

Priority Information Needs for Band-tailed Pigeons, Zenaida Doves, White-tipped Doves and Scaly-naped Pigeons

A FUNDING STRATEGY

Developed by the Association of Fish and Wildlife Agencies' Migratory Shore and Upland Game Bird Support Task Force.

February 25, 2011


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Top row: zenaida dove by VSmithUK, band-tailed pigeon by Hi Mountain Lookout, band-tailed pigeon by Jerry Ting;
Second row: zenaida dove by Mo Stevens;
Third row: scaly-naped pigeon by Ross Tsai;
Fourth row: white-tipped dove by Francesco Veronesi

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Executive Summary

This Strategy contains recommendations for obtaining priority information needed to improve habitat and harvest management decisions for populations of band-tailed pigeons, Zenaida doves, white-tipped doves and scaly-naped pigeons by focusing on evaluating and improving knowledge of monitoring efforts, vital rates (survival, reproduction and recruitment) and habitat needs during the annual life cycle of these birds. The Strategy is intended to increase financial support for management and research during the next 5–10 years with thoughtful and deliberate planning based on good scientific principles.

The Migratory Shore and Upland Game Bird Support Task Force determined that convening a group of band-tailed pigeon, Zenaida dove, white-tipped dove and scaly-naped pigeon experts would be the most efficient and effective process to develop the Strategy. Experts from Flyways, universities and from state and federal agencies in the United States, Canada and Mexico were invited to participate in the process.

Discussions during three online meetings resulted in the identification of five priority information needs for band-tailed pigeons, Zenaida doves, white-tipped doves and scaly-naped pigeons (in no particular order):

1. Reliable demographics of band-tailed pigeons.
2. Association of food availability with abundance and distribution of band-tailed pigeons.
3. Status assessment of white-tipped doves in south Texas to determine distribution, population abundance and biology.
4. Population and harvest data collected annually for Zenaida doves and scaly-naped pigeons.
5. Adaptive harvest strategy for Zenaida doves and scaly-naped pigeons.

Strategy development participants identified two overarching guidelines that should be considered in further development of each of the priority information needs: (1) Consider the effects of climate or ecosystem change on band-tailed pigeon, Zenaida dove, white-tipped dove and scaly-naped pigeon habitats and ultimately on the abundance and distribution of these species and (2) Actively engage other countries. It is important to consider the role that habitat and harvest management decisions in other countries have on the overall management of these species. New or expanded information-gathering activities should be range-wide in scope.

The priorities described in this Strategy promote efforts to reduce uncertainty in current management practices. Improved information will enable managers to target site-specific and range-wide management and monitoring programs, increasing the cost-effectiveness of management.

Introduction

In 2006, the Migratory Shore and Upland Game Bird Working Group (Working Group) established a Migratory Shore and Upland Game Bird Support Task Force (Task Force). The Task Force is composed of nine representatives of state, federal and non-governmental organizations. The Task Force was directed to update the research and management needs of the 16 species of migratory shore and upland game birds and to develop a strategy for funding priority research and management needs for these species. Band-tailed pigeons, Zenaida doves, white-tipped doves and scaly-naped pigeons were one of the groups of species selected.

STRATEGY PURPOSE

This Strategy contains recommendations for obtaining priority information needed to improve habitat and harvest management decisions for populations of band-tailed pigeons, Zenaida doves, white-tipped doves and scaly-naped pigeons by focusing on evaluating and improving knowledge of monitoring efforts, vital rates (survival, reproduction and recruitment) and habitat needs during the annual life cycle of these birds. The Strategy is intended to increase financial support for management and research during the next 5–10 years with thoughtful and deliberate planning based on good scientific principles. Resulting priorities will be used to guide the acquisition and expenditure of funds, as well as provide the means to attract additional funding from partners interested in the habitats and the populations of migratory shore and upland game birds. Separate from the Strategy, an Action Plan will be developed to encourage partners to collaborate and support these information needs, to use or redirect current funding and to secure new funding. Finally, the Action Plan will ensure the development of a consistent message when pursuing funding.

STRATEGY DEVELOPMENT PROCESS

The Task Force determined that convening a group of band-tailed pigeon, Zenaida dove, white-tipped dove and scaly-naped pigeon experts would be the most efficient and effective process to develop the Strategy. Experts from Flyways, universities and from state and federal agencies in the United States, Canada and Mexico were invited to participate in the process. The group held three online meetings during September–October 2010. A list of participants is included in Appendix A. The Task Force retained D.J. Case & Associates to facilitate the online meetings and to compile and finalize the Strategy.

Status of band-tailed pigeons, Zenaida doves, white-tipped doves and scaly-naped pigeons

BAND-TAILED PIGEONS

Band-tailed pigeons are divided into six subspecies, only two of which occur north of Mexico, and each of those occupies a disjunct geographic distribution in western North America: the Pacific Coast and Interior (Figure 1; Braun 1994). In the early 1970s the total population size in the Pacific Coast region was approximated at 2.9–7.1 million birds and fewer than 250,000 birds in the Interior region (estimated from harvest reports and band recovery rates, Braun 1994). Thus, the size of the two populations were estimated to be markedly different during this period. Some interchange occurs between races (Schroeder and Braun 1993).

Band-tailed pigeons inhabit coniferous forests in mountainous areas (Keppie and Braun 2000). They are highly mobile habitat generalists and have high fidelity to a given area but can be nomadic depending on food availability. Food availability appears to be a major determinant of abundance, distribution and productivity. These birds have seemingly low reproductive potential considering that they almost invariably have 1-egg clutches, but under ideal conditions may produce up to three successful nests per year.

Band-tailed pigeons are a valued game bird offering a different type of pursuit than any other game bird. Hunting band-tailed pigeons has been allowed in all states within the species range except Texas. However, seasons have been periodically closed due to concern over overharvest or population status. Seasons have been closed in one or more states within each population during 55 (Interior) and 29 (Pacific Coast) of the last 98 years (1913–2010).

Little is known about the demographics of band-tailed pigeons because their habits make them especially difficult to study and monitor. Monitoring information is presently limited to annual estimates of relative abundance and harvest (absolute harvest and age ratios in the harvest). This information is compiled by biologists from the U.S. Fish and Wildlife Service, with assistance from various partners, in an annual status report for band-tailed pigeons (Sanders 2010). Available information from the all-bird North American Breeding Bird Survey and Mineral Site Survey (limited to the Pacific Coast population) provides evidence that the abundance of band-tailed pigeons has declined significantly over time (Figure 2).

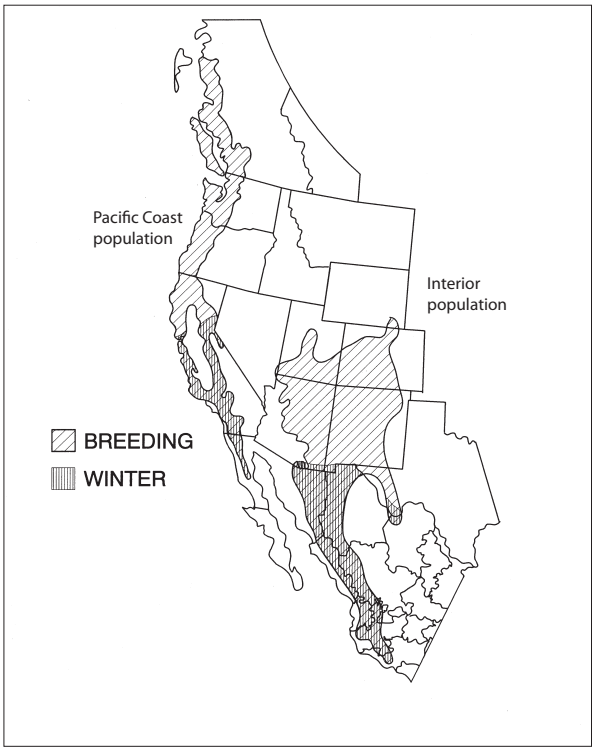

Figure 1. Distribution of Pacific Coast and Interior band-tailed pigeons in North America (after Braun et al. 1975).

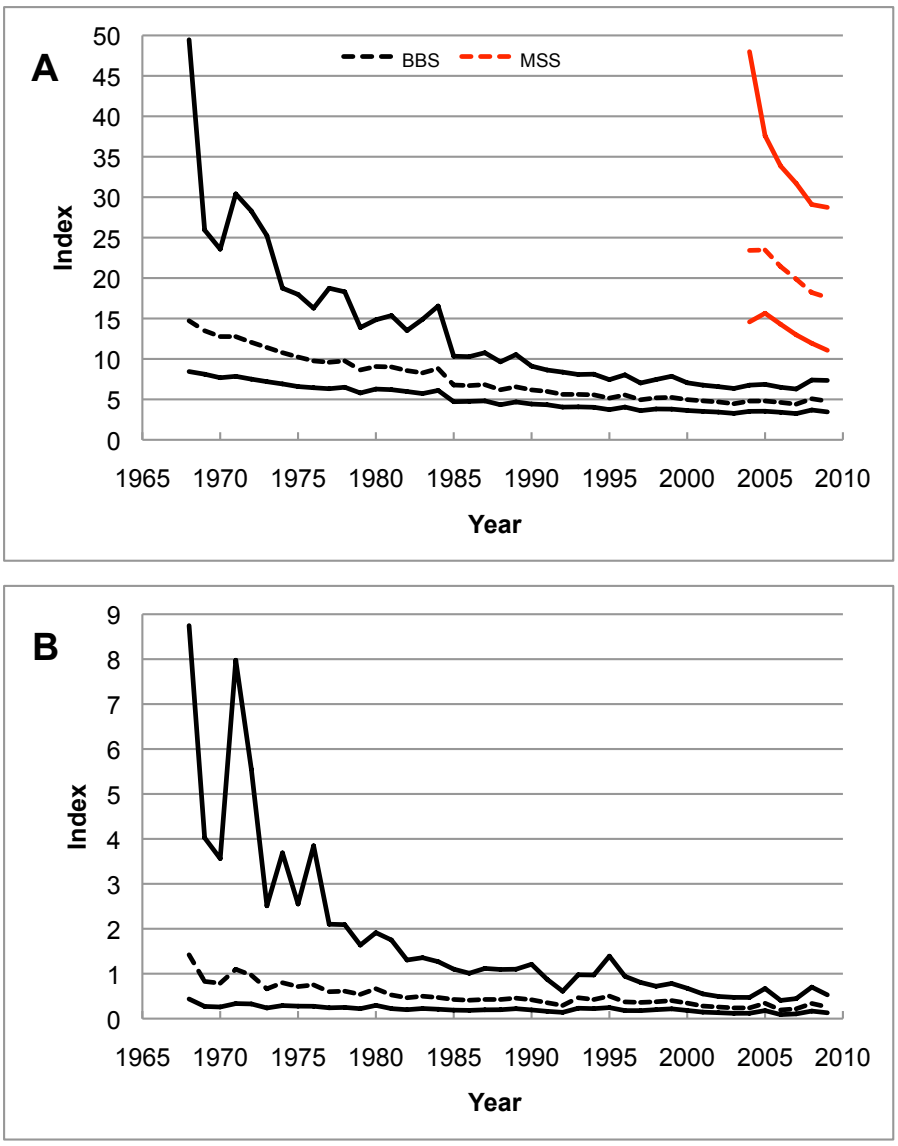

Figure 2. Abundance indices for the Pacific Coast (A) and Interior (B) populations of band-tailed pigeons based on results from the North American Breeding Bird Survey and the Mineral Site Survey (scaled by dividing the index by 10). Solid lines indicate the 95% credible intervals for the indices. The Mineral Site Survey is only conducted for the Pacific Coast population.

Apparent long-term population declines have led to especially restrictive hunting regulations for the last 14 years in the Pacific Coast states (9-day season with a 2 bird bag limit, California has a season in each of 2 zones), but has remained relatively liberal in the Interior states (20–30-day season with a 5 bird bag limit, New Mexico has a season in each of 2 zones). Hunter participation and harvest are at an all-time low for both populations. Since 1999, Interior band-tailed pigeon harvest has been estimated from 1,300 to 5,000 (mean = 3,136) birds per year, while Pacific Coast population harvest has been estimated between 8,200 to 30,200 (mean = 17,000) birds per year.

Currently, band-tailed pigeon abundance is thought to be limited primarily by food availability resulting from habitat alteration associated with land management practices. Also, band-tailed pigeons are subject to Trichomoniasis, a parasitic disease caused by a single-celled

protozoan, *Trichomonas gallinae,* introduced with exotic pigeons and doves. Virulent strains of *T. gallinae* have caused major mortality events or epizootics in band-tailed pigeons in addition to less visible, chronic losses. Periodic annual losses from *T. gallinae* in the Pacific Coast population can exceed harvest by 2 to 3 times (Stromberg et al. 2008).

The single greatest challenge in the monitoring and management of band-tailed pigeon populations is the lack of reliable information on population abundance. Existing surveys for this species provide only trends in abundance and provide no information about absolute population size. Furthermore, estimates from existing surveys may be unreliable because sample sizes (routes or mineral sites) and pigeon counts at sample sites are low, variances are high and coverage of habitat by survey routes or sites is poor, especially for the Interior region. Also, interpretation of count data at mineral sites is challenged by the lack of understanding of why these birds use mineral sites (Sanders 2000).

WHITE-TIPPED DOVES

White-tipped doves occur throughout Central and South America, reaching the northernmost periphery of their range in south Texas (Figure 3). Although historically found in only the four southern most counties in Texas (Starr, Hidalgo, Wallacy and Cameron), white-tipped doves have expanded their range into seven additional counties (Zapata, Brooks, Kenedy, Webb, McMullen, Dimmit and Live Oak) (Boydstun and DeYoung 1985).

Figure 3. Distribution of white-tipped doves (shaded region) in North, Central and South America (Hogan 1999).

Only incidental information on trend or population abundance estimates is available for white-tipped doves. White-tipped doves are not detected frequently enough on the Breeding Bird Survey, Dove Call-count Survey, or Texas Parks and Wildlife Department Urban Dove Survey to establish abundance estimates. Historically, coo-count surveys were conducted for white-winged doves in the Lower Rio Grande Valley and white-tipped doves were recorded incidentally on these surveys. These surveys gave a bird per station estimate in targeted habitat, from these estimates it appears detection rates remained steady over a thirteen year period from 1983–1996 (Hogan 1999).

Texas began hunting white-tipped doves in 1984. Texas Parks and Wildlife Department administers the White-winged Dove Harvest Survey to estimate hunter participation and harvest for the 4-day special white-winged dove season in Texas. The average annual harvest for the white-tipped doves is approximately 2,500 birds with an average daily bag of 0.328 birds per hunter (Figure 4).

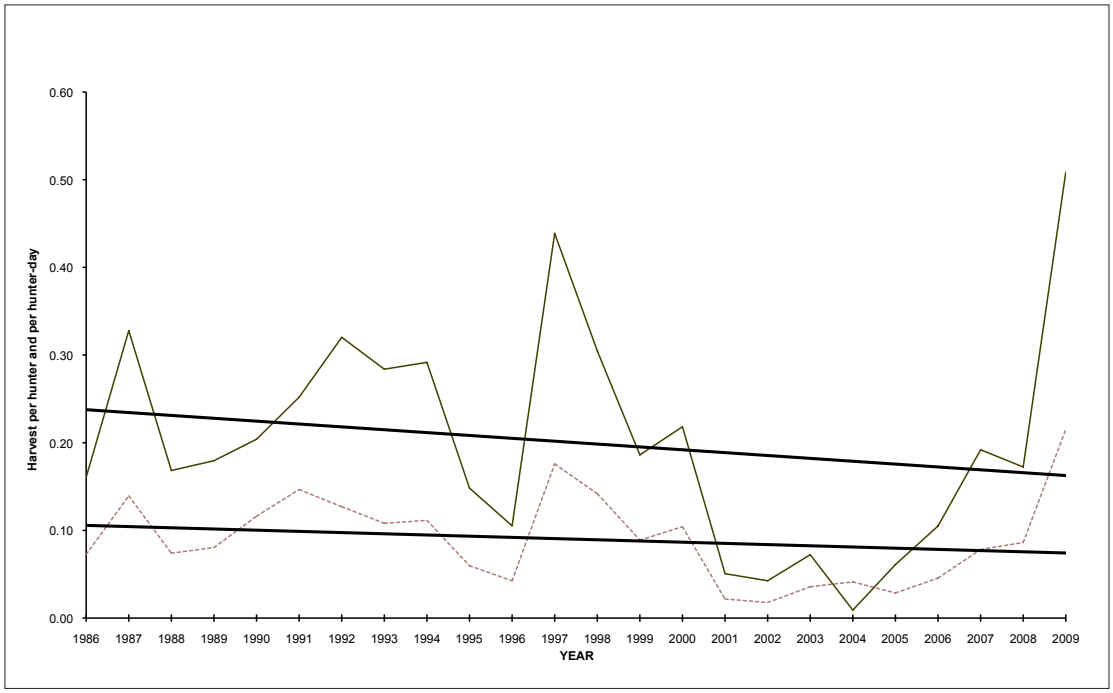

Figure 4. Trend in estimated white-tipped doves harvested per hunter (black line) and per hunter-day (gray line) during the September 4-day special white-winged dove season in the Lower Rio Grande Valley of Texas, 1986–2009.

SCALY-NAPED PIGEONS AND ZENAIDA DOVES

There are four game species of pigeons and doves in Puerto Rico: the scaly-naped pigeon, Zenaida dove, white-winged dove and mourning dove. In addition, there are two nongame species that are considered management priorities: the plain pigeon, which is an endemic subspecies that is listed as endangered; and the white-crowned pigeon, which is listed as threatened. Scaly-naped and white-crowned pigeons are regionally threatened over much of their Caribbean range due to hunting, poaching and habitat clearing for development. Monitoring data are scarce even for islands where pigeons and doves are heavily hunted.

Information about population status and trends for the scaly-naped pigeon and the Zenaida dove in Puerto Rico (provided here) is based on data collected by the Department of Natural and Environmental Resources since 1986 (Rivera-Milán, USFWS, pers. comm.). Although both species are found throughout the Caribbean, little is known about their population status and trends outside of Puerto Rico.

The scaly-naped pigeon is also a year-round resident throughout much of the West Indies, including the islands off Venezuela. It is a vagrant on Jamaica. This pigeon is a habitat generalist that occurs from coastal dry forests to high-elevation wet forests, coffee plantations and suburban areas. The estimated density of the scaly-naped pigeon on Puerto Rico ranged from 0.07 to 0.54 individuals per hectare (Figure 5) and population size ranged from 29,847 to 219,559 individuals in 1986–2010 (Rivera-Milán, USFWS, unpublished manuscript). The scaly-naped pigeon recovered from low numbers in the 1980s probably due to reforestation in abandoned agricultural areas. Currently the scaly-naped pigeon population is stable on Puerto Rico. On average, 21,048 scaly-naped pigeons are harvested annually by about approximately 3,000 hunters.

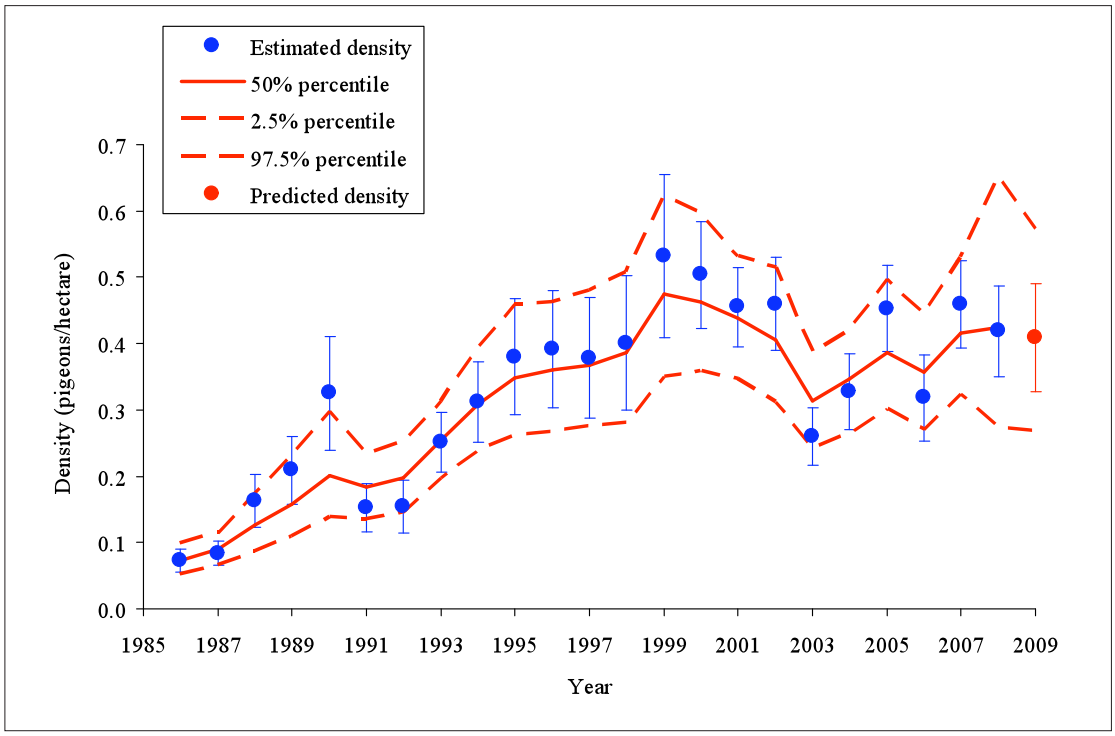

Figure 5. Estimated density of scaly-naped pigeons on Puerto Rico in 1986–2010 (Rivera-Milán, USFWS, unpublished manuscript).

The Zenaida dove is a year-round resident of the West Indies. It is also found on the coast of the Yucatan Peninsula and offshore islands, and is reported occasionally in coastal areas of southern Florida. It is a habitat generalist that occurs from coastal dry forests to high-elevation wet forests, agricultural areas, plantations, shrublands, suburban and urban areas. The estimated density of Zenaida doves on Puerto Rico ranged from 0.53 to 1.31 individuals per hectare (Figure 6) and population size ranged from 303,305 to 749,679 individuals from 1986–2010 (Rivera-Milán, USFWS, unpublished manuscript). The Zenaida dove population

has remained stable since 1986. Zenaida doves benefitted from a mixture of agriculture and fragmented landscapes during the 1900s. On average, 2,839 Zenaida doves are harvested annually by approximately 3,000 hunters.

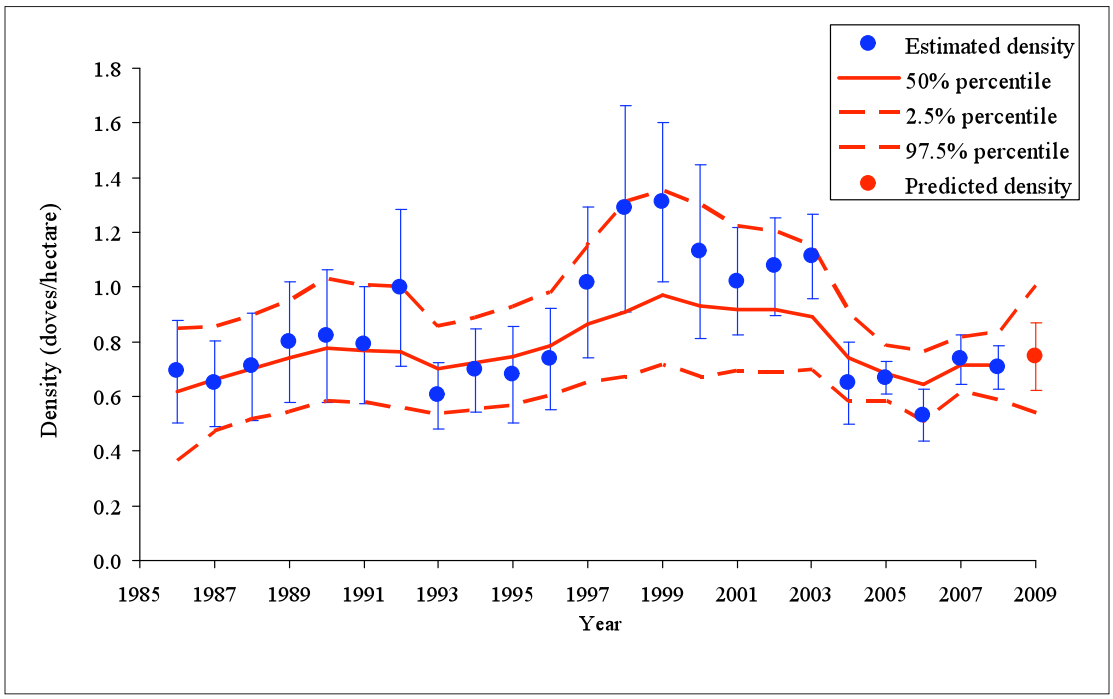

Figure 6. Estimated density of Zenaida doves on Puerto Rico in 1986–2010 (F. F. Rivera-Milán, USFWS, unpublished manuscript).

Priority Information Needs

Discussions during three online meetings resulted in the identification of five priority information needs for band-tailed pigeons, Zenaida doves, white-tipped doves and scaly-naped pigeons (in no particular order):

1. Reliable demographics of band-tailed pigeons.
2. Association of food availability with abundance and distribution of band-tailed pigeons.
3. Status assessment of white-tipped doves in south Texas to determine distribution, population abundance and biology.
4. Population and harvest data collected annually for Zenaida doves and scaly-naped pigeons.
5. Adaptive harvest strategy for Zenaida doves and scaly-naped pigeons.

Rationale, descriptions, timetables and costs for each of the priorities follow.

GUIDELINES

Workshop participants identified two overarching guidelines that should be considered in further development of each of the five priority information needs.

1. Consider the effects of climate or ecosystem change on band-tailed pigeon, Zenaida dove, white-tipped dove and scaly-naped pigeon habitats and ultimately on the abundance and distribution of these species.
2. Actively engage other countries. It is important to consider the role that habitat and harvest management decisions in other countries have on the overall management of these species. New or expanded information-gathering activities should be range-wide in scope.

Priority 1. Reliable demographics of band-tailed pigeons.

RATIONALE

Estimates of range-wide demographics (abundance, harvest and vital rates) are critical to assess the status of both band-tailed pigeon populations in North America, to ensure their long-term conservation and to help inform harvest management decisions. Reliable estimates of band-tailed pigeon abundance and vital rates on an annual or other periodic basis are currently lacking. Two existing surveys (one limited to the Pacific Coast population) provide trends in breeding population abundance over time, but provide no information about absolute population size. The ability of both existing surveys to accurately index population abundance over time has not been evaluated. Other methods for estimating abundance of band-tailed pigeons have been studied, but only on a limited spatial and temporal basis.

Surveys of band-tailed pigeon total harvest and age ratios in the harvest exist, but estimates are imprecise and may be biased due to challenges associated with identification of an appropriate sampling frame (i.e., active band-tailed pigeon hunters). Sample sizes (number of wings submitted) are currently inadequate to reliably estimate age ratio of the harvest for the Interior population due to inability to identify active band-tailed pigeon hunters.

Available range-wide vital rate estimates (survival and recovery or harvest rates) for Interior and Pacific Coast band-tailed pigeons are currently 30–40 years out of date. More contemporary vital rates estimates are limited spatially and temporally. Periodic estimation of range-wide vital rates is necessary for population status assessment and to identify factors that affect vital rates and regulate population size. Food availability and trichomoniasis may have profound effect on survival rates, especially young birds. Also, existing data is inadequate to evaluate differential vulnerability rates between young and adult birds. This information would allow more reliable estimation of recruitment from age-specific harvest data.

DESCRIPTION

A method for reliably estimating range-wide abundance of band-tailed pigeons is primarily needed, especially absolute abundance on an annual or other periodic basis. This may involve either developing a species-specific survey for both the Interior and Pacific Coast populations to estimate absolute abundance or evaluation and modification as necessary of existing surveys of relative abundance.

Evaluation and refinement of harvest-survey sample frames are necessary to improve the reliability of estimates of total harvest and the age ratios of the harvest. A complete sample frame of all active band-tailed pigeon hunters will reduce potential bias in estimation of hunter activity and harvest, and ability to correctly identify active and non-active band-tailed pigeon hunters in the sample frame will improve precision in estimation of hunter activity and harvest.

Also needed is examination of the feasibility to conduct periodic range-wide banding programs to provide reliable estimates of survival rates, harvest rates and age-related differential vulnerability to harvest. Banding programs also would provide information on the distribution of band-tailed pigeons.

TIMETABLE AND COST

The total estimated cost to develop and implement a survey to estimate absolute abundance over 2–4 years is $500,000 for each population. Alternatively, the total estimated cost for evaluation of existing surveys for unbiased estimation of relative abundance over 2–4 years is $400,000 for each population.

The total estimated cost for improving the sampling frame of surveys to provide more reliable estimates of total harvest and age ratios of the harvest over 2–4 years is $350,000.

The total estimated cost to conduct the feasibility study of range-wide banding programs over 2–4 years is $150,000 for each population.

Priority 2. Association of food availability with abundance and distribution of band-tailed pigeons.

RATIONALE

Understanding the cause of apparent long-term population declines and the factors that currently limit population size in both band-tailed pigeon populations remains a high priority as identified in Flyway management plans for this species.

Researchers recently found that band-tailed pigeons are highly mobile habitat generalists (Leonard 1988, Sanders 2000, 2003). Considering all habitat components and their juxtaposition, none appear to currently limit population size with the exception of food availability. Food availability has the potential of limiting population distribution, abundance and productivity. Band-tailed pigeons generally have high fidelity to a given area, but if food availability is unfavorable in a given region, these birds may show nomadic behavior.

The extent to which the range-wide distribution and abundance of food items have changed over time and the effect on band-tailed pigeon populations is unknown. A reduction in agricultural crops near mountain areas has resulted in a substantial apparent decline in band-tailed pigeon abundance in Colorado (Szymczak and Funk 1993). Native mast seed and berry producing shrubs can be prevalent in early to intermediate forest successional stages. Factors that can affect the availability of these food resources include: 1) fire suppression; 2) herbicide application following intensive harvest; 3) intensive reforestation practices; 4) clearing for agricultural practices; and 5) harvest for medicinal use. Although the overall distribution of shrubs has not likely changed, the volume of mast seed and berry production most likely has changed in relation to shrub composition, number, size, form and overstory shading.

DESCRIPTION

Evaluate current food availability for band-tailed pigeons and model how food availability may have changed over time based on natural events and land management practices. Studies should examine if food availability currently limits population abundance and is associated with apparent long-term population declines.

TIMETABLE AND COST

The total estimated cost for this priority over 2–4 years for each population is $350,000.

Priority 3. Status assessment of white-tipped doves in south Texas to determine distribution, population abundance and biology.

RATIONALE

A status assessment of white-tipped dove in south Texas will aid in harvest management decisions. Very little information on white-tipped dove life history and biology is available, preventing managers from adequately managing this harvested species. A series of research projects on white-tipped dove biology need to be conducted to be able to adequately assess the population abundance and distribution, vital rates, movements and dispersal of white-tipped doves in south Texas.

DESCRIPTION

A series of research projects conducted in south Texas in the mid 1980s focused on some aspects of life history such as nesting chronology, distribution, movements and habitat associations but no research has been conducted since then. A more current investigation of density and distribution is warranted to better manage for this species. A targeted series of research projects addressing the biology of white-tipped doves needs to be conducted in south Texas. Research needs include determining population estimates, distribution, survival rates, productivity, population size and habitat requirements in south Texas. A better understanding of current population estimates and distribution will aid in developing better harvest estimates and an overall management objective for the species.

An evaluation of survey methodologies to improve techniques to detect and monitor white-tipped dove populations in Texas needs to be conducted. White-tipped doves are known to be a relatively sedentary species with limited and spotty distribution, all factors compounding the ability to adequately survey this species. White-tipped doves had the narrowest nesting habitat requirement of the three dove species, only nesting in areas with tress >3m tall with a canopy coverage >70% (Hayslette et al. 2000). Based on this information, white-tipped doves might lend themselves to targeted habitat associated surveys using DISTANCE (Collins et al. 2010). Distribution of white-tipped doves across the landscape might also be better understood using land cover type associations.

Research targeted toward establishing population abundance and distribution may be the only feasible tools available for better understanding this species based on biological characteristics and funding availability.

TIMETABLE AND COST

The estimated cost to conduct the survey methodology research over a 3–5 year period is $50,000/year.

Priority 4. Population and harvest data collected annually for Zenaida doves and scaly-naped pigeons.

RATIONALE

For modeling and decision making purposes, conducting population and harvest monitoring annually are of critical importance for the management of pigeons and doves. Since 1986, personnel from the Puerto Rico Department of Natural and Environmental Resources have been monitoring pigeons and doves using distance sampling surveys to estimate density and population size and wing surveys to estimate total harvest and the species composition of the harvest on Puerto Rico.

The wing survey for pigeons and doves on Puerto Rico was discontinued in 2007 because the post office declined to deliver wing envelopes. Negotiations continue but the alternatives explored so far are too costly. A questionnaire was used instead of the wing survey in 2009 but the sample was small and biased. Another problem is that hunting statistics are based on the mean number of hunters estimated from license data collected in 1982–1989, because current information on hunter numbers is lacking. Efforts are underway to establish a pigeon and dove stamp and obtain license data annually. Also in 2009, the Department of Natural and Environmental Resources decided to monitor the populations biennially due to the cost of conducting island-wide surveys.

Zenaida doves are hunted on St. Croix but not on the United States Virgin Islands. Scaly-naped pigeons are not hunted on the United States Virgin Islands. The Zenaida dove and scaly-naped pigeon populations of Puerto Rico and United States Virgin Islands should be monitored annually as part of the same regulatory cycle.

DESCRIPTION

The objective of distance sampling and wing surveys is to estimate abundance and total harvest annually as part of a regulatory cycle that includes population monitoring, model updating, decision making based on distance sampling estimates and model predictions, and harvest monitoring. Population and harvest thresholds have been established through monitoring and model-based predictions about future status.

Density and abundance estimates are reasonably precise (CV = 0.1–0.2) but pigeon and dove populations can show wide fluctuations annually due to weather conditions and food abundance in dry and humid forests. The Zenaida dove is abundant and total harvest is a small fraction of population size. In contrast, the scaly-naped pigeon population recovered from low numbers in the 1980s and is harvested at about 0.75 of its maximum sustained yield. Therefore the scaly-naped pigeon population should be monitored annually to maintain density at or above 0.34 individuals/hectare and abundance at or above 130,000 individuals in at least 408,863 hectares of available habitat on the island. Having independent measures of harvest and abundance trends is a management priority.

In 2004 and 2005, distance sampling surveys were conducted by personnel from the Department of Planning and Natural Resources on St. Croix. Surveys were not conducted in other years. However, scaly-naped pigeons were abundant and hunting may be sustainable given that there were less than 20 licensed hunters on St. Croix in 2004–2005.

TIMETABLE AND COST

Population monitoring. The total estimated cost for island-wide surveys is $100,000/year. The request is for $25,000/year for five years, after which the need for annual population monitoring will be reevaluated. This funding is in addition to financial support from U.S. Fish and Wildlife Service Region 4 and Department of Natural and Environmental Resources through Federal Aid projects. This funding addition will be used to increase the number of observers conducting island-wide distance sampling surveys and ensure that the surveys are conducted annually.

The United States Virgin Islands should be included in management-based monitoring efforts using distance sampling to estimate density and population size and determine if hunting is sustainable. The total estimated cost is $15,000/year for two years. This funding is in addition to U.S. Fish and Wildlife Service Region 4 funds.

Harvest monitoring. Wing envelopes and/or questionnaires are sent to all licensed hunters (N ~5,000) to obtain a representative sample (n ≥ 500). The cost of monitoring the harvest through the wing survey and/or questionnaire is $75,000/year. The request is for $15,000/year for five years to develop and test methods that are acceptable to the postal service or perhaps a private mail carrier. This funding is in addition to financial support from U.S. Fish and Wildlife Service Region 4 and Department of Natural and Environmental Resources through Federal Aid projects. This funding addition will be used to increase sample size of the wing survey and/or questionnaire.

Priority 5. Adaptive harvest strategy for Zenaida doves and scaly-naped pigeons.

RATIONALE

Implementing structured decision making and adaptive harvest management is critically important for sustainably harvesting scaly-naped pigeon and Zenaida dove populations on Puerto Rico. Despite progress in the integration of research, monitoring and management, distance sampling surveys are mainly used for surveillance monitoring (i.e., determining if the population is below or above the established threshold), which is not guided by hypotheses and associated models of population response to management and is not formally integrated into a decision making framework.

With the monitoring and modeling framework in place, the next step is the implementation of structured decision making and adaptive harvest management to make informed regulatory decisions in the face of uncertainty due to imperfect knowledge about population state and population response to management actions, imperfect monitoring of population state, unpredictable environment and incomplete control of management actions.

DESCRIPTION

An adaptive harvest strategy will include population monitoring, model updating, setting of regulations based on density and abundance estimates from distance sampling data and model predictions, and harvest monitoring. Collaboration between scientists and managers will be necessary to define ecological, utility and decision thresholds based on specific management objectives and alternatives, population and harvest monitoring data, and predictive models about population response to management action.

TIMETABLE AND COST

Taking the next step will require refinement of the monitoring and modeling framework in place; as well as hands-on training of wildlife biologists and managers from Department of Natural and Environmental Resources. The total estimated cost is $10,000/year for five years. Data analysis, modeling and training will be conducted by wildlife biologists from the Branch of Population and Habitat Assessment, Division of Migratory Bird Management, U.S. Fish and Wildlife Service.

Measuring Success

The priorities described in this Strategy promote efforts to reduce uncertainty in current management practices. Improved information will enable managers to target site-specific and range-wide management and monitoring programs, increasing the cost-effectiveness of management.

Specific outcomes expected for each priority include:

Priority 1 & 2:

- Success in addressing the priority needs described in this strategy will reduce uncertainty in assessing band-tailed pigeon population status in North America and increase our knowledge of the ecology and habitat requirements of this species. Ultimately, these priorities build on the foundation of current efforts in a way that ensures the long-term conservation and informed harvest management of these critically important birds in a changing environment.

Priority 3:

- Development of a survey protocol to establish a baseline population estimate and distribution of white-tipped doves in south Texas.

Priority 4:

- Collect island-wide population and harvest data annually in 2011–2015. Estimate density and abundance with precision (desired coefficient of variation, CV = 0.1–0.2). Obtain a representative sample of hunting licenses (desired sample size, $n \geq 500$).

Priority 5:

- Develop an adaptive harvest strategy for Zenaida doves and scaly-naped pigeons, including population monitoring, harvest model updating, setting regulations and harvest monitoring for 2011–2015.
- In 2011–2015, offer two training workshops to wildlife managers and biologists from the Puerto Rico Department of Natural and Environmental Resources.

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Appendix A

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