Standard Operating Procedures for Habitat and Population Inventories and Monitoring

Landbirds

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1998

Introduction

Two of the central goals of the National Wildlife Refuge System outlined in *Refuges 2000* (USFWS 1993) are "to perpetuate the migratory bird resource" and "to preserve a natural diversity and abundance of fauna and flora on refuge lands". The conservation of biological diversity is also identified as an "overall principle" in the Service's *Vision of the Future* (USFWS 1991) and is a specific mandate in the Alaska National Lands Interest Conservation Act. Although 50% of Alaska's breeding avifauna consists of migratory landbirds, little information on distribution, habitat requirements, and population status of landbirds is currently available. Because Refuges in Alaska contain considerable land area (>76 million acres), include habitats unique within the Refuge System, and constitute a large proportion (83%) of Refuge System lands, they the potential to play a major role in the conservation of landbirds in Alaska.

In 1992, the national Monitoring Working Group of Partners in Flight reviewed techniques currently used for monitoring neotropical migratory birds, primarily focusing on forest dwelling species, and developed a set of recommendations to improve procedures and expand the scope of existing programs. These methods can be applied to all small landbirds and can be adapted for use on Refuges in Alaska. Although monitoring methods for passerines are fairly well developed, techniques for some landbird groups (e.g., colonially-nesting songbirds, swifts, owls) need further refinement. The techniques we outline below generally apply to breeding season and migration periods. For many procedures detailed methods are published elsewhere. We have attached some procedures; for additional references, contact Brad Andres or the Regional Nongame Migratory Bird Coordinator. Thanks to Philip Martin, U. S, Fish and Wildlife Service, and Colleen Handel, Alaska Biological Science Center, for providing comments on a draft of this document.

Definition of Inventory and Monitoring

Landbird monitoring programs are broadly divided into extensive and intensive methods. Extensive methods have high spatial coverage and low temporal replication within a season, whereas intensive methods have low spatial coverage and high temporal replication within a season. Inventories are the most general of extensive methods and are used to determine the one-time occurrence (status) of a species on a particular refuge. Replication of inventories across spatial units is used to determine the relative abundance and distribution of a species among units. If quantitative inventories are replicated across years, a population monitoring program evolves.

The central purpose of many monitoring programs is to determine if estimates of population parameters are changing through generations (trends). Broad-scale changes in population size, or an index of population size, are often monitored by extensive methods (e.g., point counts, Breeding Bird Surveys). Although tracking population size is relatively easy through extensive methods, monitoring of primary population parameters (birth rate, death rate, and dispersal) is necessary to understand mechanisms of population change (Temple and Wiens 1989). Estimates of primary population parameters can onlybe obtained by using intensive methods (e.g. Monitoring Avian Productivity and Survivorship and migration monitoring stations).

No matter which monitoring program is used, a multi-year commitment at the appropriate level of effort is necessary to obtain meaningful results and should be an important consideration when deciding among monitoring alternatives. The potential species detected or captured with various monitoring techniques should also be considered. Adequate training of participants involved in all monitoring programs is crucial and can greatly add to the cost of a project. The use of adequately-trained volunteers in landbird monitoring programs should be considered.

Prioritization schemes have been developed for monitoring neotropical migratory birds by the Monitoring Working Group of Partners in Flight (1992) and Ralph et al. (1993). Prioritized monitoring objectives are to document: 1) occurrence and distribution of all species, 2) abundance and population trends of selected species, 3) demographics (survival and reproductive success) of selected species, and 4) habitat associations for all species. A general monitoring scheme is depicted in Figure 1.

Definition of Habitat Inventory and Monitoring

Because habitat alteration is generally proceeding at a slower rate in Alaska than in the rest of the country, Alaska's breeding landbird populations could serve as controls to investigate breeding ground effects as the cause for population changes on the continental scale. For example, if populations in Alaska decline despite no change in habitat availability (and productivity is high) causes can be indirectly attributed to factors on the wintering grounds or at migratory stop-overs (which would also be reflected in declining survivorship). Refuges could contribute to Alaska baseline data. In general, information on boreal-breeding birds across the continent is scant. Proposed timber harvest in the Northwest Territories and inaccessibility of boreal forests in northern Canada elevate the importance of Alaska, and particularly Refuges, to provide a benchmark for population processes of landbirds that are relatively uninfluenced by humans.

Monitoring changes in habitat along with changes in bird populations is important to aid understanding of reasons for population changes (Ralph et al. 1993, Monitoring Working Group 1992). Boreal Partners in Flight recommended using vegetation classifications developed by Viereck et al. (1992) and Kessel (1979) as the standardized schemes for collecting habitat information on migratory landbirds. Refuges should plan to collect habitat information from all points or stations within the three years of the station or transect initiation, and thereafter each 5-10 years. Habitat assessment of roadside Breeding Bird Survey routes by Migratory Bird Management occurred during 1996-1998 (see Andres et al. 1997b).

Relationship to Ecosystem Approach

Landbirds are an important component of Alaska ecosystems and occupy a wide variety of habitats. Declines in populations of landbirds, particularly resident species, could reflect the deterioration of ecosystem processes. Although inventories, and some habitat-based monitoring schemes, are feasible to implement at the individual Refuge level, often single Refuges will not have the appropriate statistical power to detect population or demographic changes on their unit. The allocation of effort among a cluster of refuges, as a division of the biogeographical region, is likely the most feasible approach to broadscale landbird monitoring. Including additional Federal land owners, and other partners, in clusters could greatly enhance the ability to detect changes in populations or demography and would be a cost effective strategy. Possible Refuge clusters, organized by Kessel and Gibson’s (1978) biogeographic regions, are shown in Table 1.

Within Alaska, little is known about ecological processes governing populations of landbirds. For example, we know little about the effects that fire and fire management have on songbird populations and habitat. Similarly, few studies are available to assess the effects that insect outbreaks have on songbird populations and habitat. Refuges could play a key role in examining these ecological processes.

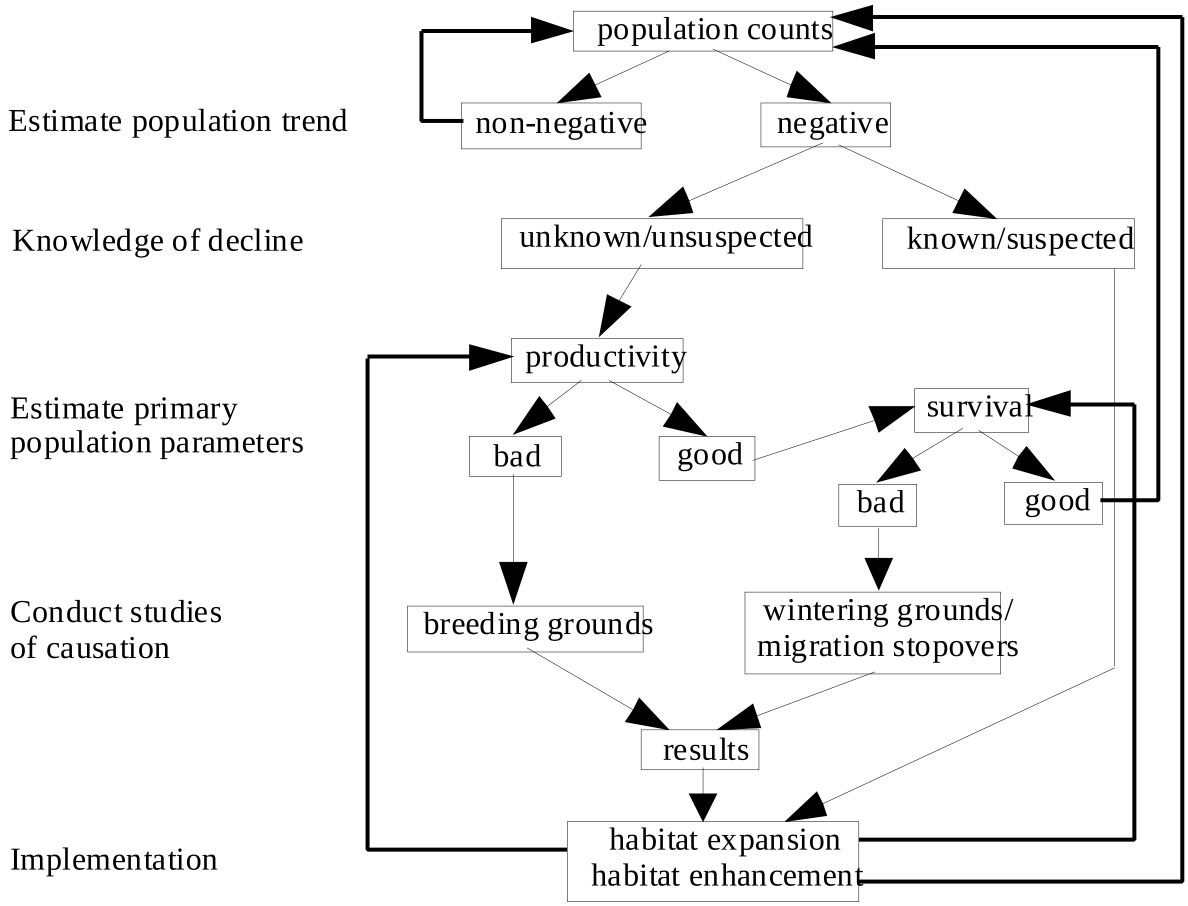

Figure 1. General scheme for decisions on monitoring questions, effort, and feedbacks (dark lines).

Table 1. Refuge clusters by biogeographical region.

Biogeographic Region	Refuge Cluster	Potential Partners
Central	Innoko Koyukuk Nowitna	Denali NP
	Arctic Kanuti Yukon Flats	Gates of the Arctic NPP
	Tetlin	Wrangell-St. Elias NPP Yukon Charlie Rivers NP Fort Greely Fort Wainwright
Southwestern	Alaska Peninsula Becharof Izembek	Katmai NPP
	Alaska Maritime Kodiak	
Western	Togiak Yukon Delta	
	Alaska Maritime Selawik	Bering Land Bridge NP Cape Krusenstern NM Kobuk Valley NP Noatak NP
Southcoastal	Kenai	Chugach National Forest Kenai Fjords NP Lake Clark NPP Tongass National Forest Wrangell-St. Elias NPP
Northern	Arctic	USFWS - ES BLM
Southeastern	Alaska Maritime	USFWS - ES Glacier Bay NPP Klondike-Goldrush NHP Tongass National Forest

Matrix of Survey Intensity and Implementation Priority

Table 2. Recommended biological standard survey techniques for landbirds from highest to lowest implementation priority and from lowest to highest survey intensity.

Priority	Method	Highest level of desired information	Lowest inference level
1	Refuge Checklist Project/ area search	occurrence, relative abundance, breeding status, distribution	refuge
2	Breeding Bird Survey	population trend, distribution	biogeographic region
3	Off-road Point Counts	population trend, distribution	refuge/cluster
4	Monitoring Avian Productivity and Survivorship (MAPS)	productivity and adult survivorship	cluster/ biogeographic region
5	migration monitoring	population trend and productivity	biogeographic region?
5	nest searches	productivity	cluster/ biogeographic region

Description of Techniques

Refuge Checklist Project/Area Search

Principal to the management of migratory landbird resources is an understanding of their occurrence within the landscape. Broad-scale information on distribution and abundance of a multitude of species can be obtained through a standardized checklist project. Checklist data can also be used to examine broad-scale habitat patterns of a targeted species group.

Briefly, field observers record the abundance and breeding status of species and the amount of observation effort in a township (Andres 1995). Advantages of a checklist program are that information is collected on numerous species and can be collected secondarily to other projects. The Refuge Checklist Project focuses on the breeding season but could be easily expanded to include migration and wintering periods. Focused effort in a well-defined area can be considered an area search (Andres and Brann 1997); intensive coverage of an area results in a breeding bird atlas (Andres et al. 1997a).

Besides establishing baseline distributional information, checklists have been used to document changes in populations. Analysis of trends generated from reporting frequencies of checklists completed during the breeding season corresponded well with local Breeding Bird Survey trends in Wisconsin (Temple and Carey 1990) and in Quebec (Cyr and Larivee 1993). Reporting frequencies and abundance classes recorded on the Alaska refuge checklists could be used to corroborate population changes detected in other monitoring programs and is currently being investigated.

Checklist projects provide an important vehicle for training observers for participation in other intensive monitoring programs. Checklists also provide an excellent means of familiarizing agency personnel with nongame bird species in their management areas and can be used in public outreach programs.

Breeding Bird Survey (BBS)

The BBS is a continent-wide program designed to monitor the populations of North American breeding birds. Each roadside route consists of a 24.5 mile stretch of secondary road composed of 50 stops placed at 0.5 mile intervals. Routes are surveyed once a year by an observer who is familiar with the sight and song of birds in the region. At each of the 50 stops, the observer records the number of individuals of every species, either heard or seen, during a 3-minute period. Because of differences in the skills of observers, the same observer is encouraged to survey the route for a number of years. Trend analysis statistics are well-developed for this survey (Geissler and Sauer 1990) and are available on the internet (http://www.mbr.nbs.gov/bbs/bbs.html).

Expansion of the BBS has been identified as the top monitoring priority by the Monitoring Working Group of Partners in Flight (1992). Although typical roadside routes are limited in Alaska, particularly on Refuges, adaptation of BBS techniques to surveys along rivers is a possible way to expand the BBS in Alaska. Additionally, biases of roadside counting (i.e.

whether habitats near the road are representative of habitats away from the road) are probably minimal in Alaska. Expanding coverage of the BBS in Alaska, including establishment of river routes, is the top monitoring priority of the Boreal *Partners in Flight* Working Group (see Andres et al. 1997b for current status of Alaska BBS). Refuges should strive to conduct BBS routes where possible. Generally, species need to be regularly recorded on 14 routes to provide reasonable estimates of long-term population trends. Procedures for establishing and conducting river BBS routes are available from Migratory Bird Management.

Off-road Point Counts

Similar to the BBS, off-road point counts involve timed counts (5 or 10 minutes instead of 3) of birds at a series of spatially fixed points. To supplement data from the BBS, point count transects should target species or habitats that are not well sampled by the BBS or be established in roadless areas. Series of points placed 250 m apart in forested habitats, and 500 m in non-forested habitats, should be restricted (ideally) to a single major habitat type (e.g., mixed forest, riparian shrub, alpine).

Ralph et al. (1993) suggested that routes of 25 stops be conducted along tertiary roads or other roads where a full BBS route can not be accommodated. Boreal *Partners in Flight* established a standard of 12 points for each point count transect (see Handel 1997a, 1997b for methods). Because of the logistical costs associated with reaching remote point count sites on Refuges, it seems desirable to maximize the amount of information collected at each site. Therefore, Refuges should establish a transect that includes as many points as can be surveyed within 4-5 hours of sunrise (with a minimum of 12 points to be used in statewide analysis). Similarly, transects in different habitats could be established at the same remote location.

Most likely, analysis of point count trends will follow the BBS and, generally a minimum of 15 transects within a biogeographic region, or cluster, will be required (C. M. Handel, U. S. Geol. Surv., pers. commun.; see Andres et al. 1997b for further thoughts on allocation). Thus, it may not be logistically feasible to obtain a large enough sample size for statistically meaningful trend estimates on a given refuge. If estimates of trends obtained from point count transects are unbiased, then estimates can be combined across transects regardless of the number of points on each transect (C. Moore, U. S. Geol. Surv., pers. commun.). Information on the Alaska off-road point count program is provided at http://www.usgs.gov/research/bpif/bpif.html

Because observer changes influence trend estimates (Geissler and Sauer 1990), the same observer should conduct the counts each year. Observer differences might also be accounted for by having several observers conduct the same transect within the same year and averaging their results. Training could alleviate some inter-observer variability if observers have relatively similar detection rates. At the same time, variability could increase if good observers get a lot better. A "test" transect could be run to determine variability in the detection rate of observers. Because seasonal employees are often used on Refuges to conduct point counts, supervisors should ensure that observers are well-trained. After BBS routes, Refuges should establish several off-road point count transects on their land units. Doyle (1997) developed an allocation scheme to do this.

Point count techniques can also be used in an experimental design context to determine differences in densities of birds (birds/point) between experimental and control groups such as fire/no fire and can be used to determine differences between habitat types (although see Schieck 1997). Hamel et al. (1996) provide a good discussion of the use of point counts.

Monitoring Avian Productivity and Survivorship (MAPS)

The MAPS program was initiated to gather information on primary population parameters of nongame birds (DeSante et al. 1993). Demographic data provide information on the mechanisms responsible for population trends. One objective of the MAPS program is to establish long-term monitoring sites on public lands that are protected.

The MAPS program centers around constant-effort mist netting at stations scattered across the continent (DeSante and Burton 1994). Each station operates 10-20 mist nets once every 10 days throughout the breeding season. Nets are placed at a density of 1.25-1.5 per hectare in areas that achieve high capture rates and will have long-term continuity in netting effort and habitat stability. Estimates of adult survival and productivity are used to monitor the health of bird populations. Environmental variables can be incorporated into analyses to isolate human-induced factors that are responsible for demographic changes. A variety of models have been developed to determine survivorship from capture-recapture data (Nichols 1992). Currently, the MAPS program uses a modified Cormack-Jolly-Seber model (transient) to estimate survivorship (DeSante et al. 1996).

MAPS data will need to be pooled across numerous sites to achieve reasonably precise (CV < 20%) estimates of survival. Although stations within a Refuge, and partner, cluster might provide adequate on species with high capture rates, survival will likely have to be estimated over a larger area to achieve reasonable precision (see DeSante et al. 1996 and Rosenberg 1997). Further, detailed examination of variation in species-specific capture rates among stations is needed to evaluate the MAPS program in Alaska. The MAPS protocol might be most useful in investigating specific hypotheses about productivity and survivorship that are directed by species or species groups that are known to be declining.

For some species, productivity estimated from mist net data did not correspond well with fledging rates of the local population, and survivorship of adults was dependent on breeding status (Nur and Geupel 1993). However, the ratio of hatching year to after hatching year birds was a good predictor of recruitment the following year (Nur and Geupel 1993). The value of MAPS data to estimate productivity is still questionable because of juvenile dispersal.

Because of the effort and expertise involved, MAPS stations should be undertaken after monitoring targets for BBS and off-road point counts are met. Species composition and abundance at the site should be carefully scrutinized to ensure that sufficient numbers of target species will be captured (DeSante and Burton 1994). Several MAPS stations have been established on refuges (Andres et al. 1997b, Dewhurst et al. 1996, Sowl 1996). Information on MAPS procedures is available at
http://ourworld.compuserve.com/homepage/birdbanding/ibpmaps.htm

Migration Monitoring

At a workshop on monitoring of landbirds during migration, participants agreed that many boreal-breeding species were poorly monitored. could only be monitored during migration at latitudes south of their breeding grounds. Because techniques varied widely among locations (Dunn and Hussell 1995), standard protocols for migration monitoring are being developed (Hussell and Ralph 1998; contact Andres for copies or see http://www.rsl.pws.fs.fed.us/pif/migmon.html and .../mnstalst.html for a list of stations).

The most intensive migration monitoring methods include a combination of banding and counting. Central to the success of a migration monitoring program is the maintenance of constant detection or capture rates at a station across all years. Thus, intensive effort (counts or captures every 1-3 days) need to be maintained in the same habitat during the same time window across numerous years. Despite standardization of procedures, variability in weather must be accounted for in trend analyses of migration data (Hussell et al. 1992).

Population trends derived from migration banding data often corresponded well with trends derived from BBS routes within the same physiographic stratum and appeared to monitor local populations (Hagan et al. 1992, Hussell et al. 1992, and Pyle et al., Point Reyes Bird Observatory, unpubl. data). Workers at migration stations in the lower 48 can not often distinguish between local and foreign breeding birds. The establishment of migration stations in Alaska would ensure that all birds detected or captured were boreal breeders. Comparisons between a network of sites will be needed to track population changes and changes in productivity. As standardized techniques are developed, migration monitoring may become a viable program for monitoring population size and productivity on Refuges in Alaska. Boreal *Partners in Flight* has developed a list of recommendations for migration monitoring in Alaska (see attachment).

At this time, sites on Refuges should be explored for their potential as migration monitoring sites (with an emphasis on fall migration). Implementing a migration station on a Refuge would require: 1) committing to an effort every 1-3 days for the entire period from 1 August to 1 October, 2) placing nets in an area of high capture rates, 3) assuring that capture/detection efforts are consistent from year to year, and 4) providing adequately trained personnel. Standardized counts should be conducted along with banding at the station. Several migration monitoring stations have been established on refuges (Andres et al. 1997b, Dewhurst et al. 1996, Doyle 1996). Migration banding provides an excellent opportunity for public outreach.

Nest Searches

Locating and following the fate of nesting birds is the most direct way to determine reproductive success (Ralph et al. 1993). Information collected by nest searching reflects local conditions and can be directly related to habitat features. However, nest finding can be labor intensive and large sample sizes are needed to determine differences between populations. Ralph et al. (1993) suggested that 8 plots of 40-50 ha in forested habitats are needed to find a total 20 nests for a single species. Nest searches are an important component of the BBIRD protocol (Martin and Geupel 1993, Martin and et al. 1997; see http://pica.wru.umt.edu/bbirds/ or contact Andres for a copy). Martin et al. (1997) suggest that 4 plots (20 ha each) are needed to locate 20 nests in western riparian habitats.

Nest searches would be most useful if effort is concentrated on a few target species that exhibit population declines, are suspected of being affected by habitat-related factors (e.g., predation), or are not covered well in other monitoring programs. Nest searching methods grew out of a concern about the effects that cowbirds had on the reproductive success of landbirds. Nest searches should take low priority until specific questions about reproductive success can be formulated. If nest searches are undertaken, several target species should be selected and plots established in habitats that maximize finding nests of these species. High priority species in the landbird conservation plan, which is currently being developed for Alaska, would be a logical place to start.

Other Methods

Noteworthy observations of species and numbers can add to our knowledge of Alaska avifauna. Observations should be submitted to the University of Alaska Museum (Daniel D. Gibson, P.O. Box 756960, 907 Yukon Drive, University of Alaska Museum, Fairbanks, AK 99775) and the regional editor of the *National Audubon Society Field Notes* (Thede Tobish, 2510 Foraker Dr., Anchorage, AK 99517).

The Christmas Bird Count (CBC) tallies individuals of all species within a circle with a 15-mile radius during one day in late December or early January. The count may provide some utility for monitoring population trends of common and widespread resident species in Alaska. CBC data is available through the internet at http://www.mbr.nbs.gov/bbs/cbc.html, but Alaska is not included in the analysis. The CBC is also a popular volunteer activity and provides an opportunity for public outreach.

The North American Migration Count, like the Christmas Bird Count, tallies individuals of all species within a defined area (Alaska State Game Management Unit) on the second Saturday in May. The count provides a snapshot of migration when compared with other counts conducted across the continent, and provides an opportunity for public outreach by involving volunteers.

Although delineating territories of breeding birds (spot mapping) is the best way to get accurate estimates of densities, the method is quite time consuming and is probably not practical to implement on refuges. For some uncommon or widely-dispersed species (e.g. Olive-sided Flycatcher), however, this may be the preferred method to track changes of population size (Bibby et al. 1992).

Data Maintenance

Migratory Bird Management (MBM), Region 7 will serve as a depository for the Refuge Checklist Project information. MBM will also provide technical support to Refuges for the development and implementation of landbird monitoring programs and will act as a liaison to regional and national working groups. Breeding Bird Survey and MAPS data are sent to the respective offices for archiving and analysis. Pilot project data for off-road points are currently being analyzed to recommend regional sampling efforts by the USGS-BRD Alaska Science Center (see Andres et al. 1997b). There are no regional standards for the remaining procedures.

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RECOMMENDATIONS FOR MIGRATION MONITORING IN ALASKA

On 4 December 1995, a subset of BPIF members met and discussed the development of a set of preliminary recommendations for conducting studies of landbirds during migration. The impetus for this meeting was the increased interest in migration studies in Alaska and the formation of a national committee to compile information on field methods for migration studies. Because most past effort has focused on banding, we devoted our discussion to this technique. Results of this meeting are presented below.

Site

- good accessibility
- long-term commitment (>10 years), new sites at least 2 years
- target figure of 20 HY and 10 AHY individuals of species of interest; 50% of captures should be type A/B migrants, 15-20% type N
- reconnoiter site to assess potential of having migrants (visually, small effort netting)
- try to provide housing and locate site near volunteer pool
- build partnerships with other agencies and NGOs to ensure long-term continuity
- select site with a mosaic of habitats that has high catchability, but is stable over the life of the station
- be sure land managers are aware of netting activities and provide protection for the site
- priority regions for new sites include: the upper Yukon Valley, the lower Yukon Valley, western Alaska and southeastern Alaska

Methods

- mist-netting was identified as priority at migration sites
- maintain daily checklists (presence/absence or categorical) to compare abundance and species composition to captures
- if personnel are available, undertake a daily area search or transect survey (done systematically with standardized procedure)
- double-check that all nets are closed at end of daily session

Effort

- optimal seasonal period, 15 July - 7 October; essential window, 1 August - 20 September (for Neotropical migrants)
- netting should occur every day, or at least 4 out of 5 days
- maintain constant daily effort at 6 hours/day
- netting should be conducted under similar weather conditions from year to year
- try to maintain similar cumulative net-hours between years
- begin netting within ½ hour of sunrise
- begin with 5 nets and increase to a number that is readily handled by available personnel
- maintain net type, size and configuration between years; 30 mm mesh is recommended to maximize captures of warblers

Data Collection

Follow procedures of the MAPS program and in the handbook by Ralph et al. (1993).
Prioritization of data collected on an individual bird:

1. location (given)
2. band number
3. species
4. date
5. age (how aged) - a) skull, b) wing molt, c) tail-shape, d) iris color
6. bander and scribe
7. sex (how sexed) - a) wing chord, b) BP/CP, c) plumage and crown
8. fat
9. weight
10. other measurements

Species should be prioritized for processing; small, long-distance migrants should be done first (Rufous Hummingbirds, Wilson's Warblers, Ruby-crowned Kinglets)
record net-hours (opening and closing of each net, or minimally the median of all nets)
record weather (record open and closing): 1) wind speed - Beaufort scale, 2) visibility in km, 3) ceiling, 4) cloud cover in 1/10ths, 5) temperature in ^{o}C, 6) precipitation by BBS scale, 7) pressure in millibars, 8) wind direction

Equipment

stream-line operation, have more than you think necessary
bird bags, holding boxes, optivisors
banding lab with heater, chairs, and good light (dive lights)
good trails to nets
spare nets, forms and bands