these plans associates those species with oak woodland habitat. Six species (Ash-throated Flycatcher, Western Scrub-Jay, Oak Titmouse, Blue-gray Gnatcatcher, Western Bluebird, and Lark Sparrow) are focal species in the California Oak Woodland Bird Conservation Plan. Interestingly, eight of the 11 focal species (all but Ash-throated

Flycatcher, Oak Titmouse, and Lesser Goldfinch) were underrepresented in MAPS data from NWRs; they represent important target species for new MAPS stations.

Shrubland habitat target species

We identified 15 target species for monitoring in coastal scrub and chaparral habitats on NWRs in the three coastal states of the USFWS Pacific Region, and in shrub-steppe habitats on NWRs in all five states of the USFWS Pacific Region (Table 8). Five of these species showed significant population declines, four showed non-significant declines, and six showed population increases. Only two of these 15 species were relatively well represented in MAPS datasets from stations currently associated with NWRs, Bewick's Wren with a high rating and Lazuli Bunting with a medium rating; the other 13 species represent important target species for new MAPS stations. Regional adult survival-rate estimates have been obtained for seven of the 15 species from 1992-1998 MAPS data. Altogether, 13 of the 15 species have been identified as focal species or species of special concern in various regional PIF efforts (*Gray Flycatcher, Bewick's Wren, Wrentit, Sage Thrasher, Virginia's Warbler, Green-tailed Towhee, Rufous-crowned, Brewer's, Vesper, Black-throated, Sage, and White-crowned sparrows, and Lazuli Bunting*). Four species (Bewick's Wren, Wrentit, Green-tailed Towhee, and Vesper Sparrow) are focal species in the Oregon/Washington Westside Lowland Valleys plan, while nine species (Gray Flycatcher, Sage Thrasher, Virginia's Warbler, Green-tailed Towhee, Brewer's, Vesper, Black-throated, and Sage sparrows, and Lazuli Bunting) are focal species in the Oregon/Washington Columbia Plateau plan. The Idaho and Nevada PIF Bird Conservation Plans each list five species (Gray Flycatcher, Sage Thrasher, Virginia's Warbler, and Sage Sparrow are common to both lists, while Brewer's Sparrow is listed in Idaho and Vesper Sparrow is listed in Nevada), and the California Coastal Scrub/Chaparral Bird Conservation Plan lists four species (Wrentit, Rufous-crowned, Sage, and White-crowned sparrows) as focal species.

Distribution of MAPS Stations and Gaps in Distribution in the Pacific Region

Washington

A total of 33 MAPS stations have been operated for at least one year in Washington, with nine of these stations (seven current and two discontinued) having been operated on NWR lands (Fig. 1a). Only three of the remaining 24 stations were operated on lowland riparian or oak

woodland habitats; the other 21 stations were located in various montane habitats or in lowland coniferous forest, primarily on USDA Forest Service lands. Only eight of the 33 stations have been located in eastern Washington, which clearly represents a gap in MAPS coverage. The NWR complexes in eastern Washington can offer a partial means of filling this gap, although three NWR units in eastern Washington already have or have had MAPS stations. Especially needed are shrub-steppe stations in Washington -- there are none. Additional lowland riparian and oak woodland stations would also be welcome in western Washington.

Oregon

Despite the fact that 56 MAPS stations have been operated in Oregon, only three have been operated on NWR lands and only eight have been operated in lowland riparian, oak woodland, or shrubland habitats, with seven of the eight in western Oregon (Fig. 1b). The only eastern Oregon station in any of the priority habitats considered here was a NWR station in lowland riparian and shrub-steppe habitats on Hart Mountain that was operated for only one year, 1989. The remaining 48 stations in Oregon have all been in various montane habitats or lowland conifers, with the great majority on Forest Service lands. The overall distribution of stations in western and eastern Oregon is 36 west/20 east.

MAPS has clearly been successful in gathering data from coniferous forest habitats in Oregon and Washington, but has had relatively little success in monitoring lowland riparian, oak woodland and, especially, shrub-steppe habitats. Clearly, additional stations are needed throughout Oregon in lowland riparian habitats, in western Oregon in oak woodland habitat, and in eastern Oregon in shrub-steppe habitat. The few national wildlife refuges in eastern Oregon provide some, but relatively few, opportunities to fill these gaps; additional opportunities are available on NWR lands in western Oregon.

Idaho

Only six MAPS stations have ever been operated in Idaho and none have been operated on NWR lands (Fig. 1c). Two of the six stations were in shrubland, with the remaining four stations in montane or coniferous forest habitats. The six NWR units in southern Idaho likely offer some opportunity for filling the obvious gap in MAPS data fro Idaho, at least for lowland riparian and probably shrub-steppe habitats.

California

Although a total of 144 MAPS stations were operated in California for at least one year through 2002, only 13 stations (six current and seven discontinued) have been operated on NWR lands (Figs. 1d-e). Still, coverage of lowland riparian (especially) and coastal scrub habitats has been good in California, with 31 non-NWR stations in lowland riparian habitat and 16 non-NWR stations in coastal scrub or inland chaparral habitats. Coverage of oak woodland habitat has also been relatively good with 11 such non-NWR stations. Many NWR lands in California offer opportunities for further increased coverage of lowland riparian habitats, but relatively few offer much in the way of oak woodland or interior chaparral habitats, and Modoc NWR and the Klamath Basin NWR complex may provide the only opportunities for monitoring eastside shrub-steppe habitats. As in Oregon and Washington, MAPS coverage of various montane habitats and lowland coniferous forest habitats has been excellent, with 73 such stations having been operated. Again, most of these latter stations are on Forest Service lands with a lesser number on National Park Service lands.

Nevada

A total of 12 stations have been operated in Nevada, with four (three current and one discontinued) on NWR lands (Figs. 1d-e); two are in lowland riparian and two in shrubland habitat. Seven of the remaining eight stations have been in lowland riparian habitat with the eighth in shrubland habitat. The nine total lowland riparian stations provide an important starting point for monitoring Great Basin riparian habitat, but additional stations are needed. Clearly, many more shrub-steppe stations will be needed to determine why five shrub-steppe species (Sage Thrasher, Brewer's, Vesper, Black-throated, and Savannah sparrows) are declining, the first two significantly so, and two (Green-tailed Towhee and Sage Sparrow) seem to be increasing. An effort is underway in this habitat by the Shrub-steppe Working Group to address some of these questions across the Great Basin and Columbia Plateau by nest-monitoring; an additional component in this effort using MAPS stations (which assess productivity at a larger spatial scale than nest-monitoring) could help shed light on these questions.

Monitoring Potential of Pacific Region NWRs

We estimated the potential for monitoring target landbirds using MAPS protocol at priority habitats of special concern from checklists from 35 NWR units, each representing an entire NWR complex, a single refuge in a complex, or a single refuge that was an administrative unit by itself. Of these, 20 NWR units emerged as priority refuges (or refuge complexes) -- seven in Washington, four each in Oregon and California, three in Idaho, and two in Nevada. Priority refuges are those with a monitoring potential score of at least III (class III means the sum of the relative abundances of all target species known to breed on the refuge is 40-60, where species classified as abundant are given a value of 4, common 3, uncommon 2, and occasional or rare 1), *and* that can serve as a priority location for monitoring the species typical of at least one priority habitat of conservation concern (i.e., can monitor four oak woodland or shrubland species or eight lowland riparian species).

Washington

We obtained 10 species lists from eight of the nine administrative units in Washington (representing 12 out of a total of 21 NWR properties) which together hold 33 breeding target landbird species. No species lists were found for the Hanford Reach NM/Saddle Mt. NWR and for several refuges in both the Ridgefield and WA Maritime NWR Complexes. Table 9 shows that lowland riparian species are well represented at all locations except McNary and Conboy Lake NWRs, which are classified as low priority locations along with the Columbia NWR Complex. Oak woodland species (although not necessarily oak woodland habitat) are well represented at five locations where four or more species are known breeders. Shrubland species are generally underrepresented except at Toppenish NWR where seven species are known breeders, and at Little Pend Orielle and Turnbull NWRs, and Columbia NWR Complex where four species each are known breeders.

Overall, seven of the 10 refuges or complexes for which we had species lists emerged as priority locations (in bold in Table 9) for monitoring species of special concern – Nisqually and Willipa NWR Complexes, and Little Pend Orielle, Toppenish, Ridgefield, Turnbull, and Dungeness NWRs. In addition, the Columbia NWR Complex might also be considered for monitoring shrubland species, especially because there are insufficient stations region-wide for monitoring this habitat. Active or recently active MAPS stations are associated with five of these locations, but clusters of MAPS stations might be established at Little Pend Orielle,

Toppenish, and Turnbull NWRs, where four or more species from each habitat category could be monitored.

Oregon

We obtained six species lists (one of which – for the Willapa NWR Complex – was discussed above under WA) from six of the eight administrative units in Oregon (representing 10 of the 20 NWR properties) which together hold 39 breeding target landbird species. No species lists were found for the Oregon Coast or Tualatin NWR Complexes. Table 10 shows that lowland riparian species are well represented at all locations except Umatilla, which is classified as a low priority location. Oak woodland species (although, again, not necessarily oak woodland habitat) are well represented at four locations where six or more species are known breeders. Shrubland species are also well represented at the same four locations where five or more species are known breeders.

Overall, four of the five refuges or complexes for which we had species lists emerged as priority locations (in bold) for monitoring target species of special concern – Klamath Basin and Willamette Valley NWR Complexes, and Malheur NWR and Hart Mountain NAR. Active or recently active MAPS stations are or have been associated with both Hart Mountain NWR and the Willamette Valley NWR Complex. Clusters of additional MAPS stations might well be established at all four of the priority NWR locations, where between 28 and 34 species and all three habitats of special concern can be monitored. Of special interest is the fact that three of these four priority refuges or complexes are located in eastern Oregon, where MAPS stations are relatively few and shrub-steppe species can be targeted.

Idaho

We obtained six species lists from all three of the administrative units in Idaho (representing six of the seven NWR properties) which together hold 31 breeding target landbird species. Table 11 shows that lowland riparian species are well represented at three of the six locations. Not surprisingly, oak woodland species are not well represented at any location, with no more than three such species being present as known breeders. Shrubland species are well represented at only one location, Gray's Lake NWR, where six species are known breeders.

Overall, three of the six refuges for which we had species lists emerged as priority locations (in bold) for monitoring species of special concern – Deer Flat, Kootenai, and Gray's Lake NWRs. No active or recently active MAPS stations are associated with any of these

locations, but clusters of MAPS stations might be established at all three of the priority NWR locations where between 15 and 19 species can be monitored in the lowland riparian and shrubland habitats.

California

We obtained nine species lists (one of which – for the Klamath Basin NWR Complex – was discussed above under OR) from eight of the ten administrative units in California (representing 31 of the 40 NWR properties) which together hold 40 breeding target landbird species. No species lists were found for the Hopper Mountain and Humboldt Bay NWR Complexes, or the Tijuana Slough and Sweetwater Marsh NWRs of the San Diego NWR Complex. Table 12 shows that lowland riparian species are well represented at six locations with eight or more known breeding species. Oak woodland species are also well represented at five locations where four or more species are known breeders; special note should be taken of San Diego NWR where 14 oak woodland species are represented. Shrubland species are poorly represented with only two locations having four or more species of known breeders.

Overall, four of the eight refuges or complexes for which we had species lists emerged as priority locations (in bold) for monitoring species of special concern – Sacramento and San Francisco Bay NWR Complexes, and San Diego and Seal Beach NWRs. Active or recently active clusters of MAPS stations are associated with the Sacramento and San Luis NWR Complexes, but additional stations should be established or reestablished on these and at all of the priority NWR locations, especially San Diego NWR where 37 species that are well distributed among all three habitats of special concern can be monitored. We also suggest that, if a need for monitoring shrub-steppe species emerges, monitoring should be continued at the Modoc NWR. In addition, because of the large number of species, including many oak woodland species, that were actually monitored by MAPS at the Hopper Mountain NWR, we suggest that monitoring should be reinstated there despite having no published bird list information from which to estimate the monitoring potential of the refuge.

Nevada

We obtained six species lists from all four of the administrative units in Nevada (representing eight of the nine NWR properties) which together hold 30 breeding target landbird species. The Sheldon National Antelope Reserve is administered from Lakeview, Oregon, as part of the

Sheldon/Hart Mountain NAR Complex but is included here. We failed to find a species list only from the Moapa Valley NWR of the Desert NWR Complex. Table 13 shows that no species of special concern for any of the three priority habitat types was identified in the species list for Desert National Wildlife Range of the Desert NWR Complex. Lowland riparian species are also relatively poorly represented at all locations except Ruby Lake NWR and Sheldon NAR. Oak woodland species are surprisingly well represented at Sheldon NAR where six species are known breeders, despite the fact that oak woodland habitat is likely not found there. Shrubland species are well represented on four of the six NWR locations, but especially well represented at Ruby Lake NWR and Sheldon NAR.

Overall, only two of the six reserves or complexes for which we had species lists emerged as priority locations (in bold) for monitoring species of special concern – Ruby Lake NWR and Sheldon NAR. Active or recently active MAPS stations are associated with Ash Meadows, Pahranagat, and Ruby Lake NWRs, but clusters of MAPS stations might well be established at Ruby Lake NWR and Sheldon NAR where 28 and 25 species, respectively, that are relatively well represented in all three priority habitat categories can be monitored.

Problems on the Wintering Grounds of Migratory Species

Recent evidence suggests that population declines in a number of Neotropical-wintering migratory landbird species are caused by habitat loss and degradation on their wintering grounds (DeSante et al. 2001). Such habitat loss and degradation can lower overwintering survival rates and cause surviving birds to leave their wintering grounds in poor physical condition, leading to high mortality during spring migration and low breeding productivity (Nott et al. 2002). Large-scale, long-term data on winter demographic parameters of these species and linkages between those parameters and winter habitat characteristics are urgently needed to understand the population dynamics of these migratory landbirds and guide management and conservation efforts for them.

In response to these needs, IBP established the MoSI (Monitoreo de Sobrevivencia Invernal) Program to fill this data gap (DeSante et al. in press b). The objectives of MoSI are: 1) to assess habitat-, age-, and sex-specific overwintering survival rates and late winter physical condition for a suite of target species in a variety of winter habitats by applying state-of-the-art mark-recapture models to data collected from a network of standardized mist-netting and bird-banding stations throughout Mexico, Central America, and the Caribbean; 2) to use

these data to formulate management plans for these species on their winter grounds; and 3) to use the MoSI network to facilitate feather collection for DNA and stable isotope analyses that aim to link breeding and wintering populations of these species. IBP initiated a five-year pilot project aimed at evaluating, enhancing, and expanding the MoSI Program, and has created partnerships with 20 organizations and individuals in Mexico, Central America, and the Caribbean who operated 29 MoSI stations during the winter of 2002-03, the first year of this pilot project (63 stations are being operated during the winter of 2003-04). We suggest that the Pacific Region of the USFWS could contribute in various ways to enhance the operation of MoSI stations in western Mexico and Central America, the major wintering grounds for Neotropical migrants from the Pacific Region. We also suggest that the MoSI protocol could be integrated into an analogous program in the southern United States to address these same issues in temperate-wintering migratory species. If this were to happen (in fact, 24 such stations are currently being operated on military installations in southeastern United States during the winter of 2003-04), such stations on NWR lands in southern California, Arizona, and New Mexico could provide important information on the overwintering survival of a number of declining sparrows that breed in the USFWS Pacific Region.

SUMMARY AND CONCLUSIONS

We identified three major priority habitat types of conservation concern in the five-state (Washington, Oregon, Idaho, California, and Nevada) area of the USFWS Pacific Region that are relatively widespread on multiple NWR units and within which the population demographics of numerous species of landbirds can be effectively monitored using MAPS protocol. The three priority habitat types are: 1) lowland (non-montane) riparian habitat throughout the region, 2) lowland (non-montane) oak woodland habitat throughout the three coastal states of region, and 3) shrubland habitat, including coastal scrub and inland lowland (non-montane) chaparral in California, and shrub-steppe in the eastern portions of the three coastal states, in southern Idaho and throughout Nevada. Three other major habitats of conservation concern for landbirds -- lowland conifer forest, montane forest and shrubland (including montane riparian), and grassland -- are not included in this report, the first two because the population demographics of their landbirds are already relatively well monitored by MAPS through cooperative efforts with the USDA Forest Service and USDI National Park Service, the agencies that are the largest landholders there, and the third because the population demographics of its breeding landbirds cannot easily be monitored using MAPS protocol.

We developed a list of 47 target species associated with the three identified habitats of special concern by considering all landbird species characteristic of each of those habitats and eliminating those species that we believed could not be sampled effectively on Pacific Region NWRs by MAPS protocol. We identified 18 target species associated with lowland riparian habitats, of which six showed significant region-wide BBS population declines, 13 were listed as focal species in one or more regional BCPs, and only one was underrepresented on NWR lands and thus emerged as a priority species for new monitoring efforts. We identified 14 target species associated with oak woodland habitats, of which five showed significant region-wide BBS population declines, 11 were listed as focal species in one or more regional BCPs, and 10 were underrepresented on NWR lands and thus emerged as priority species for new monitoring efforts. We identified 15 target species associated with shrubland habitats, of which five showed significant region-wide BBS population declines, 13 were listed as focal species in one or more regional BCPs, and 13 were underrepresented on NWR lands and thus emerged as priority species for new monitoring efforts.

We superimposed the distribution of MAPS stations on GIS layers of NWR landholdings in the Pacific Region to identify major gaps in MAPS coverage in the five-state area and to link them to the presence of NWR lands. We found a general paucity of MAPS stations in the eastern portions of Washington, Oregon, and California, and throughout Idaho and Nevada, except in the central western part of Nevada. We found that lowland riparian habitat was relatively well monitored in California, could use additional stations in the western parts of Washington and Oregon, and generally needed many more stations in the eastern parts of the region. We found that oak woodland habitat needed additional monitoring stations throughout the three coastal states, especially in Oregon and Washington. We found that coastal scrub habitat was relatively well monitored in California, but inland chaparral habitat in California was not being effective monitored. We found that the largest habitat-specific gap in MAPS coverage was in shrub-steppe habitat throughout the Great Basin and Columbia Plateau. Low breeding bird densities coupled with hot temperatures and lack of shade increase the difficulty of monitoring this habitat using MAPS protocol. An effort is underway by the PIF Shrub-steppe Working Group to address some issues related to landbird productivity in this habitat by nest monitoring. We suggest that an additional component in this effort using MAPS stations (which assess productivity at larger spatial scales than nest-monitoring) sited with hypothesis-driven sampling strategies could help achieve some of the research and management goals of this cooperative effort.

We attempted to assess the monitoring value of the 18 current and 11 discontinued (prior to 2002) MAPS stations on NWR lands based on their total capture rates and numbers of species captured. However, because stations west of the Cascades/Sierra axis and stations at lower latitudes typically captured more individuals and species than more easterly and northerly stations, and because the largest gaps in coverage tended to be easterly and northerly, assessments of the monitoring value of stations based on total capture rates and numbers of species captured often contradicted assessments based on monitoring needs for priority habitats and gaps in geographical coverage.

We combined species lists from 35 NWR units and our target species lists for each of the three major habitats of special concern to estimate the MAPS monitoring potential of those 35 NWR units. Twenty of the NWR units (seven of which have or have had MAPS stations) had high monitoring potential, and emerged as priority refuges or refuge complexes for continuing or establishing new MAPS stations. Seven of these were in Washington, four each

in Oregon and California, three in Idaho, and two in Nevada. We suggest that clusters of stations could be started on the Toppenish NWR in eastern Washington, on all four priority refuges in Oregon (three are eastside), on all three priority refuges in Idaho, on the Sheldon NAR in Nevada, and on the San Diego NWRs in California, especially in oak woodland and chaparral habitats on this last refuge. These would provide excellent locations for establishing MAPS stations using hypothesis-driven sampling strategies. Although the Dungeness and San Francisco NWR Complexes and Seal Beach NWR showed high monitoring potential, conditions may not be optimal for establishing clusters of MAPS stations on these refuges, but single stations might be established.

Combining all of these considerations, we suggest that all nine of the Washington MAPS stations deserve being continued or restarted, although consideration might be given to relocating the single stations on the Turnbull and Little Pend Orielle NWRs to better locations on those refuges in an effort to boost the low capture rates and species totals. Similarly, all three Oregon and all four Nevada stations could well be continued or restarted, except for the Ash Meadows NWR station, which has little in common with the priority habitats in the Pacific Region. However, it may be a very important refuge for monitoring species typical of the Southwest, such as Verdin, Crissal Thrasher, Lucy's Warbler, and Blue Grosbeak, which are not considered here. The Pahranagat station had a reasonably good total capture rate and number of target species captured, despite not being on a refuge of high monitoring potential; the decision to restart this station could go either way. The two Ruby Lake NWR stations, the long-defunct Hart Mountain NAR station, and both stations on William L. Finley NWR are high priority stations based on all considerations. The three current San Luis NWR complex stations in California are producing good capture rates and species totals and should be continued, despite the refuge complex not having a high priority for monitoring. Two of the three discontinued San Luis stations had low capture rates and probably warranted discontinuance, while the Elk Pasture station (12239) might be considered for restarting. The current Sacramento NWR Complex station, Sul Norte (12209) and Stony Creek (12216), should be continued, while restarting of the two discontinued Sacramento stations could go either way (capture rates are relatively low but the refuge has high monitoring potential). The current eastside Modoc NWR station should be continued and the discontinued Hopper Mountain NWR station should be restarted; it captured good numbers of 15 target species of special concern, more than any other of the 29 stations on NWR lands. Although operated for

only one year, the discontinued Salinas River NWR station could also be considered for restarting, especially since it is part of a refuge complex with high monitoring potential.

If the Pacific Region of the USFWS has resources to aid the establishment of stations on non-NWR lands, we suggest that they be established in the following priority habitat types: 1) inland chaparral habitat in California; 2) oak woodland habitat anywhere in the three coastal states with possibly the highest priority in Oregon and Washington (unless sudden oak death in California continues as an important ecosystem-wide problem); and 3) lowland riparian habitat east of the Cascade/Sierra axis and westside in Oregon and Washington. If it is considered desirable to integrate a component of MAPS stations into the monitoring efforts of the Shrub-steppe Working Group, then shrub-steppe habitat east of the Cascade/Sierra axis will also be a high priority habitat. We further suggest that working with partners to site stations with hypothesis-driven sampling strategies will provide the best monitoring results, which can then be applied to research and management goals.

Finally, we suggest that not all causes of population declines in Pacific Region landbirds can be addressed on the breeding grounds; habitat loss and degradation on the wintering grounds can cause low overwintering survival and poor physical condition that can, in turn, lead to high mortality on spring migration and to poor productivity on the breeding grounds. We suggest that the USFWS Pacific Region can contribute to enhancing the operation of MoSI (Monitoreo de Sobrevivencia Invernal) stations in western Mexico and Central America, where most of the declining Neotropical migrants breeding in Pacific Region spend the winter, as well as analogous stations in southern California, Arizona, and New Mexico, where many of the declining temperate migrants breeding in the Pacific Region spend the winter. The Institute for Bird Populations (which created and helps coordinate the MoSI Program) is very interested in exploring ways in which the Pacific Region of the USFWS could help facilitate the MoSI Program.

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LITERATURE CITED

DeSante, D.F. 2000. Patterns of productivity and survivorship from the MAPS Program. Pp. 166-177 in Bonney, R., D.N. Pashley, R. J. Cooper, and L. Niles, eds. *Strategies for Bird Conservation: the Partners in Flight Planning Process*. Proceedings RMRS-P-16. Ogden, UT: USDA, Forest Service, Rocky Mountains Research Station.

DeSante, D.F., K.M. Burton, and D.R. O'Grady. 1996. The Monitoring Avian Productivity and Survivorship (MAPS) program fourth and fifth annual report (1993 and 1994). *Bird Populations* 3:67-120.

DeSante, D.F., K.M. Burton, P. Velez, and D. Froehlich. 2003. MAPS Manual, 2003 Protocol. The Institute for Bird Populations, Point Reyes Station, CA. 67 pp.

DeSante, D.F., M.P. Nott, and D.R. Kaschube. In press a. Monitoring, modeling, and management: why base avian management on vital rates and how should it be done? *In* Bird Conservation Implementation and Integration in the Americas (C. J. Ralph and T. D. Rich, eds.). USDA Forest Service Gen. Tech. Rep. PSW-GTR-191.

DeSante, D.F., and D.R. O'Grady. 2000. The Monitoring Avian Productivity and Survivorship (MAPS) Program 1997 and 1998 Report. *Bird Populations* 5:49-101.

DeSante, D.F., D.R. O'Grady, K.M. Burton, P. Velez, D. Froehlich, E.F. Feuss, H. Smith, and E.D. Ruhlen. 1998. The Monitoring Avian Productivity and Survivorship (MAPS) program sixth and seventh annual report (1995 and 1996). *Bird Populations* 4:69-122.

DeSante, D.F., D.R. O'Grady, and P. Pyle. 1999. Measure of productivity and survival derived from standardized mist-netting are consistent with observed population changes. *Bird Study* 46 (suppl.):S178-188.

DeSante, D.F., M.P. Nott, and D.R. O'Grady. 2001. Identifying the proximate demographic cause(s) of population change by modelling spatial variation in productivity, survivorship, and population trends. *Ardea* 89 (special issue): 185-207.

DeSante, D. F., T. S. Sillett, R. B. Siegel, J. F. Saracco, C. A. Romo de Vivar Alvarez, S. Morales, A. Cerezo, D. R. Kaschube, M. Grosselet, and B. Mila. *In Press*. MoSI (Monitoreo de Sobrevivencia Invernal): Assessing habitat-specific overwintering survival of Neotropical migratory landbirds. *In* Bird Conservation Implementation and Integration in the Americas (C. J. Ralph and T. D. Rich, eds.). USDA Forest Service Gen. Tech. Rep. PSW-GTR-191.

Igl, Lawrence D. 1996. Bird Checklists of the United States. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page: http://www.npwrc.usgs.gov/resource/othrdata/chekbird/chekbird.htm (Version 1FEB2003).

Nott, M.P., and D.F. DeSante. 2002. Demographic monitoring and the identification of transients in mark-recapture models. Pp. 727-736 in Scott, J. M., P. Heglund, M. L. Morrison, et al. (eds.), Predicting Species Occurrences: Issues of Accuracy and Scale. Island Press, Washington, USA.

Nott, M.P., D.F. DeSante, and N. Michel. 2003. *Management Strategies for Reversing Declines in Landbirds of Conservation Concern on Military Installations: a Landscape-Scale Analysis of MAPS Data*. Unpublished report to the U.S. Department of Defense Legacy Resource Management Program. The Institute for Bird Populations, Point Reyes Station, CA. 357 pp.

Nott, M.P., D.F. DeSante, R.B. Siegel, and P. Pyle. 2002. Influences of the El Niño/Southern Oscillation and the North Atlantic Oscillation on avian productivity in forests of the Pacific Northwest of North America. *Global Ecology and Biogeography* 11:333-342.

Pollock, K.H., J.D. Nichols, C. Brownie, and J.E. Hines. 1990. Statistical inference for capture-recapture experiments. *Wildlife Monographs*, No. 107.

Pradel, R., J.E. Hines, J.-D. Lebreton, and J.D. Nichols. 1997. Capture-recapture survival models taking account of transients. *Biometrics* 53:60-72.

Rosenberg, D.K., DeSante, D.F., and Hines, J.E. 2000. Monitoring survival rates of landbirds at varying spatial scales: an application of the MAPS program. Pp 178-184 In: Bonney, R. D.N. Pashley, R.J. Cooper, and L. Niles (eds.) *Strategies for Bird Conservation: the Partners in Flight Planning Process*. Proceedings RMRS-P-16. Ogden, UT: USDA, Forest Service, Rocky Mountain Research Station.

Rosenberg, D.K., DeSante, D.F., McKelvey, K.S., and Hines, J.E. 1999. Monitoring survival rates of Swainson's Thrush Catharus ustulatus at multiple spatial scales. *Bird Study* 46:S198-208.

Sauer, J. R., J. E. Hines, and J. Fallon. 2002. The North American Breeding Bird Survey, Results and Analysis 1966 - 2001. Version 2002.1, *USGS Patuxent Wildlife Research Center*, Laurel, MD. Home Page: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Washington NWRs

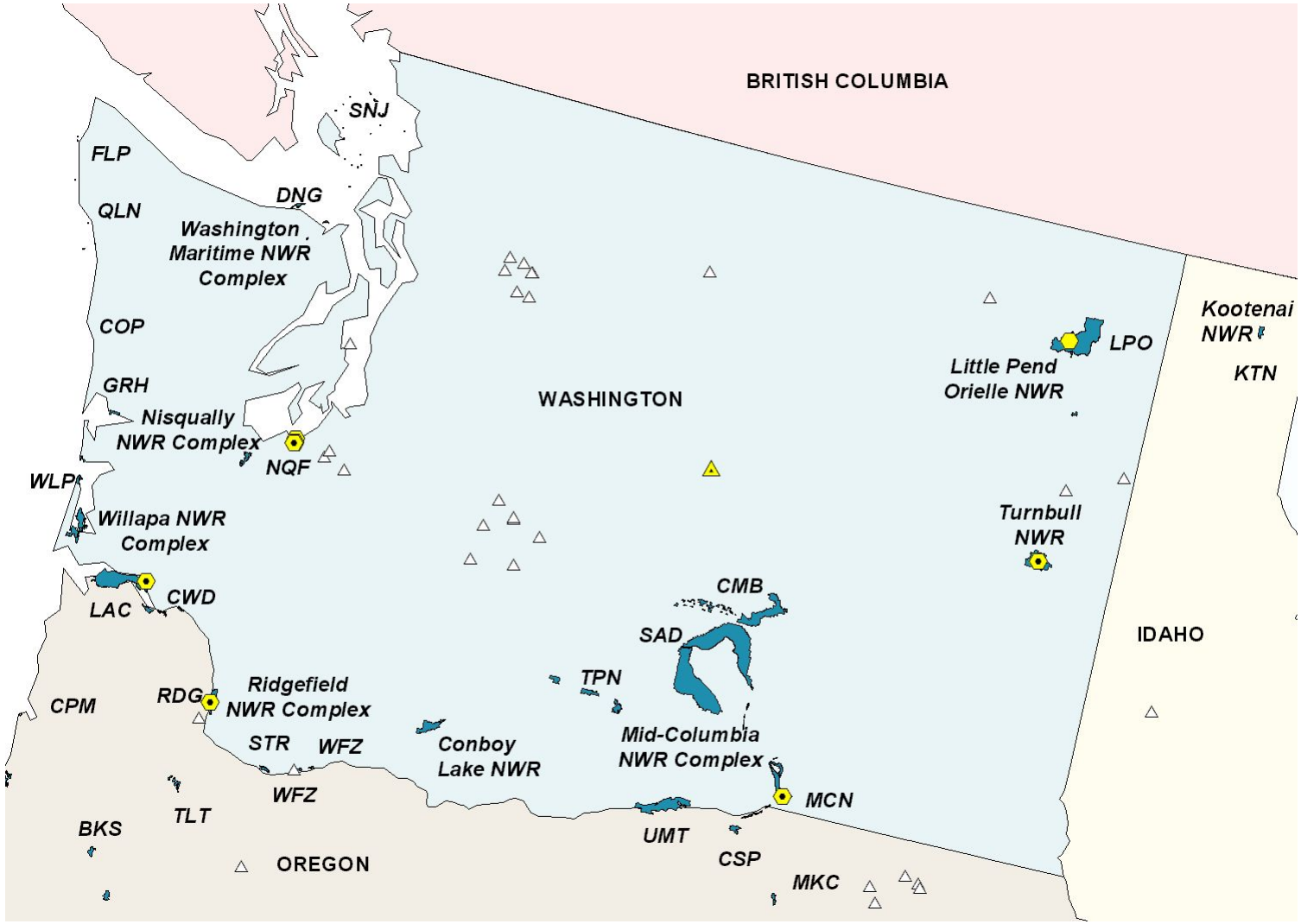

Figure 1a. Map of USFWS National Wildlife Refuges (and refuge complexes) for the state of Washington (and Kootenai NWR in Idaho). Refuges belonging to a complex are denoted by a 3-letter code consistent with Table 1. Symbols denote the locations of MAPS stations: a) that were operated in 2002 or will be operated in 2003 on NWR property (dotted hexagons), b) were operated on NWR property but were discontinued prior to 2002 (open hexagons), c) not on NWR property but in lowland riparian, oak woodland, or shrubland habitats (dotted triangles), and d) not on NWR property and not in lowland riparian, oak woodland, or shrubland habitats (most are in forested habitats) (open smaller triangles).

Oregon NWRs

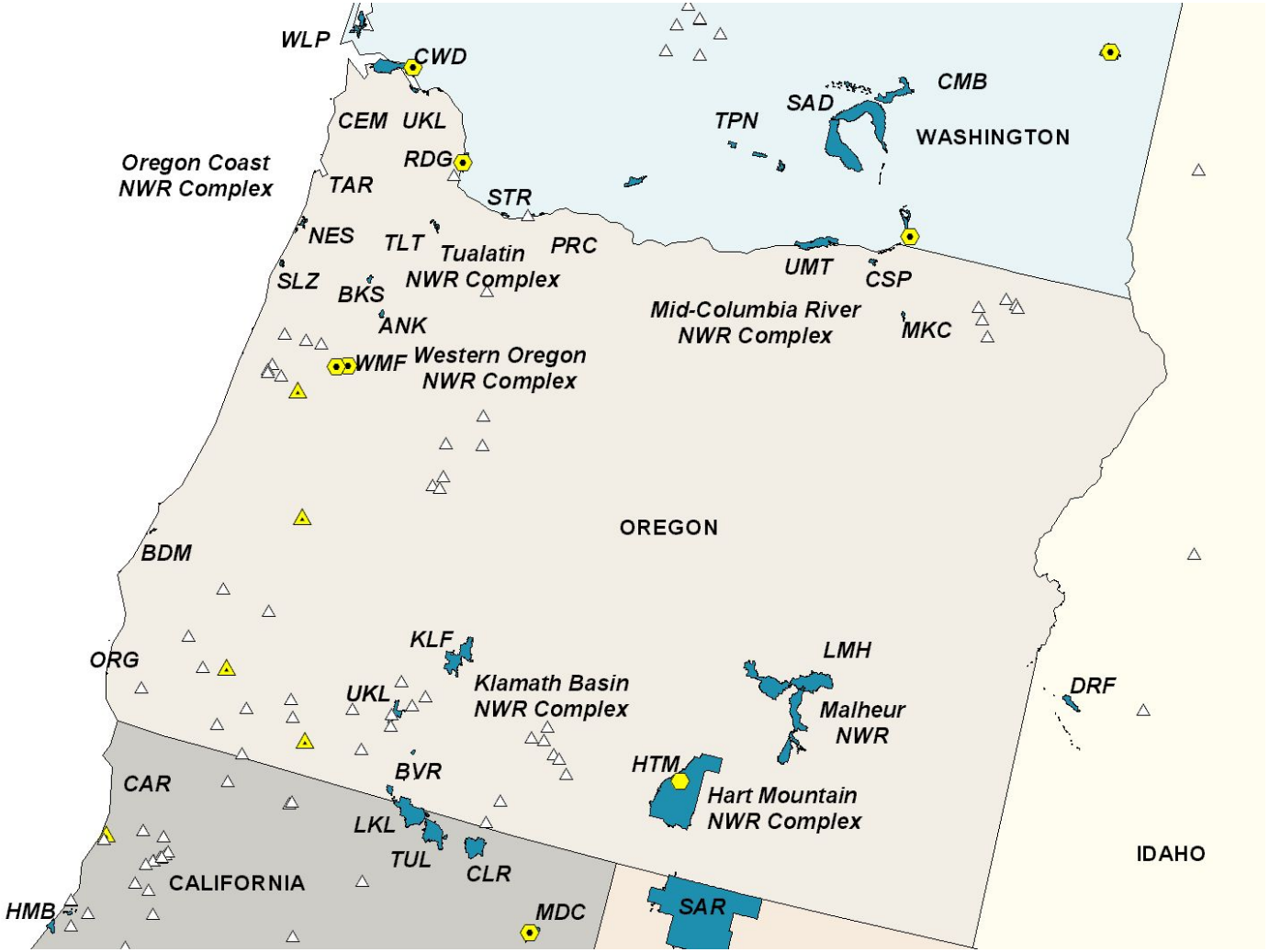

Figure 1b. Map of USFWS National Wildlife Refuges (and refuge complexes) for the state of Oregon. Refuges belonging to a complex are denoted by a 3-letter code consistent with Table 1. Symbols denote the locations of MAPS stations: a) that were operated in 2002 or will be operated in 2003 on NWR property (dotted hexagons), b) were operated on NWR property but were discontinued prior to 2002 (open hexagons), c) not on NWR property but in lowland riparian, oak woodland, or shrubland habitats (dotted triangles), and d) not on NWR property and not in lowland riparian, oak woodland, or shrubland habitats (most are in forested habitats) (open smaller triangles).

Idaho NWRs

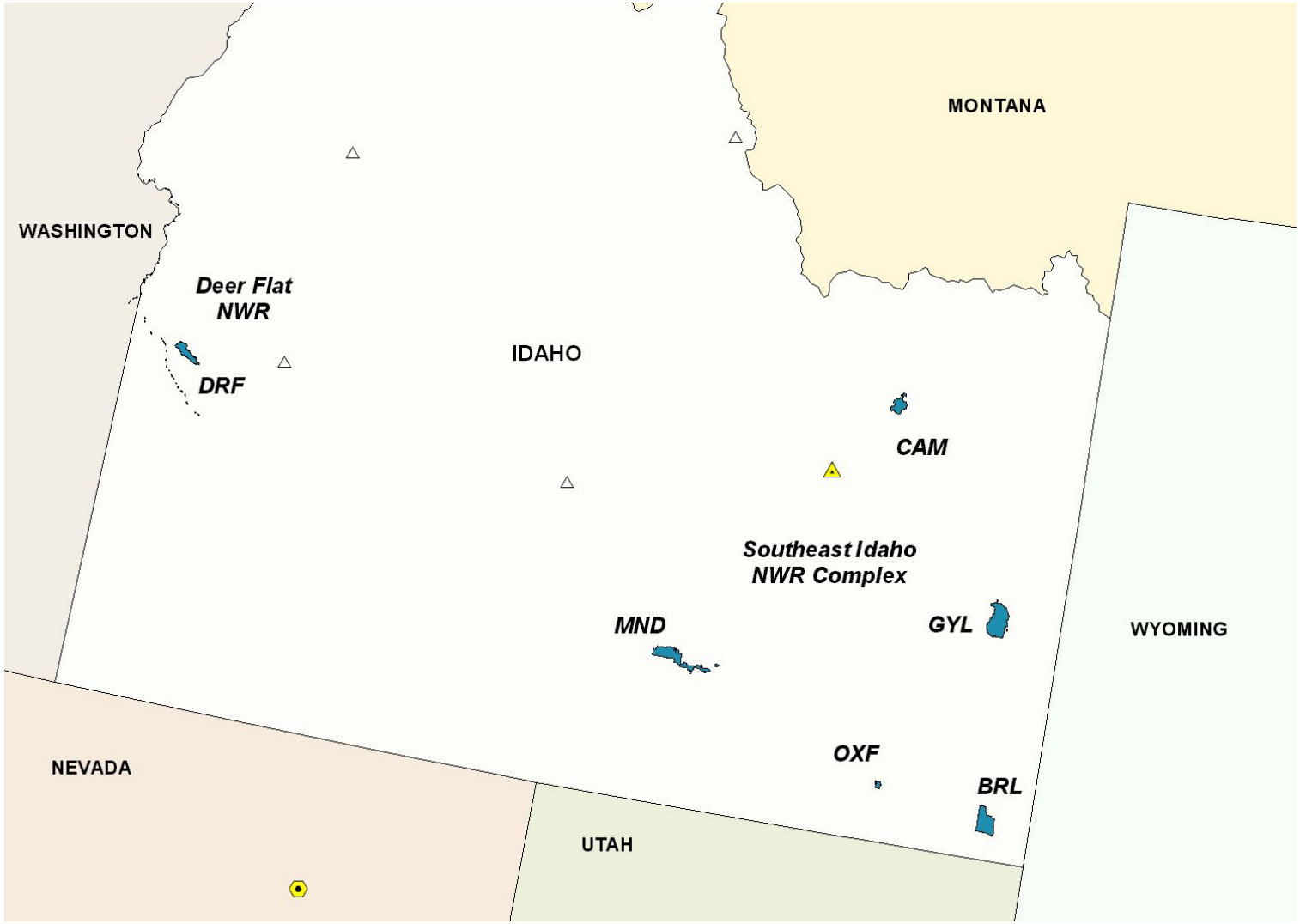

Figure 1c. Map of USFWS National Wildlife Refuges (and refuge complexes) for the state of Idaho (except northern Idaho). Refuges belonging to a complex are denoted by a 3-letter code consistent with Table 1. Symbols denote the locations of MAPS stations: a) that were operated in 2002 or will be operated in 2003 on NWR property (dotted hexagons), b) were operated on NWR property but were discontinued prior to 2002 (open hexagons), c) not on NWR property but in lowland riparian, oak woodland, or shrubland habitats (dotted triangles), and d) not on NWR property and not in lowland riparian, oak woodland, or shrubland habitats (most are in forested habitats) (open smaller triangles).

Northern California and northern Nevada NWRs

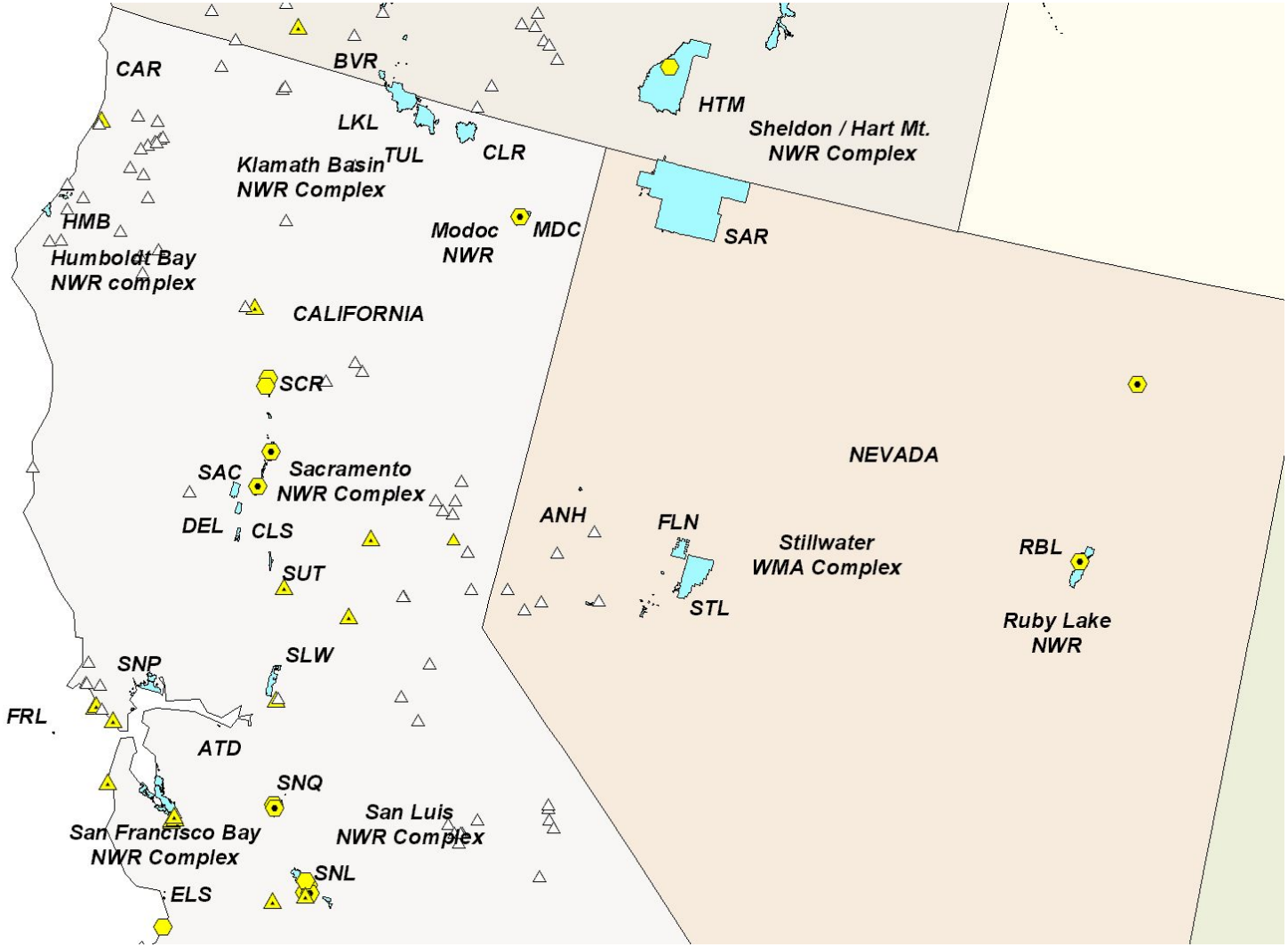

Figure 1d. Map of USFWS National Wildlife Refuges (and refuge complexes) for northern portions of California and Nevada. Refuges belonging to a complex are denoted by a 3-letter code consistent with Table 1. Symbols denote the locations of MAPS stations: a) that were operated in 2002 or will be operated in 2003 on NWR property (dotted hexagons), b) were operated on NWR property but were discontinued prior to 2002 (open hexagons), c) not on NWR property but in lowland riparian, oak woodland, or shrubland habitats (dotted triangles), and d) not on NWR property and not in lowland riparian, oak woodland, or shrubland habitats (most are in forested habitats) (open smaller triangles).

Southern California and southern Nevada NWRs

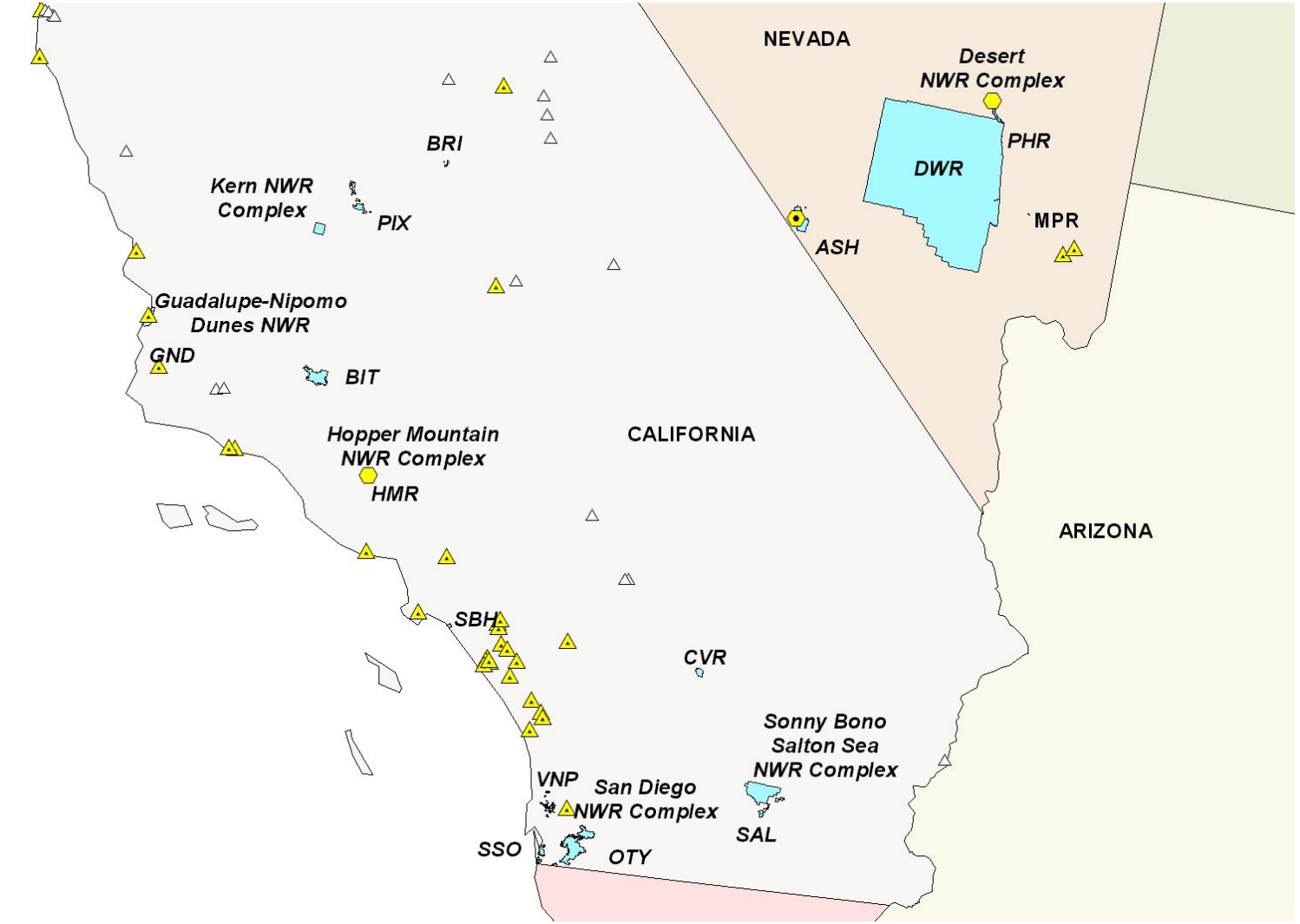

Figure 1e. Map of USFWS National Wildlife Refuges (and refuge complexes) for the southern portions of California and Nevada. Refuges belonging to a complex are denoted by a 3-letter code consistent with Table 1. Symbols denote the locations of MAPS stations: a) that were operated in 2002 or will be operated in 2003 on NWR property (dotted hexagons), b) were operated on NWR property but were discontinued prior to 2002 (open hexagons), c) not on NWR property but in lowland riparian, oak woodland, or shrubland habitats (dotted triangles), and d) not on NWR property and not in lowland riparian, oak woodland, or shrubland habitats (most are in forested habitats) (open smaller triangles).

Table 1. List of U.S. Fish and Wildlife Service (Region 1) National Wildlife Refuge properties grouped by state and NWR administrative units, which may be single refuges or refuge complexes (NWRC). Each unit is identified by a unique FWS three-character (RID) code (if known) and associated with a FWS office responsible for administration. Individual properties or complexes for which we analyzed published bird checklists are shown in bold. These checklists are available from (http://www.npwrc.usgs.gov/resource/othrdata/chekbird/chekbird.htm (Version 02/21/2003)).

Refuge Unit/Complex	Refuge Name	RID	Admin. Office
	Washington		
Columbia NWR	Columbia NWR	CMB	Othello, WA
Hanford Reach/Saddle Mt. NWR	Saddle Mountain NWR	SAD	Richland, WA
Little Pend Orielle NWR	Little Pend Orielle NWR	LPO	Colville, WA
Mid-Columbia NWRC	**McNary NWR**	MCN	Pasco, WA
	Toppenish NWR	TPN	Toppenish, WA
Nisqually NWRC	Nisqually NWR/Black River	NQF	Olympia, WA
	Grays Harbor NWR	GRH	Olympia, WA
Ridgefield NWRC	**Ridgefield NWR**	RDG	Ridgefield, WA
	Steigerwald Lake NWR	STR	Stevenson, WA
	Franz Lake NWR	WFZ	Stevenson, WA
	Conboy Lake NWR		Glenwood, WA
	Pierce NWR	PRC	Stevenson, WA
Turnbull NWR	Turnbull NWR	TUR	Cheney, WA
WA Maritime NWRC	**Dungeness NWR**	DNG	Port Angeles, WA
	Protection Island NWR		Port Angeles, WA
	Quillayute Needles NWR	QLN	Port Angeles, WA
	San Juan Islands NWR	SNJ	Port Angeles, WA
	Flattery Rocks NWR	FLP	Port Angeles, WA
	Copalis NWR	COP	Port Angeles, WA
Willapa NWRC	Willapa NWR	WLP	Ilwaco, WA
	J.B. Hanson NWR	CWD	Cathlamet, WA

Table 1 (continued).

Refuge Unit/Complex	Refuge Name	RID	Admin. Office
	Oregon		
Klamath Basin NWRC	Klamath Marsh NWR	KLF	Chiloquin, OR
	Upper Klamath NWR	UKL	Tulelake, CA
	Bear Valley NWR	BRV	Tulelake, CA
Malheur NWR	Malheur NWR	LMH	Princeton, OR
Mid-Columbia NWRC	**Umatilla NWR**	UMT	Pasco, WA
	Cold Springs NWR	CSP	Pasco, WA
	McKay Creek NWR	MKC	Pasco, WA
Oregon Coast NWRC	Oregon Islands NWR	ORG	Newport, OR
	Bandon Marsh NWR	BDM	Newport, OR
	Nestucca Bay NWR	NES	Newport, OR
	Sitletz Bay NWR	SLZ	Newport, OR
	Cape Meares NWR	CEM	Newport, OR
	Three Arch Rocks NWR	TAR	Newport, OR
Sheldon/Hart Mt. NARC	**Hart Mountain NAR**	HTM	Lakeview, OR
Tualatin River NWR	Tualatin River NWR	TLT	Sherwood, OR
	Wapato Lake NWR		Sherwood, OR
Willamette Valley NWRC	William L. Finley NWR	WMF	Corvallis, OR
	Ankeny NWR	ANK	Jefferson, OR
	Baskett Slough NWR	BKS	Dallas, OR
Willapa NWRC	Lewis and Clark NWR		Cathlamet, WA
	Idaho		
Deer Flat NWR	Deer Flat NWR	DRF	Nampa, ID
Kootenai NWR	Kootenai NWR	KTN	Bonners Ferry, ID
Southeast Idaho NWRC	**Minidoka NWR**	MND	Rupert, ID
	Camas NWR	CAM	Hamer, ID
	Oxford Slough WPA	OXF	Hamer, ID
	Grays Lake NWR	GYL	Wayan, ID
	Bear Lake NWR	BRL	Montpelier, ID

Table 1 (continued).

Refuge Unit/Complex	Refuge Name	RID	Admin. Office
	California		
Hopper Mt. NWRC	Bitter Creek NWR	BIT	Ventura, CA
	Guadalupe-Nipomo Dunes	GND	Guadalupe, CA
	Hopper Mountain NWR	HMR	Ventura, CA
	Blue Ridge NWR	BRI	Ventura, CA
Humboldt Bay NWRC	Humboldt Bay NWR	HMB	Loleta, CA
	Castle Rock NWR	CAR	Loleta, CA
	Lanphere Dunes NWR		Arcata, CA
Kern NWRC	Kern NWR	KRN	Delano, CA
	Pixley NWR	PIX	Delano, CA
Klamath Basin NWRC	Tule Lake NWR	TUL	Tulelake, CA
	Lower Klamath NWR	LKL	Tulelake, CA
	Clear Lake NWR	CLR	Tulelake, CA
Modoc NWR	Modoc NWR	MDC	Alturas, CA
Sacramento NWRC	Sacramento River NWR	SCR	Willows, CA
	Butte Sink WMA		Willows, CA
	Sacramento NWR	SAC	Willows, CA
	North Central Valley WMA		Willows, CA
	Delevan NWR	DEL	Willows, CA
	Willow Creek-Lurline WMA		Willows, CA
	Colusa NWR	CLS	Willows, CA
	Sutter NWR	SUT	Willows, CA
San Diego NWRC	**San Diego NWR**	SND	Jamul, CA
	Tijuana Slough NWR	SSO	Imperial Beach, CA
	Seal Beach NWR	SBH	Seal Beach, CA
	Sweetwater Marsh	OTY	Imperial Beach, CA
San Francisco Bay	Don Edwards San Francisco Bay	SFB	Fremont, CA
NWRC	San Pablo Bay NWR	SNP	Mare Island, CA
	Salinas River NWR	SLN	Fremont, CA
	Farallon NWR	FRL	Fremont, CA
	Ellicott Slough NWR	ELS	Fremont, CA
	Marin Islands NWR		Mare Island, CA
	Antioch Dunes NWR	ATD	Fremont, CA

Table 1 (continued).

Refuge Unit/Complex	Refuge Name	RID	Admin. Office
	California (cont.)		
San Luis NWRC	Grasslands WMA	SNL	Los Banos, CA
	San Luis NWR	SNQ	Los Banos, CA
	San Joaquin River NWR		Los Banos, CA
	Merced NWR		Los Banos, CA
	Stone Lakes NWR		Sacramento, CA
	Diablo Range NWR		Sacramento, CA
Sonny Bono Salton Sea NWRC	Sonny Bono Salton Sea NWR	SAL	Calipatria, CA
	Coachella Valley NWR	CRV	Calipatria, CA
	Nevada		
Desert NWRC	**Pahranagat NWR**	PHR	Alamo, NV
	Desert National Wildlife Range	DWR	Las Vegas, NV
	Ash Meadows NWR	ASH	Amargosa Vy., NV
	Moapa Valley NWR	MPV	Las Vegas, NV
Ruby Lake NWR	Ruby Lake NWR	RUL	Ruby Valley, NV
Sheldon/Hart Mt. NARC	**Sheldon NAR**	SAR	Lakeview, OR
Stillwater NWRC	Stillwater NWR	STL	Fallon, NV
	Fallon NWR	FLN	Fallon, NV
	Anaho Island NWR	ANH	Fallon, NV

Table 2. Location and operator information for the 29 stations operated on NWRs in Washington, Oregon, Idaho, California, and Nevada. The 18 "current" stations that operated in 2002 or plan to operate in 2003 are listed first, followed by the 11 stations discontinued prior to 2002. Within each group, stations are sorted (from north to south and then from west to east) by state and latitude (although all stations at each location are together).

LOC[1]	STA[2]	STATION[3]	NAME[4]	NWR REFUGE[5]	COUNTY[6]	STATE[7]	FUNDER[8]	ORGANIZATION[9]
TBWR	11911	TBWR	Turnbull NWR	Turnbull	Spokane	WA	USFWS	USFWS - Turbull NWR
NISQ	11208	RIVR	Riverine	Nisqually	Thurston	WA	USFWS	USFWS - Nisqually NWR
NISQ	11207	REST	Restoration	Nisqually	Thurston	WA	USFWS	USFWS - Nisqually NWR
NISQ	11209	SURG	Surge Plain	Nisqually	Thurston	WA	USFWS	USFWS - Nisqually NWR
COLR	11988	JBHR	Julia Butler Hansen W.R.	Julia Butler Hansen	Wahkiakum	WA	USFWS	Amer. Bird Conservancy
COLR	11901	RNWR	Bachelor Point	Ridgefileld	Clark	WA	USFWS	Amer. Bird Conservancy
WALL	11215	WALL	Wallula	McNary	Walla Walla	WA	USFWS	USFWS Mid-Columbia R. NWR
FNLY	11217	SNBE	Snagboat Bend	William L. Finley	Linn	OR	USFWS	Pacific Wildlife Research, Inc.
FNLY	11985	PIBU	Pigeon Butte	William L. Finley	Benton	OR	USFWS/OR F&W	USGS BRD
MODO	11909	SUBH	Subheadquarters	Modoc	Modoc	CA	USFWS	USFWS – Modoc NWR
SACR	12216	STCR	Stony Creek	Sacramento River	Glenn	CA	USFWS/TNC/NFWF/HP Found/PRBO	PRBO
SACR	12209	SN--	Sul Norte	Sacramento River	Glenn	CA	USFWS/TNC	PRBO
SNLN	12296	GACO	Gardner's Cove	San Joaquin River	Stanislaus	CA	USFWS	USFWS
SNLN	12303	CHIS	Christman Island	San Joaquin River	Stanislaw	CA	USFWS	USFWS
SNLN	12241	SOSA	South San Joaquin	San Luis	Merced	CA	USFWS-San Luis NWR/NFWF/PRBO	USFWS
MARY	12266	AIRF	Mary's River Ranch	Ruby Lake	Elko	NV	USFWS/GBB0	USFWS
RUBY	12243	CACR	Cave Creek	Ruby Lake	Elko	NV	USFWS-Ruby Lake NWR	USFWS
AMWR	12214	AMHQ	Ash Meadows	Ash Meadows	Nye	NV	USFWS	USFWS - Ash Meadows NWR
EWAS	11960	LPOW	Lower Manz	Little Pend Oreille	Stevens	WA	USFS	USFS – Colville NF
NISQ	11206	DIKE	Dike	Nisqually	Thurston	WA	USFWS	USFWS - Nisqually NWR
HART	11104	HART	Hart Mountain	Hart Mountain NAR	Lake	OR	USFWS	USFWS - Ash Meadows NWR
SACR	12207	OHM-	Ohm	Sacramento River	Tehama	CA	USFWS/TNC	PRBO
SACR	12208	FLYN	Flynn	Sacramento River	Tehama	CA	USFWS/TNC	PRBO
SALU	12260	OXBO	Oxbow	San Luis	Merced	CA	USFWS – San Luis NWR/NFWF/PRBO	PRBO
SALU	12240	NOSA	North San Joaquin	San Luis	Merced	CA	USFWS – San Luis NWR/NFWF/PRBO	PRBO
SALU	12239	ELPA	Elk Pasture	San Luis	Merced	CA	USFWS - San Luis NWR/NFWF/PRBO	PRBO
BGSR	12280	SALI	Salinas River Mouth	Salinas River	Monterey	CA	USFWS	Ventana Wilderness Society
HMWR	12206	HMWR	Hopper Mountain	Hopper Mountain	Ventura	CA	USFWS	USFWS
PNWR	12250	UPLK	Upper Lake	Pahranagat	Lincoln	NV	USFWS	USFWS

Table 2. (cont). Location and operator information for the 29 stations operated on NWRs in Washington, Oregon, Idaho, California, and Nevada. The 18 "current" stations that operated in 2002 or plan to operate in 2003 are listed first, followed by the 11 stations discontinued prior to 2002. Within each group, stations are sorted (from north to south and then from west to east) by state and latitude (although all stations at each location are together).

[1]LOC: location code (identifies national forest, national park, military installation or other location where a single station or a set of stations is located and is run by a single operator). Location codes are unique.
[2]STA: unique station number
[3]STATION: four-character station code. A station is defined as a discrete study area consisting of a number of net sites. Station codes are unique within a location.
[4]NAME: name of station
[5]NWR REFUGE: the National Wildlife Refuge on which the station is located
[6]COUNTY: county/counties in which the station is located (includes parishes, boroughs, independent cities, etc.)
[7]STATE: two-character postal code for state, province, or territory in which the station is located
[8]FUNDER: source(s) of financial support for operation of station
[9]ORGANIZATION: the organization under whom the station is operated

Table 3. Location, elevation, habitat, and data status information for the 29 stations operated on National Wildlife Refuges in Washington, Oregon, Idaho, California, and Nevada. The 18 "current" stations that operated in 2002 or plan to operate in 2003 are listed first, followed by the 11 stations discontinued prior to 2002. Within each group, stations are sorted (from north to south and then from west to east) by state and latitude (although all stations at each location are together).

LOC[1]	STA[2]	STATION[3]	LAT.[4]	LONG.[5]	PREC.[6]	ELEV.[7]	HABITAT[8]	HISTORY[9]	MISSING DATA[10]	*MAPSPROG* YEARS[11]
TBWR	11911	TBWR	47 25 10	-117 33 30	10S	695	Aspen	94-	02	99-01
NISQ	11208	RIVR	47 05 00	-122 42 36	01S	--	big-leaf maple-cottonwd rip. for.	00-02		00-02
NISQ	11207	REST	47 04 40	-122 42 30	01S	--	Oldfield	00-02		00-02
NISQ	11209	SURG	47 04 29	-122 42 47	01S	--	decid. rip. surge plain-tide infl	00-02		00-02
COLR	11988	JBHR	46 15 20	-123 24 49	01S	--	bottomland riparian forest/fields	98-02		
COLR	11901	RNWR	45 47 30	-122 46 20	10S	3	cottonwood/ash riparian forest	93-02		
WALL	11215	WALL	46 03 30	-118 53 10	10S	106	cottonwood-willow riparian corrid	01-		01,02
FNLY	11217	SNBE	44 25 30	-123 13 15	01S	73	cotton-willow riparian	01-		01,02
FNLY	11985	PIBU	44 24 00	-123 18 50	10S	300	deciduous woodland	98-		99-02
MODO	11909	SUBH	41 27 00	-120 31 40	10S	1326	riparian woodland	94-01, 03-		00,01
SACR	12216	STCR	39 41 10	-121 57 50	10S	91	valley riparian	95-		
SACR	12209	SN--	39 27 50	-121 59 30	10S	61	valley riparian	93-95,99,01-		
SNLN	12296	GACO	37 38 10	-121 12 30	10S	28	oak woodland/cottonwoods&willows	99-		99,00
SNLN	12303	CHIS	37 37 00	-121 11 40	10S	30	cottonwood-willow-valley oak rip.	00-		00
SNLN	12241	SOSA	37 10 40	-120 45 40	10S	20	cottonwood/sandbar willow forest	95-97,99-		99,00
MARY	12266	AIRF	41 19 00	-115 19 00	10S	1650	deciduous shrubland/herb. meadow	98-	02	
RUBY	12243	CACR	40 12 00	-115 29 00	01M	1829	Riparian	96-		99-02
AMWR	12214	AMHQ	36 25 10	-116 19 50	10S	664	mesquite/saltbush	95-02	02	99-01
EWAS	11960	LPOW	48 28 20	-117 41 30	10S	701	mixed conifer/riparian	97-01	01	99,00
NISQ	11206	DIKE	47 05 58	-122 42 25	01S	5	decid. shrub corridor betw. wetl.	00		00
HART	11104	HART	42 33 00	-119 38 50	10S	1712	willow/sagebrush/meadow	89		
SACR	12207	OHM-	40 06 30	-122 08 30	10S	91	valley riparian	93-00		
SACR	12208	FLYN	40 03 20	-122 09 00	10S	91	valley riparian	93-95		
SALU	12260	OXBO	37 14 30	-120 49 10	10S	20	mixed shrubland	97		
SALU	12240	NOSA	37 13 20	-120 47 30	10S	20	mixed shrubland	95-97		
SALU	12239	ELPA	37 10 40	-120 48 10	10S	20	deciduous shrubland	95		
BGSR	12280	SALI	36 45 00	-121 47 00	01M	3	coastal riparian	98		
HMWR	12206	HMWR	34 27 30	-118 51 30	10S	762	black walnut/oak woodland	93-97		
PNWR	12250	UPLK	37 17 50	-115 07 50	10S	1000	rip. wdlnd./marsh/desert scrub	97-01	01	00

Table 3. (cont.) Location, elevation, habitat, and data status information for the 29 stations operated on National Wildlife Refuges in Washington, Oregon, Idaho, California, and Nevada. The 18 "current" stations that operated in 2002 or plan to operate in 2003 are listed first, followed by the 11 stations discontinued prior to 2002. Within each group, stations are sorted (from north to south and then from west to east) by state and latitude (although all stations at each location are together).

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[1]LOC: location code (identifies national forest, national park, military installation or other location where a single station or a set of stations is located and is run by a single operator). Location codes are unique.

[2]STA: unique station number

[3]STATION: four-character station code. A station is defined as a discrete study area consisting of a number of net sites. Station codes are unique within a location.

[4]LAT.: latitude of station as precisely as known up to nearest second; given as DD MM SS (degrees, minutes, seconds)

[5]LONG.: longitude of station as precisely as known up to nearest second; given as DDDD MM SS (degrees, minutes, seconds)

[6]PREC.: level of precision of latitude-longitude determination.

- 01M = 01 minute
- 10S = 10 seconds
- 01S = 1 second

[7]ELEV.: elevation of station above sea level (m)

[8]HABITAT: operator's description of habitat(s)

[9]HISTORY: year(s) in which the station was operated and expects to continue operations

[10]MISSING DATA: year(s) for which IBP has not yet received the data from the operator

[11]MAPSPROG YEARS: year(s) of data on which the operator used MAPSPROG for data entry and verification

Table 4. Mean annual capture rates of adults by station, at the 18 "current" stations that operated in 2002 or plan to operate in 2003, for species-station combinations for which the mean annual capture rate of adults was at least 2.5 birds per year for the years in which the station was operated during the 13-year period 1989-2001. Species captured at a rate of at least 2.5 birds per year at ten or more stations are shown in bold; at five to nine stations are shown in italics.

SPECIES	TBWR TBWR 11911	NISQ RIVR 11208	NISQ REST 11207	NISQ SURG 11209	COLR JBHR 11988	COLR RNWR 11901	WALL WALL 11215	FNLY SNBE 11217	FNLY PIBU 11985
Red-naped Sapsucker	2.88								
Nuttall's Woodpecker									
Downy Woodpecker								3.00	
Western Wood-Pewee	**5.38**						**5.00**	**11.00**	
Willow Flycatcher	*7.00*	*11.00*	*8.00*			*8.00*		*4.00*	
Dusky Flycatcher									
"Western" Flycatcher				*4.00*	*8.50*	*4.11*			
Ash-throated Flycatcher									
Warbling Vireo									
Tree Swallow									
Black-capped Chickadee		*3.00*	*3.00*	*3.50*				*4.00*	*3.25*
Oak Titmouse									
Verdin									
Bushtit								*3.00*	
Bewick's Wren		**3.50**				**9.00**	**9.00**	**3.00**	**3.00**
House Wren	**4.50**					**13.33**	**10.00**		
Winter Wren					10.50				
Swainson's Thrush		**40.50**	**15.50**	**35.50**	**68.75**	**31.22**		**34.00**	**25.25**
American Robin		**4.00**	**5.50**	**9.00**	**25.25**	**16.22**		**7.00**	**7.00**
Northern Mockingbird									
California Thrasher									
Crissal Thrasher									
Cedar Waxwing		5.00			5.50				
Orange-crowned Warbler									22.75
Lucy's Warbler									
Yellow Warbler	**2.75**	**7.00**	**5.00**				**4.00**	**12.00**	
Black-throated Gray Warbler									2.75
MacGillivray's Warbler									
Common Yellowthroat			**3.00**		**3.25**	**9.56**		**28.00**	**4.75**
Wilson's Warbler				*3.50*	*15.00*	*7.89*	*3.00*		*3.25*
Yellow-breasted Chat									
Western Tanager									4.25
Spotted Towhee						**4.67**		**3.00**	**11.25**
Brewer's Sparrow									
Lark Sparrow									
Savannah Sparrow									
Fox Sparrow									
Song Sparrow	**6.50**	**20.00**	**18.50**	**15.00**	**21.00**	**47.89**	**36.00**	**62.00**	**4.00**
Black-headed Grosbeak	**3.25**					**8.22**	**7.00**	**4.00**	
Blue Grosbeak									
Lazuli Bunting							*3.00*		

Table 4. (cont.) Mean annual capture rates of adults by station, at the 18 "current" stations that operated in 2002 or plan to operate in 2003, for species-station combinations for which the mean annual capture rate of adults was at least 2.5 birds per year for the years in which the station was operated during the 13-year period 1989-2001. Species captured at a rate of at least 2.5 birds per year at ten or more stations are shown in bold; at five to nine stations are shown in italics.

SPECIES	MODO SUBH 11909	SACR STCR 12216	SACR SN-- 12209	SNLN GACO 12296	SNLN CHIS 12303	SNLN SOSA 12241	MARY AIRF 12266	RUBY CACR 12243	AMWR AMHQ 12214	Total over all 18 stations
Red-naped Sapsucker										2.88
Nuttall's Woodpecker		*3.57*	*7.20*	*4.00*						*14.77*
Downy Woodpecker			3.80	4.33						11.13
Western Wood-Pewee		**5.14**	**7.00**						**2.57**	**36.09**
Willow Flycatcher										*38.00*
Dusky Flycatcher									4.14	4.14
"Western" Flycatcher										*16.61*
Ash-throated Flycatcher		**5.29**	**8.20**	**5.67**	**4.50**	**6.67**			**3.14**	**33.47**
Warbling Vireo							3.25			3.25
Tree Swallow	39.88									39.88
Black-capped Chickadee										*16.75*
Oak Titmouse			*3.00*	*5.33*	*5.00*					*13.33*
Verdin									3.43	3.43
Bushtit			*2.60*	*11.33*	*12.50*	*9.83*				*39.26*
Bewick's Wren		**9.43**	**14.40**	**3.33**	**8.00**	**6.83**			**7.00**	**76.49**
House Wren			**10.80**	**13.33**	**12.50**	**12.00**				**76.46**
Winter Wren										10.50
Swainson's Thrush										**250.72**
American Robin	**5.50**	**6.86**	**3.40**			**3.00**	**4.75**	**6.33**		**103.81**
Northern Mockingbird									7.29	7.29
California Thrasher						2.50				2.50
Crissal Thrasher									2.86	2.86
Cedar Waxwing										10.50
Orange-crowned Warbler										22.75
Lucy's Warbler									6.86	6.86
Yellow Warbler	**11.25**					**3.67**	**38.00**	**29.50**	**7.29**	**120.46**
Black-throated Gray Warbler										2.75
MacGillivray's Warbler								4.83		4.83
Common Yellowthroat	**3.88**					**2.83**		**33.33**	**3.00**	**91.60**
Wilson's Warbler	*8.38*									*41.02*
Yellow-breasted Chat							9.00	8.33	6.86	24.19
Western Tanager									3.00	7.25
Spotted Towhee		**6.57**	**15.00**	**13.00**	**20.50**	**16.00**				**89.99**
Brewer's Sparrow							11.50			11.50
Lark Sparrow		2.57								2.57
Savannah Sparrow							2.50			2.50
Fox Sparrow							3.25			3.25
Song Sparrow	**16.50**			**15.67**	**10.00**	**14.67**	**9.50**	**6.00**		**303.23**
Black-headed Grosbeak		**29.00**	**33.80**		**9.50**	**5.00**				**99.77**
Blue Grosbeak				3.00					6.00	9
Lazuli Bunting		*7.00*	*3.00*	*3.33*						*16.33*

Table 4. (cont.) Mean annual capture rates of adults by station, at the 18 "current" stations that operated in 2002 or plan to operate in 2003, for species-station combinations for which the mean annual capture rate of adults was at least 2.5 birds per year for the years in which the station was operated during the 13-year period 1989-2001. Species captured at a rate of at least 2.5 birds per year at ten or more stations are shown in bold; at five to nine stations are shown in italics.

SPECIES	TBWR TBWR 11911	NISQ RIVR 11208	NISQ REST 11207	NISQ SURG 11209	COLR JBHR 11988	COLR RNWR 11901	WALL WALL 11215	FNLY SNBE 11217	FNLY PIBU 11985
Red-winged Blackbird									
Brown-headed Cowbird						**4.67**	**4.00**	**8.00**	
Bullock's Oriole						**6.56**			
Purple Finch					4.50				4.75
Cassin's Finch									
House Finch						**6.33**			
Lesser Goldfinch									
American Goldfinch	**2.88**		**3.50**			**21.00**	**17.00**	**20.00**	
Total capture rate	35.14	94.00	62.00	70.50	162.25	198.67	98.00	206.00	96.25
Number of species	8	8	8	6	9	15	10	15	12
Target species (see Tables 6-8)									
Total capture rate	32.26	89.00	62.00	70.50	141.75	192.34	98.00	203.00	84.50
Number of species	7	7	8	6	6	14	10	14	9

Table 4. (cont.) Mean annual capture rates of adults by station, at the 18 "current" stations that operated in 2002 or plan to operate in 2003, for species-station combinations for which the mean annual capture rate of adults was at least 2.5 birds per year for the years in which the station was operated during the 13-year period 1989-2001. Species captured at a rate of at least 2.5 birds per year at ten or more stations are shown in bold; at five to nine stations are shown in italics.

SPECIES	MODO SUBH 11909	SACR STCR 12216	SACR SN-- 12209	SNLN GACO 12296	SNLN CHIS 12303	SNLN SOSA 12241	MARY AIRF 12266	RUBY CACR 12243	AMWR AMHQ 12214	Total over all 18 stations
Red-winged Blackbird							2.75			2.75
Brown-headed Cowbird	**8.38**	**3.29**	**8.60**	**6.67**	**4.50**	**3.50**			**5.43**	**57.04**
Bullock's Oriole	**9.00**	**11.00**	**3.80**		**4.00**	**4.67**		**8.67**	**15.57**	**63.27**
Purple Finch										9.25
Cassin's Finch								3.67		3.67
House Finch	**17.38**		**7.40**	**16.33**	**9.00**					**56.44**
Lesser Goldfinch			*2.80*	*3.33*						*6.13*
American Goldfinch		**5.00**	**6.20**	**20.00**		**5.83**				**101.41**
Total capture rate	120.15	94.72	141.00	128.65	100.00	97.00	84.50	100.66	84.44	1973.93
Number of species	9	12	17	15	11	14	9	8	15	11.17[1]
Target species (see Tables 6-8)										
Total capture rate	62.89	94.72	129.80	104.99	91.00	97.00	75.25	92.16	50.86	1772.02
Number of species	7	12	15	12	10	14	6	6	8	9.50[2]

[1] Mean number of species captured at rates greater than 2.5 birds per year over all 18 stations.
[2] Mean number of target species captured at rates greater than 2.5 birds per year over all 18 stations.

Table 5. Mean annual capture rates of adults by station, at the 11 stations that discontinued operations prior to 2002, for species-station combinations for which the mean annual capture rate of adults was at least 2.5 birds per year for the years in which the station operated during the 13-year period 1989-2001. Species captured at a rate of at least 2.5 birds per year at ten or more stations are shown in bold; at five to nine stations are in italics.

SPECIES	EWAS LPOW 11960	NISQ DIKE 11206	HART HART 11104	SACR OHM- 12207	SACR FLYN 12208	SALU OXBO 12260	SALU NOSA 12240	SALU ELPA 12239	BGSR SALI 12280	HMWR HMWR 12206	PNWR UPLK 12250	Total Over all 11 stations
Nuttall's Woodpecker				*4.63*	*4.33*		*3.50*	*4.00*				*16.46*
Downy Woodpecker							3.00					3.00
Red-shafted Flicker								3.00				3.00
Western Wood-Pewee			**4.00**	**2.88**	**8.00**						**4.75**	**19.63**
Willow Flycatcher		*8.00*									*3.50*	*11.50*
Hammond's Flycatcher	3.00											3.00
"Western" Flycatcher									*3.00*	*7.80*		*10.80*
Ash-throated Flycatcher				**8.50**	**5.00**	**8.00**	**6.50**	**6.00**		**4.60**	**4.25**	**42.85**
Warbling Vireo			3.00									3.00
Tree Swallow			3.00									3.00
Cliff Swallow			10.00						7.00			17.00
Barn Swallow		3.00	17.00									20.00
Black-capped Chickadee		*3.00*										*3.00*
Oak Titmouse				*3.38*	*6.00*					*9.80*		*19.18*
Bushtit				*2.63*			*3.50*		*20.00*			*26.13*
Bewick's Wren				**10.00**	**11.33**		**10.50**	**5.00**			**4.25**	**41.08**
House Wren				**2.88**			**3.50**	**35.00**		**4.80**		**46.18**
Marsh Wren		3.00										3.00
Western Bluebird										3.20		3.20
Swainson's Thrush	**13.00**								**6.00**	**2.60**		**21.60**
American Robin	**2.75**	**3.00**	**11.00**									**16.75**
Wrentit										10.20		10.20
Cedar Waxwing	3.00											3.00
Orange-crowned Warbler			7.00									7.00
Yellow Warbler	**2.50**		**26.00**				**4.00**		**14.00**		**55.00**	**101.50**
Audubon's Warbler			3.00									3.00
MacGillivray's Warbler	14.75		5.00									19.75
Common Yellowthroat	**2.50**	**18.00**			**13.33**			**4.00**			**22.00**	**59.83**

Table 5. (cont.) Mean annual capture rates of adults by station, at the 11 stations that discontinued operations prior to 2002, for species-station combinations for which the mean annual capture rate of adults was at least 2.5 birds per year for the years in which the station operated during the 13-year period 1989-2001. Species captured at a rate of at least 2.5 birds per year at ten or more stations are shown in bold; at five to nine stations are in italics.

SPECIES	EWAS LPOW 11960	NISQ DIKE 11206	HART HART 11104	SACR OHM- 12207	SACR FLYN 12208	SALU OXBO 12260	SALU NOSA 12240	SALU ELPA 12239	BGSR SALI 12280	HMWR HMWR 12206	PNWR UPLK 12250	Total Over all 11 stations
Wilson's Warbler			*11.00*						*8.00*	*3.00*		*22.00*
Yellow-breasted Chat											2.50	2.50
Western Tanager			7.00									7.00
Spotted Towhee				**9.13**	**13.00**		**4.50**	**6.00**		**4.40**		**37.03**
California Towhee										12.20		12.20
Brewer's Sparrow			7.00									7.00
Vesper Sparrow			19.00									19.00
Savannah Sparrow		10.00	7.00						7.00			24.00
Song Sparrow	**13.25**	**12.00**				**9.00**		**7.00**	**39.00**	**20.80**		**101.05**
Black-headed Grosbeak				**11.13**	**11.33**	**4.00**				**6.40**		**32.86**
Lazuli Bunting			*4.00*	*8.25*						*6.20*		*18.45*
Red-winged Blackbird			5.00			13.00		3.00				21.00
Brown-headed Cowbird			**6.00**			**3.00**	**3.00**					**12.00**
Bullock's Oriole			**6.00**			**3.00**	**4.50**	**14.00**				**27.50**
Purple Finch										7.00		7.00
House Finch			**3.00**	**3.75**					**51.00**	**3.20**	**5.50**	**66.45**
Lesser Goldfinch					*3.33*					*12.20*	*4.50*	*20.03*
Lawrence's Goldfinch										4.20		4.20
American Goldfinch		**4.00**		**3.50**					**8.00**			**15.50**
Total capture rate	54.75	64.00	164.00	70.66	75.65	40.00	46.50	87.00	163.00	122.60	106.25	994.41
Number of species	8	9	20	12	9	6	10	10	10	17	9	10.91[1]
Target species (see Tables 6-8)												
Total capture rate	34.00	58.00	108.00	66.91	75.65	27.00	43.50	81.00	105.00	112.40	100.75	812.21
Number of species	5	7	11	11	9	5	9	8	8	15	8	8.73 [2]

[1] Mean number of species captured at rates greater than 2.5 birds per year over all 18 stations.
[2] Mean number of target species captured at rates greater than 2.5 birds per year over all 18 stations.

Table 6. List of 18 target landbird species associated with lowland riparian habitats in the USFWS Pacific Region (Washington, Oregon, Idaho, California, and Nevada). The common name, scientific name, and Bird Banding Laboratory four-letter code is presented for each species. The migratory status is given as year-round resident (R), migrant wintering exclusively in temperate regions (T), migrant wintering primarily in temperate regions (TI), migrant wintering primarily in neotropical regions (NI), and migrant wintering exclusively in neotropical regions (N). Nesting status is given as cavity (C), tree (T), shrub (S), and ground (G). MAPS monitoring potential indicates the number of MAPS stations on NWRs at which the species had an average annual capture rate of at least 2.5 adults per year: high (H) - ten or more stations; medium (M) – five to nine stations; low (L) - one to four stations; and absent (-) - no station. Species for which an estimate of the apparent adult survival rate (Phi) has been obtained in the Northwest and/or Southwest MAPS Regions from seven years (1992-1998) of MAPS data are indicated by (X). The direction of the 1980-2001 BBS population trends for the USFWS Pacific Region is given as declining (-) or increasing (+). The statistical significance associated with negative BBS trend estimates only is indicated by (- $P>0.10$, * $0.05<P\leq0.10$, ** $0.01<P\leq0.05$, *** $P\leq0.01$). Species are listed in taxonomic order within each of three groups: significantly ($P\leq0.05$) declining, non-significantly declining, and increasing.

SPEC Code	Common Name[1]	Scientific name	Mig. status	Nest. status	MAPS potent.	Phi Estimate	Population. Trend (BBS)	Sig.
WIFL	**Willow Flycatcher**	Empidonax traillii	N	S	M	X	-	**
BUSH	**Bushtit**	Psaltriparus minimus	R	T	M	X	-	**
YWAR	**Yellow Warbler**	Dendroica petechia	N	S	H	X	-	***
WIWA	**Wilson's Warbler**	Wilsonia pusilla	N	G	M	X	-	***
BUOR	**Bullock's Oriole**	Icterus bullockii	N	T	H	X	-	***
WEWP	**Western Wood-Pewee**	Contopus sordidulus	N	T	H	X	-	*
WEFL	Western Flycatcher	Empidonax (sp)	N	C	M	X	-	*
BCCH	**Black-capped Chickadee**	Poecile atricapillus	R	C	M	X	-	-
HOWR	**House Wren**	Troglodytes aedon	NI	C	H	X	-	-
SWTH	**Swainson's Thrush**	Catharus ustulatus	N	S	H	X	-	-
AMRO	American Robin	Turdus migratorius	T	T	H	X	-	-
SOSP	**Song Sparrow**	Melospiza melodia	T	G	H	X	-	-
BHCO	Brown-headed Cowbird	Molothrus ater	TI	P	H	X	-	-
AMGO	American Goldfinch	Carduelis tristis	T	S	H	X	-	-
COYE	**Common Yellowthroat**	Geothlypis trichas	NI	S	H	X	+	
YBCH	**Yellow-breasted Chat**	Icteria virens	N	S	L	X	+	
SPTO	Spotted Towhee	Pipilo maculatus	T	G	H	X	+	
BHGR	**Black-headed Grosbeak**	Pheucticus melanocephalus	N	T	H	X	+	

[1] Species in bold are listed as focal in PIF Bird Conservation Plans (BCPs) in one or more states.

Table 7. List of 14 target landbird species associated with oak woodland habitats in the three coastal states of the USFWS Pacific Region (Washington, Oregon, and California). The common name, scientific name, and Bird Banding Laboratory four-letter code is presented for each species. The migratory status is given as year-round resident (R), migrant wintering exclusively in temperate regions (T), migrant wintering primarily in temperate regions (TI), migrant wintering primarily in neotropical regions (NI), and migrant wintering exclusively in neotropical regions (N). Nesting status is given as cavity (C), tree (T), shrub (S), and ground (G). MAPS monitoring potential indicates the number of MAPS stations on NWRs at which the species had an average annual capture rate of at least 2.5 adults per year: high (H) - ten or more stations; medium (M) – five to nine stations; low (L) - one to four stations; and absent (-) - no station. Species for which an estimate of the apparent adult survival rate (Phi) has been obtained in the Northwest and/or Southwest MAPS Regions from seven years (1992-1998) of MAPS data are indicated by (X). The direction of the 1980-2001 BBS population trends for the USFWS Pacific Region is given as declining (-) or increasing (+). The statistical significance associated with negative BBS trend estimates only is indicated by (- $P>0.10$, * $0.05<P\leq0.10$, ** $0.01<P\leq0.05$, *** $P\leq0.01$). Species are listed in taxonomic order within each of three groups: significantly ($P\leq0.05$) declining, non-significantly declining, and increasing.

SPEC Code	Common Name[1]	Scientific name	Mig. status	Nest. status	MAPS Potent.	Phi Estimate	Population. Trend (BBS)	Sig.
OATI	**Oak Titmouse**	*Baeolophus inornatus*	R	C	M	X	-	***
WEBL	**Western Bluebird**	*Sialia mexicana*	T	C	L	X	-	***
CHSP	**Chipping Sparrow**	*Spizella passerina*	NI	T	-	X	-	***
LASP	**Lark Sparrow**	*Chondestes grammacus*	T	G	L	-	-	***
LEGO	**Lesser Goldfinch**	*Carduelis psaltria*	T	T	M	X	-	**
NUWO	Nuttall's Woodpecker	*Picoides nuttallii*	R	T	M	X	-	-
ATFL	**Ash-throated Flycatcher**	*M. cinerascens*	N	C	H	X	-	-
WBNU	**White-breasted Nuthatch**	*Sitta carolinensis*	R	C	-	-	-	-
BGGN	**Blue-gray Gnatcatcher**	*Polioptila caerulea*	NI	T	-	-	-	-
OCWA	**Orange-crowned Warbler**	*Vermivora celata*	NI	G	L	X	-	*
CALT	**California Towhee**	*Pipilo crissalis*	R	S	L	X	-	-
LAGO	Lawrence's Goldfinch	*Carduelis lawrencei*	T	T	L	-	-	-
HUVI	Hutton's Vireo	*Vireo huttoni*	R	T	-	-	+	
WESJ	**Western Scrub-Jay**	*Aphelocoma californica*	R	T	-	X	+	

[1] Species in bold are listed in PIF Bird Conservation Plans (BCPs) in one or more states.

Table 8. List of 15 target landbird species associated with coastal scrub and chaparral habitats of the three coastal states (Washington, Oregon, and California), and/or shrubsteppe habitat of all five states (above three plus Idaho and Nevada) in the USFWS Pacific Region. The common name, scientific name, and Bird Banding Laboratory four-letter code is presented for each species. The migratory status is given as year-round resident (R), migrant wintering exclusively in temperate regions (T), migrant wintering primarily in temperate regions (TI), migrant wintering primarily in neotropical regions (NI), and migrant wintering exclusively in neotropical regions (N). Nesting status is given as cavity (C), tree (T), shrub (S), and ground (G). MAPS monitoring potential indicates the number of MAPS stations on NWRs at which the species had an average annual capture rate of at least 2.5 adults per year: high (H) - ten or more stations; medium (M) – five to nine stations; low (L) - one to four stations; and absent (-) - no station. Species for which an estimate of the apparent adult survival rate (Phi) has been obtained in the Northwest and/or Southwest MAPS Regions from seven years (1992-1998) of MAPS data are indicated by (X). The direction of the 1980-2001 BBS population trends for the USFWS Pacific Region is given as declining (-) or increasing (+). The statistical significance associated with negative BBS trend estimates only is indicated by (- $P>0.10$, * $0.05<P\leq0.10$, ** $0.01<P\leq0.05$, *** $P\leq0.01$). Species are listed in taxonomic order within each of three groups: significantly ($P\leq0.05$) declining, non-significantly declining, and increasing.

SPEC Code	Common Name[1]	Scientific name	Mig. status	Nest. status	MAPS potent.	Phi Estimate	Population Trend (BBS)	Sig.
WREN	**Wrentit**	*Chamaea fasciata*	R	S	L	X	-	**
SATH	**Sage Thrasher**	*Oreoscoptes montanus*	T	S	-	-	-	***
CATH	California Thrasher	*Toxostoma redivivum*	T	S	L	-	-	**
BRSP	**Brewer's Sparrow**	*Spizella breweri*	T	S	L	-	-	**
WCSP	**White-crowned Sparrow**	*Zonotrichia leucophrys*	TI	S	-	X	-	**
BEWR	**Bewick's Wren**	*Thryomanes bewickii*	R	C	H	X	-	-
VESP	**Vesper Sparrow**	*Pooecetes gramineus*	T	S	L	-	-	-
BTSP	**Black-throated Sparrow**	*Amphispiza bilineata*	TI	G	-	-	-	*
SAVS	Savannah Sparrow	*P. sandwichensis*	TI	G	L	X	-	-
GRFL	**Gray Flycatcher**	*Empidonax wrightii*	N	S	-	-	+	
VIWA	**Virginia's Warbler**	*Vermivora virginiae*	N	G	-	X	+	
GTTO	**Green-tailed Towhee**	*Pipilo chlorurus*	NI	S	-	X	+	
RCSP	**Rufous-crowned Sparrow**	*Aimophila ruficeps*	R	G	-	-	+	
SAGS	**Sage Sparrow**	*Amphispiza belli*	T	S	-	-	+	
LAZB	**Lazuli Bunting**	*Passerina amoena*	N	S	M	X	+	

[1] Species in bold are listed in PIF Bird Conservation Plans (BCPs) in one or more states.

Table 9. National Wildlife Refuge (NWR) complexes (and refuges if refuge-specific checklists were available) in Washington (number of units in the state in each NWR complex is shown in parentheses). Numbers of MAPS stations that were operated in 2002 or will be operated in 2003 are presented (numbers of stations discontinued prior to 2002 are shown in parentheses). From published bird checklists, estimates are given of: a) the numbers of breeding target landbird species associated with each habitat type, and b) an overall assessment of the monitoring potential of each refuge or complex (see text). Priority habitat types on a refuge (in bold) have at least four oak woodland or shrubland species or eight lowland riparian species. Priority locations (in bold) contain at least one priority habitat *and* have an overall monitoring potential of III or IV.

NWR Administrative Unit	No. of MAPS Stations	Number of Species			Monitoring Potential
		Lowland Riparian	Oak Woodland	Shrubland	
Columbia NWR		**10**	1	**4**	II
Hanford Reach /Saddle Mountain NWR					
Little Pend Orielle NWR	(1)	**16**	**5**	**4**	IV
Mid Columbia NWR Complex (2)					
McNary NWR	1	6	0	2	II
Toppenish NWR		**16**	**4**	**7**	IV
Nisqually NWR Complex (2)	3 (1)	**16**	3	3	IV
Ridgefield NWR Complex (5)					
Ridgefield NWR	1	**17**	**5**	3	IV
Conboy Lake NWR		7	1	0	III
Turnbull NWR	1	**15**	**4**	**4**	IV
WA Maritime NWR Complex (6)					
Dungeness NWR		**17**	2	3	IV
Willapa NWR Complex (2)	1	**16**	**4**	3	III

Table 10. National Wildlife Refuge (NWR) complexes (and refuges if refuge-specific checklists were available) in Oregon (number of units in the state in each NWR complex is shown in parentheses). Numbers of MAPS stations that were operated in 2002 or will be operated in 2003 are presented (numbers of stations discontinued prior to 2002 are shown in parentheses). From published bird checklists, estimates are given of: a) the numbers of breeding target landbird species associated with each habitat type, and b) an overall assessment of the monitoring potential of each refuge or complex (see text). Priority habitat types on a refuge (in bold) have at least four oak woodland or shrubland species or eight lowland riparian species. Priority locations (in bold) contain at least one priority habitat *and* have an overall monitoring potential of III or IV.

NWR Administrative Unit	No. of MAPS Stations	Number of Species			Monitoring Potential
		Lowland Riparian	Oak Woodland	Shrubland	
Klamath Basin NWR Complex (3)		**15**	**10**	**9**	IV
Malheur NWR		**16**	**6**	**10**	III
Mid-Columbia NWRC (3)					
Umatilla NWR		6	1	3	II
Oregon Coast NWR Complex (6)					
Sheldon/Hart Mt. NAR Complex (2)					
Hart Mountain NAR	(1)	**15**	**8**	**11**	V
Tualatin NWR (2)					
Willamette Valley NWR Complex (3)	2	**17**	**6**	**5**	IV
Willapa NWR Complex (1) (see WA)					

Table 11. National Wildlife Refuge (NWR) complexes (and refuges if refuge-specific checklists were available) in Idaho (number of units in the state in each NWR complex is shown in parentheses). Numbers of MAPS stations that were operated in 2002 or will be operated in 2003 are presented (numbers of stations discontinued prior to 2002 are shown in parentheses). From published bird checklists, estimates are given of: a) the numbers of breeding target landbird species associated with each habitat type, and b) an overall assessment of the monitoring potential of each refuge or complex (see text). Priority habitat types on a refuge (in bold) have at least four oak woodland or shrubland species or eight lowland riparian species. Priority locations (in bold) contain at least one priority habitat *and* have an overall monitoring potential of III or IV.

NWR Administrative Unit	No. of MAPS Stations	Number of species			Monitoring Potential
		Lowland Riparian	Oak Woodland	Shrubland	
Deer Flat NWR		**12**	1	3	III
Kootenai NWR		**14**	1	1	III
Southeast Idaho NWR Complex (5)					
Minidoka		6	1	0	II
Camas NWR		6	1	3	III
Gray's Lake NWR		**13**	3	**6**	III
Bear Lake NWR		2	1	2	I

Table 12. National Wildlife Refuge (NWR) complexes (and refuges if refuge-specific checklists were available) in California (number of units in the state in each NWR complex is shown in parentheses). Numbers of MAPS stations that were operated in 2002 or will be operated in 2003 are presented (numbers of stations discontinued prior to 2002 are shown in parentheses). From published bird checklists, estimates are given of: a) the numbers of breeding target landbird species associated with each habitat type, and b) an overall assessment of the monitoring potential of each refuge or complex (see text). Priority habitat types on a refuge (in bold) have at least four oak woodland or shrubland species or eight lowland riparian species. Priority locations (in bold) contain at least one priority habitat *and* have an overall monitoring potential of III or IV.

NWR Administrative Unit	No. of MAPS Stations	Number of species			Monitoring Potential
		Lowland Riparian	Oak Woodland	Shrubland	
Hopper Mountain Complex (4)	(1)				
Humbolt Bay NWR Complex (3)					
Kern NWR Complex (2)		2	0	1	I
Klamath Basin NWRC (3) (see OR)					
Modoc NWR	1	**8**	3	**5**	II
Sacramento NWR Complex (8)	2(2)	**11**	**7**	2	III
San Diego NWR Complex (4)					
San Diego NWR		**15**	**14**	**8**	IV
Seal Beach NWR		**10**	**6**	2	III
San Francisco Bay Complex (7)	(1)	**8**	**4**	2	III
San Luis NWR Complex (6)	3(3)	**8**	**4**	2	II
Sonny Bono Salton Sea NWRC (2)		4	2	1	I

Table 13. National Wildlife Refuge (NWR) complexes (and refuges if refuge-specific checklists were available) in Nevada (number of units in the state in each NWR complex is shown in parentheses). Numbers of MAPS stations that were operated in 2002 or will be operated in 2003 are presented (numbers of stations discontinued prior to 2002 are shown in parentheses). From published bird checklists, estimates are given of: a) the numbers of breeding target landbird species associated with each habitat type, and b) an overall assessment of the monitoring potential of each refuge or complex (see text). Priority habitat types on a refuge (in bold) have at least four oak woodland or shrubland species or eight lowland riparian species. Priority locations (in bold) contain at least one priority habitat *and* have an overall monitoring potential of III or IV.

	No. of	**Number of species**			
NWR Administrative Unit	**MAPS Stations**	**Lowland Riparian**	**Oak Woodland**	**Shrubland**	**Monitoring Potential**
Desert NWR Complex (4)					
Pahranagat NWR	(1)	6	2	3	II
Desert National Wildlife Range		0	0	0	None
Ash Meadows NWR	1	6	2	**6**	II
Ruby Lake NWR	2	**15**	3	**10**	IV
Sheldon/Hart Mt. NAR Complex (2)					
Sheldon NAR		**9**	**6**	**10**	III
Stillwater WMA Complex (3)		6	0	**4**	II