

Puerto Rican plain pigeon or paloma sabanera
(Patagioenas inornata wetmorei = Columba inornata wetmorei)

**5-Year Review:
Summary and Evaluation**



November 2011

**U.S. Fish and Wildlife Service
Southeast Region
Caribbean Ecological Services
Boquerón, Puerto Rico**

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5-YEAR REVIEW
Puerto Rican Plain Pigeon or paloma sabanera
(Patagioenas inornata wetmorei)

I. GENERAL INFORMATION

A. Methodology used to complete the review

On September 12, 2005, the Service published a notice in the *Federal Register* (70 FR 53807-53808) announcing the 5-year review of the Puerto Rican plain pigeon (plain pigeon; *Patagioenas inornata wetmorei*, previously known as *Columba inornata wetmorei*) and requesting new information concerning the biology and status of the species. A 60-day comment period was opened. No information on the plain pigeon was received from the public. No part of the review was contracted to an outside party. The review was also sent to three peer reviewers (Appendix A).

This 5-year review was prepared by a Service biologist and includes information that the Service has gathered since the plain pigeon was listed on October 13, 1970 (35 FR 16047-16048). The review is based on available information from our species' file, including distribution and status reports, captive breeding reports, and the best available information on the species' biology and ecology. Sources of information included the Recovery Plan, peer-reviewed literature, unpublished field observations and reports by Commonwealth and Service biologists, and communications from other qualified biologists and experts.

**Please see Addendum 1 (pages 25-30) for updated information on the Puerto Rican plain pigeon that we have gained while conducting our new five-year review initiated in 2016 (81 FR 56692). Our new signature page is included on page 23. What precedes this new information (pp. 1-24) is the first five-year review announced in September 12, 2005 (70 FR 53807-53808) and completed and signed in 2011.*

B. Reviewers

Lead Region: Nikki Lamp, Southeast Regional Office, Atlanta, Georgia.
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Lead Field Office: Dr. José A. Cruz-Burgos, Caribbean Ecological Services Field Office, Boquerón, Puerto Rico. (787) 851-7297 x208

C. Background

1. FR Notice citation announcing initiation of this review: September 12, 2005; 70 FR 53807-53808

2. Species Status: (2011 Recovery Data Call) Stable. The plain pigeon population declined after 1998 and is currently at low numbers (Rivera-Milán 2011, p. 5). In 2010, the estimated density and population size of the species was 0.02 individuals/hectare (ind/ha) and 5,809 individuals, respectively (Rivera-Milán 2011, p. 1). During April-

June 2011, the predicted density is 0.02 ind/ha, and predicted population size is 6,749 individuals (Rivera-Milán 2011, p. 1). However, the species continues to be threatened with extinction since it has not reached desirable density and abundance levels. Furthermore, stochasticity may drive population fluctuations at low numbers, which can be exacerbated in the face of climate change, habitat loss and other threatening factors. Overutilization for commercial or recreational purposes and inadequacy of existing regulatory mechanisms are not considered threats to the species. Habitat modification or destruction, disease or predation, and other natural or manmade factors continue to be threats to the species. Moreover, reproductive capacity, survival rate, and resource use and availability may all be very important, but data are lacking to elucidate the mechanisms driving the population dynamics of plain pigeons.

3. Recovery Achieved: 1 (0-25%) of species recovery objectives achieved. The following recovery tasks in the Recovery Plan have been completed: Task 22 (Establish captive reproducing flock of Puerto Rican plain pigeons), Task 2422 (Experimental release of captive-bred plain pigeons on limited scale), and Task 2423 (Monitor experimental release success through visual and telemetric methods). Tasks 11214 and 11312 (Education program) and Task 3 (Monitor population levels and range), are on-going.

4. Listing History

Original Listing:

FR notice: 35 (109) FR 16047-16048

Date listed: October 13, 1970

Entity listed: Subspecies

Classification: Endangered

Revised Listing: None

5. Associated rulemakings: None

6. Review History: The Puerto Rican Plain Pigeon Recovery Plan, approved and signed on October 14, 1982 (USFWS 1982) is the most recent published comprehensive analysis of the species' status and was used as the reference point document for this 5-year review. The species' status has also been reviewed annually since 2000 through our Recovery Data Call.

7. Species' Recovery Priority Number at start of review: 3c. The plain pigeon is recognized as a subspecies with a high degree of threat and high recovery potential. The "c" indicates conflict with development activities.

8. Recovery Plan or Outline:

Name of plan: Puerto Rican Plain Pigeon Recovery Plan

Date issued: October 14, 1982

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

- 1. Is the species under review listed as a DPS? No.**
- 2. Is there relevant information that would lead you to consider listing this species as a DPS in accordance with 1996 policy? No.**

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria? No. The plain pigeon has an approved recovery plan establishing delisting as the recovery goal; however, it does not include objective and measurable delisting criteria.

2. Adequacy of recovery criteria

- a. Do the recovery criteria reflect the best available (most up-to-date) information on the biology of the species and its habitat? No.**
- b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and there is no new information to consider regarding existing or new threat)? No.** The plan did not include a 5-listing factor analysis.

3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.

The approved recovery plan established that the plain pigeon could be considered for delisting when the following objectives are accomplished:

- a. Achieve a minimum of two, distinct, wild plain pigeon populations, each consisting of at least 250 nesting pairs (5-year average).**

- b. Secure most of the existing plain pigeon habitat of the Cidra-Cayey population.
- c. Commit the Río Abajo Commonwealth Forest or its equivalent as a reintroduction and management site for a second, disjoint population of plain pigeons.

These objectives have not been met because efforts have not been initiated to establish two distinct populations of the plain pigeon; the existing plain pigeon habitat in Cidra and Cayey has not been secured; and steps have not been initiated to commit the Río Abajo Commonwealth Forest, or its equivalent, as a reintroduction and management site for a second plain pigeon population.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Is there relevant new information regarding the species' abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g. age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends? Yes.

The Puerto Rican plain pigeon was considered almost extinct in the 1930s (Danforth 1931, p. 68), but in 1963 a small population of 52 individuals was found in Cidra. Under the Endangered Species Conservation Act of 1969, the species was listed as endangered throughout its range in 1970 and then received increased Federal protection with the passage of the Endangered Species Act (Act), as amended, in 1973. Until recently, information regarding the status of the plain pigeon population was incomplete. Pérez-Rivera (1977a, p. 77) stated that the plain pigeon population in east-central Puerto Rico was less than 200 individuals. Other estimates reflect that a population increase occurred between the 1970s and 1990s (Rivera-Milán et al. 2003a, p. 45). However, no census (detection probability $P = 1$) or count ($P < 1$) existed to estimate density and abundance of plain pigeons until distance sampling surveys started in 1986 (Rivera-Milán et al. 2003a, p. 45).

Plain pigeon density and abundance estimates were calculated from 1986-2010 based on point-transect distance sampling data collected during each of those years. This data shows that the species increased from low numbers in the 1980s until the late 1990s, although a population decline was observed in 1990 following the passage of hurricane Hugo in 1989 (Table 1). Then, an overall population increase was observed between 1991 and 1998, when hurricane Georges struck Puerto Rico (Table 1). The plain pigeon population showed signs of recovery after this hurricane, but declined again after 2001 and has not recovered to pre-hurricane densities, although an increase in population density has been observed from 2008-2010 (Table 1).

Table 1. Puerto Rican plain pigeon density and abundance estimates based on point-transect distance sampling data collected in Puerto Rico during 1986-2010 (Rivera-Milán, unpubl. manuscript).

Year	D	D SE	D CV	N Predicted Habitat	N SE	Surveyed Area (ha)	N Surveyed Area	N SE
1986	0.007	0.002	0.251	2,055	516	22,321	150	38
1987	0.015	0.003	0.212	4,724	1,001	22,321	344	73
1988	0.016	0.004	0.225	4,908	1,104	22,321	357	80
1989	0.014	0.003	0.251	4,264	1,070	22,321	310	78
1990	0.005	0.002	0.372	1,534	571	22,321	112	42
1991	0.013	0.004	0.351	3,834	1,346	22,321	279	98
1992	0.023	0.009	0.373	7,055	2,632	22,321	513	191
1993	0.024	0.009	0.372	7,209	2,682	22,321	525	195
1994	0.046	0.016	0.341	14,111	4,812	22,321	1,027	350
1995	0.041	0.012	0.303	12,577	3,811	22,321	915	277
1996	0.081	0.024	0.299	24,847	7,429	22,321	1,808	541
1997	0.075	0.027	0.360	23,007	8,289	22,321	1,674	603
1998	0.102	0.032	0.314	31,289	9,816	33,148	3,381	1,061
1999	0.037	0.019	0.514	11,350	5,828	33,148	1,226	630
2000	0.041	0.015	0.366	12,577	4,601	45,799	1,878	687
2001	0.058	0.018	0.310	17,792	5,522	62,829	3,644	1,131
2002	0.040	0.014	0.350	12,270	4,295	63,924	2,557	895
2003	0.033	0.012	0.364	10,123	3,681	70,553	2,328	847
2004	0.018	0.008	0.444	5,522	2,454	71,527	1,287	572
2005	0.016	0.006	0.375	4,908	1,841	73,411	1,175	440
2006	0.018	0.008	0.442	5,522	2,442	73,411	1,321	584
2007	0.019	0.009	0.463	5,828	2,696	69,215	1,315	608
2008	0.032	0.012	0.384	9,816	3,770	60,093	1,923	739
2009	0.036	0.006	0.167	11,043	1,841	83,629	3,011	502
2010	0.031	0.003	0.107	9,509	1,018	53,827	1,669	179

Notes:

1. D = density, N Predicted Habitat = population estimate in plain pigeon predicted habitat (PR GAP Project), N Surveyed Area = population estimate within surveyed area.

Notes: (continued)

2. Extrapolation of estimated density beyond the surveyed area is justified given that there is no difference in detection and abundance at on-road and off-road points. This argument based on 1,375 on-road and off-road points surveyed in March-July 1998-2010 (PRDNER Project W-16; Rivera-Milán et al., unpubl. data).

3. Not accounting for false absence due to imperfect detection, habitat covers at least 306,755 ha (Gould et al. 2008, PR GAP project).

4. Maps of probability of occurrence and abundance accounting for imperfect detection can be prepared using hierarchical distance sampling, count-removal sampling, and repeated-count sampling (Rivera-Milán et al., unpubl. data).

5. Based on a Bayesian state-space model of population dynamics, predicted density is 0.023 (95% credible interval = 0.013, 0.044) for 2011-2015 (Rivera-Milán et al., unpubl. manuscript).

Based on the Bayesian state-space model for the population dynamics of game and nongame species, Rivera-Milán (unpubl. data), predicted an average plain pigeon density of 0.023 individuals/ha for 2011-2015. This density extrapolated to the 306,755 ha of the predicted plain pigeon habitat on the Island (Gould et al. 2008, p. 91, PR GAP Project), results in a predicted average abundance of 7,055 (3,988 to 13,498) individuals (Rivera-Milán, unpubl. data). Rivera Milán (pers. comm., 2011) indicates that the plain pigeon population never fully recovered from the impact of Hurricane Georges and the loss of habitat in east-central Puerto Rico. However, the species seems to be moving to montane forests surrounding farms in the karst region (e.g., in the municipalities of Corozal, Morovis, Ciales, and Florida) possibly due a rapid and largely unmitigated development occurring in similar habitats in Aguas Buenas, Caguas, Cidra, Comerio and other municipalities within their traditional range of distribution (Rivera-Milán 2011, p. 1).

Based on the distance sampling data collected during 1986-2010, the plain pigeon should reach carrying capacity at a density of 0.05 ind/ha in the 306,755 ha of the predicted habitat for the species on the Island (Rivera-Milán, unpubl. manuscript). The maximum intrinsic growth rate of the species is 0.31, which indicates that the plain pigeon population may increase rapidly under favorable conditions (Rivera-Milán, unpubl. manuscript).

The plain pigeon appears to nest year-round, since nests have been found in January, February, March through August, and November (Pérez-Rivera 1978, p. 95). However, a peak of nest density usually occurs between the second week of April and second week

of June, with flocking behavior becoming conspicuous in July-August (Rivera-Milán 2001, p. 335, Rivera-Milán et al. 2003b, p. 471-476).

Plain pigeon nesting success oscillated between 15 and 70%, with an average of 42%, between 1975 and 1995 in the municipality of Cidra (Pérez-Rivera and Ruiz-Lebrón, unpubl. data). During 1997 and 1998, 102 and 166 nests were found, respectively, along road PR 172 between the municipalities of Cidra and Comerio (PRDNER 2000, p. 6). Nest success in 1997 and 1998 was 48% and 47%, respectively (PRDNER 2000, p.7). Nest abundance and density were also estimated from data gathered during 1997 and 1998 along strip transects located in forested areas near a school and at Finca Longo, also at road PR 172. The total area covered by these strip transects was 8 ha. Nest density in strip transects was estimated at 13.56 nests/ha during 1997 and 40.26 nests/ ha during 1998 (PRDNER 2000, p. 6).

Between 1986 and 1999, 377 plain pigeon nests were monitored in east-central Puerto Rico (i.e., Aguas Buenas, Caguas, Cayey, Cidra and Comerio) and an average of 0.5 fledglings were produced per nesting pair (Rivera-Milán et al. 2003b, p 473). The overall nest survival was 40% during the nesting period, 63% during the incubation period, and 66% during the nestling period (Rivera-Milán et al. 2003b, p. 473). Based on this finding, Rivera-Milán et al. (2003b, p. 376) suggested that protection from hunting and poaching, as well as recovery of second-growth forest between the 1970s and 1990s, caused an increase in survival rate, which in turn resulted in an increase of the nesting population, and the number of hatching-year individuals reaching sexual maturity and reproducing successfully. Moreover, Rivera-Milán (2001, p. 340) found that food abundance was the most important predictor of changes in the nest density of columbids, including the plain pigeon.

A number of plain pigeon releases have been conducted by the PRDNER and telemetry data has been collected for captive-reared and wild plain pigeons (PRDNER 2005, p. 6). In these releases, the body mass of captive-reared plain pigeons (n = 28) decreased from 334.6 g to 316.9 g at the time of release (PRDNER 2005, p. 25), which probably lowered their 90-day survival rate ($\phi = 0.50$; Rivera-Milán 2011, p. 3). In comparison, wild plain pigeons (n = 19, body mass = 339.1 g) had a 90-day survival rate of 0.80 (Rivera-Milán 2011, p. 3). However, these survival rate estimates are imprecise and most likely biased low due to small sample sizes (Rivera-Milán, 2011, p. 3).

b. Is there relevant new information regarding the species' genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.)? Yes.

Miyamoto et al. (1994, p. 911) studied the genetic variation among 20 surviving founders (9 males and 11 females) of the plain pigeon captive breeding program held at the University of Puerto Rico, Humacao Campus. The purpose of the study was to relate

variability of founders to the captive-bred descendants and the population of plain pigeons from the municipality of Cidra. The variation was quantified for nuclear DNA by DNA fingerprinting and for mitochondrial DNA (mtDNA) by sequencing of its control region.

The results of this study suggested a similar level of nuclear DNA variation for the 20 founders (Miyamoto et al. 1994, p. 912). The results of the DNA fingerprinting and the mtDNA polymorphism were considered uncoupled, as expected for a random mating population (Miyamoto et al. 1994, p. 912). In conclusion, both sets of DNA data indicated that the 20 founders of the recovery program were characterized by low levels of genetic variability (Miyamoto et al. 1994, p. 914). As these 20 birds were initially sampled randomly from the Cidra population, the same conclusion would apply to the remaining wild flock in Puerto Rico, which endured a severe bottleneck between 1926 and 1958 (Miyamoto et al. 1994, p. 914). An alternative explanation for the low levels of variation found is that the DNA regions studied evolved at unusually slow rates, but this possibility is unlikely since the pattern was exhibited by both nuclear and mtDNA genomes (Miyamoto et al. 1994, p. 914).

c. Is there relevant new information regarding taxonomic classification or changes in nomenclature? Yes.

On the basis of studies by Johnson and Clayton (2000) and Johnson et al. (2001) of nuclear and mtDNA and reviews of morphological (Ridgway 1916), serological (Cumley and Irwin 1944), and behavioral (Johnston 1962) characters, New World pigeons formerly included in the genus *Columba* were placed in the genus *Patagioenas* Reichenbach, 1853 (Banks et al. 2003, p. 69 and 73). Therefore, while listed as *Columba inornata wetmorei*, taxonomic research has revealed that the Puerto Rican plain pigeon be recognized as *Patagioenas inornata wetmorei*. This taxonomic change has been accepted by the scientific community (Integrated Taxonomic Information System 2011).

Three subspecies of the plain pigeon were described in 1915 from very small samples, and the diagnostic color differences among them were rather minor (Banks 1986, p. 629). Further examination of samples found in the National Museum of Natural History (USNM) revealed that the quality of the material available in 1915 was poor and suggested that the supposed distinctive characters were not consistent (Banks 1986, p. 629) Banks (1986, p.630) concluded that *Columba inornata* (now *Patagioenas inornata*) should be considered a monotypic species, as previous taxonomic distinction of separate insular populations was based on samples that were inadequate in size to show the extent of intrapopulation variation in color.

The Puerto Rican plain pigeon is a large bird about the size and shape of a domestic pigeon (*Columba livia*), but with an overall grayish-brown coloration washed with a tinge of maroon color. It is one of three subspecies of plain pigeon recognized in the West

Indies: *P. inornata inornata* from Cuba, Isle of Youth (Isle of Pines), and Hispaniola; *P. inornata exigua* from Jamaica; and *P. inornata wetmorei* from Puerto Rico (Bowdish 1903, p. 23; Wetmore 1927, p. 392-394; Danforth 1929, p. 365; Del Hoyo et al. 1996, p. 127-128). However, Banks (1986, p. 631) indicated that the Puerto Rican plain pigeon population cannot be separated from other populations at the subspecies level. Banks (1986, p. 631) did not find specific indication that the specimen of plain pigeon taken in Puerto Rico in 1962 was identified by Alexander Wetmore as the Puerto Rican plain pigeon. Thus, the identification of such bird as the subspecies *wetmorei* cannot be accepted as evidence that the Puerto Rican population continued to exist, unreported by ornithologists from 1926 until 1958 (Banks 1986, p. 631). Banks (1986, p. 631) indicated that the specimen matched individuals from Hispaniola and Cuba taken in the 1920s. Later on, Pérez-Rivera (1990, p. 21) indicated that the data presented by Banks (1986) did not support his own hypotheses because the conclusions were drawn from small samples and Banks neither conducted cytogenetic nor behavioral studies. Pérez-Rivera (1990, p. 22) presented both morphometric and behavioral information that, according to him, suggested particular differences between plain pigeons from Hispaniola and Puerto Rico. Therefore, the Puerto Rican plain pigeon is still recognized as one of three subspecies of plain pigeon.

d. Is there relevant new information regarding the species' spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g., corrections to the historical range, change in distribution of the species within its historic range, etc.)? Yes.

From the rediscovery of the plain pigeon in 1963 until the late 1980s, the only confirmed populations of Puerto Rican plain pigeons occurred in the municipality of Cidra, and parts of the surrounding municipalities of Aguas Buenas, Aibonito, Caguas, Cayey, and Comerío in east-central Puerto Rico (Pérez-Rivera and Collazo-Algarín 1976a, p. 52; Ruiz-Lebrón 1994, p. 6). However, additional sightings of the species have been recorded in other municipalities; such as Aguadilla, Cabo Rojo, Camuy, Guayama, Luquillo, Mayagüez, Corozal, Morovis, Orocovis, Ponce, Utuado, Vega Alta, and Vieques (Pérez-Rivera and Collazo-Algarín 1976a, p. 53; PRDNER 1999, p. 3; Rivera-Milán 2011, p. 3).

e. Is there relevant new information addressing habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem)? Yes.

Plain pigeons are habitat generalists that behave as an edge species, nesting, foraging, and roosting in trees at or near roads (Rivera-Milán et al. 2003a, p. 49). It also may be found in areas of continuous secondary growth forest (e.g., gallery forests) or flying through farmlands and urban areas when traveling to feeding or roosting sites (Ruiz-Lebrón et al. 1995, p. 6; Rivera-Milán et al. 2003a, p. 48-49). Plain pigeons also frequent dairy farms and croplands where they supplement their diet with grass seeds and grains leftover from

farming activities (Pérez-Rivera and Collazo-Algarín 1976a, p. 54). For breeding and roosting, the species seems to prefer areas of secondary mature forest, usually in close proximity to creeks or rivers. In fact, sites selected for nesting are always characterized by the presence of dense vegetation and proximity to water (Pérez-Rivera 1978, p. 90). These vegetation associations are common in the lower montane regions of Puerto Rico. Nests are constructed on the branches that radiate from a node of a bamboo (*Bambusa vulgaris*) stem, or in a cradle of vines which intertwine with the outer branches of the nest tree, or a crotch in a branch (Pérez-Rivera 1978, p. 91). The plain pigeon has not been observed nesting outside east-central Puerto Rico (Pérez-Rivera and Collazo-Algarín 1976a, p. 53-54; Rivera-Milán 2001, p. 339).

The massive deforestation in Puerto Rico during the early part of the twentieth century probably caused the decline of the plain pigeon. Extensive clearing of forests began early in the nineteenth century (Capó 1925, p. 48), and by 1828 about one-third of the island was cleared for agriculture (USFWS 1982). However, second-growth forests recovered as agriculture and pastureland were abandoned (Rivera-Milán et al. 2003b, p. 471). Indeed, forest recovery exceeded development between 1977 and 1989, but the contrary occurred between 1989 and 1995 (Ramos-González 2001, p. 103). Habitat destruction in the form of road construction, recreational activities, and land clearing, associated with agricultural, residential, and tourism development, has been identified as the primary factor threatening the Puerto Rican plain pigeon (Pérez-Rivera 1990, p. 24; Rivera-Milán 1996, p. 100 and 105; Rivera-Milán et al. 2003b, p 467 and 477; Pérez-Rivera and Ruiz-Lebrón, unpubl. data). Therefore, the population status of plain pigeons depends primarily on the conservation and management of remaining forests and abandoned pasturelands (Rivera-Milán 2011, p. 4). Moreover, as detections of plain pigeons are increasing in the northern limestone and karst-belt region, it would not be surprising to find the species nesting outside their traditional range of distribution (Rivera-Milán 2011, p. 4).

f. Is there any other relevant information on the species? Yes.

After being considered extinct in the late 1940s, a small population of plain pigeons was found in 1963 in the municipality of Cidra. In 1982, an aviary was built at the University of Puerto Rico, Humacao Campus, and under a cooperative agreement between the University of Puerto Rico, Humacao Campus, PRDNER, and USFWS, in 1983 the first plain pigeon was brought to the aviary to begin a captive breeding program. The purpose of the captive breeding program was to produce enough plain pigeons to establish an additional sustainable flock outside the species' main range in east-central Puerto Rico.

In 1984, nine chicks were captured from wild nests and brought to the aviary. One of these did not survive. The first plain pigeon squab was produced in the aviary at the end of 1984 from an egg that was artificially incubated, and the squab was hand-raised. In 1988, captive plain pigeons successfully raised the first squab on their own. Some of the

captive-raised pigeons were released into the wild, whereas plain pigeons that were not considered suitable for release remained in the aviary. The first group of plain pigeons was released in 1993 in the Cidra area, after a period of acclimation in a flight cage at the release site. Thirty-one birds were released between 1993 and 1995 in the same area; five individuals were returned to the aviary because they lost weight or were too tame, two were illegally hunted, five were preyed upon presumably by red-tailed hawks (*Buteo jamaicensis*), and four moved outside of telemetry range (Ruiz-Lebrón et al. 1995, p. 5 and 7). Further plain pigeon releases were not conducted in Cidra because of the potential harmful interaction between pigeons and humans due to the close proximity of release sites to urban areas.

2. Five Factor Analysis

(a) Present or threatened destruction, modification, or curtailment of its habitat or range

The massive deforestation in Puerto Rico in the early part of the twentieth century probably caused the decline of the plain pigeon. Extensive clearing of forests began early in the nineteenth century (Capó 1925, p. 48), and by 1828 about one-third of the island had been cleared for agriculture (USFWS 1982). Forest cover reached a low of about 6% in the late 1940s, but increased to about 32 to 42% of the island's area by 1990 (Helmer 2004, p. 30). The economic shift away from agriculture resulted in agricultural lands reverting to forests, but urban expansion and land development have since led to the loss of agricultural and forest land and their associated wildlife (Helmer 2004, p. 30).

The recent rapid development (urbanization and industrialization) of Cidra (Pérez-Rivera 1978, p. 96) and the surrounding municipalities within the last 15 years is the most serious threat to the species' survival. These habitat modification processes have caused the fragmentation of remaining potential habitat for the plain pigeon, and apparently have been the cause of movement of plain pigeons outside their traditional range (Pérez-Rivera 1990, p. 24; Rivera-Milán 1996, p. 100 and 105; PRDNER 2000, p. 17; Rivera-Milán et al. 2003b, p. 467 and 477). Forest recovery in Cidra exceeded urban development between 1977 and 1989, but the contrary was evident between 1989 and 1995 (Ramos-González 2001, p. 103). Valuable roosting and nesting habitat of plain pigeons may presently be at a minimum level, and further alteration and increasing proximity of human activity to this habitat may further reduce available plain pigeon habitat and intensify human-pigeon interactions (Pérez-Rivera 1990, p. 24). Plain pigeons are not widely distributed, and unmitigated development is causing major land cover changes, which may be affecting the reproduction of plain pigeons through loss and fragmentation of second growth forests in east-central Puerto Rico (Rivera-Milán et al. 2003a, p. 47).

Demands of an increasing human population are promoting development, which in combination with catastrophic weather and other factors such as predation, may affect the reproduction of plain pigeons and cause an irreversible population decline (Rivera-Milán

et al. 2003b, p 477). Therefore, destruction, modification, or curtailment of the plain pigeon habitat or range continues to be an important factor threatening the survival and recovery of this species. The magnitude of this threat is high because the plain pigeon habitat is fragmented, and the majority of the breeding population is found on private lands, where an increased level of land development threatens to further reduce and fragment the species habitat and distribution.

(b) Overutilization for commercial, recreational, scientific or educational purposes

Collection of specimens of the plain pigeon for scientific or commercial purposes is not considered a threat to the species. There are no substantive data indicating that this factor could pose a threat to the species.

(c) Disease or predation

Potential sources of nest failure such as rats (*Rattus rattus*) and pearly-eyed thrashers (*Margarops fuscatus*) do not appear to be major problems for the plain pigeon (Pérez-Rivera, University of Puerto Rico, pers. comm., 2001). Rat predation is probably a secondary effect of human disturbance (e.g., rats may destroy the egg or chick after the adult has been flushed from the nest), at least in some cases (Pérez-Rivera, pers. comm. 2001). Red-tailed hawks prey upon adult and juvenile plain pigeons, while red-legged thrushes (*Turdus plumbeus*), pearly-eyed thrashers, night herons (*Nyctanassa violacea* and *Nycticorax nycticorax*), green herons (*Butorides virescens*), cats (*Felis domesticus*), and rats prey on eggs and young chicks (Pérez-Rivera 1978, p. 92; Ruiz-Lebrón et al. 1995, p. 6; PRDNER 1999, p. 7; PRDNER 2000, p. 19; Rivera-Milán et al. 2003b, p. 475.). Green herons also have been observed displacing plain pigeons from their nests (PRDNER 1999, p. 7). Rivera-Milán et al. (2003b, p. 476) found that predator density had a significant negative relationship with nesting success and number of fledglings produced by plain pigeons. However, because predator density was also negatively related to nest density and food abundance, they suggested that predators concentrated in secondary-growth forest fragments during periods of food scarcity and spread out more evenly across landscape when food became abundant.

Pérez-Rivera and Collazo-Algarín (1976b, p. 51) reported parasitism by the warble fly (*Philornis pici*). Fifteen out of 36 captive-raised plain pigeon nestlings (42%) examined by Pérez-Rivera and Ruiz-Lebrón were infected with *Philornis* larvae (Pérez-Rivera, pers. comm. 1999). One nestling infected with 12 warble fly larvae died apparently from the effects of these parasites. Although infestations from internal parasites, such as the trematode *Tanaisia bragai*, were documented only in captive birds (Arnizaut et. al. 1991, p. 203), such events may occur in wild plain pigeons. However, the effect of this trematode on the plain pigeon population is unknown. For instance, the intermediate host of *T. bragai* is a ground snail (*Subulina octona*) that is common throughout the range of the plain pigeon (Arnizaut et. al. 1991, p. 203). Three cases of *Chlamydia* infection were

detected in plain pigeons brought to captivity from the wild between 1995 and 1996 (Pérez-Rivera and Ruiz-Lebrón, unpubl. data), but no mortality from *Chlamydia* was reported. The severity of such infections in the wild population of plain pigeons also is unknown.

There have not been studies about how disease and predators may affect plain pigeon populations, and only circumstantial evidence has been found suggesting that the survival and recovery of the plain pigeon is threatened by disease or predation. Therefore, we believe that the magnitude of threat of this factor on the plain pigeon is moderate to high, but the immediacy of threat to the species is non-imminent.

(d) Inadequacy of existing regulatory mechanisms

Federal and Commonwealth laws protect the plain pigeon. Under the Migratory Bird Treaty Act (MBTA; 50 CFR Part 21), migratory birds, their parts, nests, or eggs may not be possessed, imported, exported, bartered, and offered for sale, purchase, or barter without a valid permit issued pursuant to the provisions of the MBTA. In 1999, the Commonwealth of Puerto Rico approved the Law No. 241 known as the “Nueva Ley de Vida Silvestre de Puerto Rico” (New Wildlife Law of Puerto Rico). The purpose of this law is to protect, conserve, and enhance both native and migratory wildlife species; declare property of Puerto Rico all wildlife species within its jurisdiction, and regulate permits, hunting activities, and exotic species, among others. In 2004, the PRDNER approved the “Reglamento para Regir el Manejo de las Especies Vulnerables y en Peligro de Extinción en el Estado Libre Asociado de Puerto Rico” (Regulation 6766 to regulate the management of threatened and endangered species in Puerto Rico). This regulation includes the list of all species designated as threatened and endangered by the Commonwealth of Puerto Rico and the Endangered Species Act of 1973, as amended. Thus, the Puerto Rican plain pigeon is included as an endangered species in Regulation 6766.

Based on the presence of Federal and Commonwealth laws and regulations protecting the plain pigeon, and the absence of evidence supporting lack of enforcement of regulations to protect this species, we believe that inadequacy of existing regulatory mechanisms should not be considered a threat to the Puerto Rican plain pigeon.

(e) Other natural or manmade factors affecting its continued existence.

Severe storms and hurricanes are potential threats to the plain pigeon population. Hurricanes may destroy nesting areas and strip trees of the fruits and seeds upon which plain pigeons feed, potentially causing starvation of adult and young pigeons (Pérez-Rivera 1990, p., 24; PRDNER 2000, p. 22; Rivera-Milán et al. 2003b, p. 477). Plain pigeons, however, have shown resilience through successful reproduction in response to forest regeneration and increased food availability after a hurricane (Rivera-Milán et al.

2003a, p. 48). For example, after the category 3 hurricane Georges in September 1998, density estimates remained depressed during February-October 1999, and rebounded in 2000-2001 (Rivera-Milán et al. 2003a, p. 48). However, opportunistic observations of foraging plain pigeons suggest that short-term survival after a hurricane depends on their capacity to disperse and find food (Rivera-Milán et al. 2003b, p. 477). Hurricanes may also act as agents of dispersion, since plain pigeons may move away from the storm or be carried by it to previously unoccupied areas. For example, less than a week after hurricane Georges hit Puerto Rico, plain pigeons were reported from Mayagüez, Aguadilla, and Cabo Rojo (PRDNER 1999, p.3; J. Saliva, USFWS, pers. observ., 1998) where they had not been observed for many years. However, plain pigeons have not been recently observed in these municipalities.

Pérez-Rivera (1977b, p. 39) suggested that dispersal of plain pigeons from the historic known nesting areas in Cidra may be partially the result of competition for nest-sites with the scaly-naped pigeon (*Patagioenas squamosa*). Although the scaly-naped pigeon has been thought to occupy a different niche than the plain pigeon due to its larger size (PRDNER 2000, p. 21), both species have similar diets, and nest in similar vegetation associations, at similar heights, and in similar places (Pérez-Rivera 1978, p. 89). Areas previously used for nesting by plain pigeons in 1976 were used by scaly-naped pigeons in 1977, but no plain pigeons were observed nesting in that same area in 1977 (Pérez-Rivera 1978, p. 95).

However, distance sampling data collected during 1986-2010 indicate that densities of both species are positively correlated (Rivera-Milán, unpubl. manuscript). A negative occupancy and abundance correlation would indicate interspecific competition; hence the occupancy and abundance of scaly-naped pigeons would increase, causing a decline and restricting the number of sites occupied by plain pigeons (Rivera-Milán 2011, p. 4). Instead, plain pigeon occupancy at counting points and nest transects is mainly explained by food abundance and not by the occupancy or abundance of scaly-naped pigeons (Rivera-Milán 2001, p. 340; Rivera-Milán et al. 2003b, p. 473). More complex co-occurrence models also indicate that nesting scaly-naped pigeons did not influence the colonization or extinction rates of nesting plain pigeons in second-growth forest patches (Rivera-Milán, unpubl. manuscript). Therefore, based on long-term independent data sets, Rivera-Milán (2011, p. 5) believes that competition with scaly-naped pigeons is not an important threat and does not play an important role in plain pigeon population limitation and regulation. A more parsimonious explanation would be that both species respond to similar or covarying resources in the environment (Rivera-Milán 2001, p.340).

Unintentional killing of plain pigeons may occur while legally hunting other columbid species. The plain pigeon is similar in size and shape to the legally hunted scaly-naped pigeon, thus plain pigeons could be mistakenly shot. Wetmore (1916, p. 55) stated that, because sportsmen were familiar with the plain pigeon, the species was no doubt shot in the early 1900s. Wetmore (1938, p. 52) reported plain pigeon bones collected by Dr.

Froelich G. Rainey from an extensive midden deposit in the municipality of Ponce; which may suggest that this species was hunted and consumed regularly. The plain pigeon displays exceptional tameness around humans, and besides being unwary, it flocks seasonally for roosting and feeding and sometimes nests in loose colonies (i.e., nesting pairs not necessarily close to one another) close to urban areas (Ruiz-Lebrón, Environmental Consultant, pers. comm., 2001). These behaviors may increase the ease of poaching the species. Plain pigeons have been observed eating livestock feed (Pérez-Rivera and Collazo-Algarín 1976a, p.54; Wiley, unpubl. data). Feeding of plain pigeons on crops, as reported by Cidra residents, may have also led to hunting of pigeons because they may have been perceived as competitors, pests (i.e., damaging crops), or easy targets attracted to feeding on crop fields. Records of poaching or unintentional killing of plain pigeons, however, are scant (Wetmore 1916, p. 300-303; Pérez-Rivera et al. 1994, p.7; PRDNER 2000, p. 18).

The plain pigeon population is interspersed between towns and urban areas, and nesting has been reported in the backyards of houses (PRDNER 1999, unpubl. report). During investigations in Cidra between December 1973 and September 1975, Wiley (unpubl. report) found that nest failures were primarily due to human-caused disturbances. The majority of "undetermined causes" of nest failures (31 percent of the total) were possibly related to human disturbances as well (Wiley, unpubl. report). Disturbances to breeding birds by people moving through and around nesting areas, harassing nesting birds, and stealing squabs from nests accounted for most of the failures during 1974 and 1975 (Pérez-Rivera and Collazo-Algarín 1976b, p. 53). However, human-induced disturbance was of secondary importance to habitat loss during 1986-1999 (Rivera-Milán et al. 2003b, p. 445).

Stochastic and deterministic factors such as hurricanes may decimate the existing population of plain pigeons, particularly because the frequency of these atmospheric events is expected to increase with climate change (Rivera-Milán 2011, p. 5). However, because there is no evidence indicating that unintentional killing or poaching of plain pigeons and human-induced disturbances are frequently occurring, we believe that as a whole, the magnitude of threat from other natural or manmade factors is low, and the immediacy of threat to the plain pigeon is non-imminent.

D. Synthesis

The Puerto Rican plain pigeon is one of three subspecies of plain pigeon recognized in the West Indies. It is a large pigeon about the size and shape of a domestic pigeon, but with an overall grayish-brown coloration washed with a tinge of maroon color. Although the plain pigeon seems to prefer areas of primary or secondary forest, sometimes in close proximity to a creek or river for breeding and roosting, it also uses areas of disturbed vegetation, croplands, along roads, and urban areas for feeding, roosting, or breeding. The plain pigeon was federally listed as an endangered species on October 13, 1970

because it was thought to be extinct or near extinction. After being considered extinct in the late 1940s, a small population was found in 1963 in the municipality of Cidra, prompting the capture of some individuals in an effort to establish a captive breeding program to produce plain pigeons for later release into the wild. Observations since 1989 indicate that the plain pigeon had increased its range into the east-central region of Puerto Rico, including the municipalities of Cidra, Cayey, Caguas, Comerío, Aibonito, Aguas Buenas, Gurabo, and San Lorenzo. The captive propagation program was discontinued in the late 1990s, since population estimates suggested an increase from the 1970s to the late 1990s. However, it seems that the plain pigeon population has not fully recovered from the impact of Hurricane Georges, although a density increase has been observed since 2008.

Primary factors threatening the plain pigeon include: habitat destruction or modification in the form of construction of roads (e.g., expansion or maintenance of roads, development of new roads and trails); land clearing associated with agricultural, residential, and tourism development (e.g., construction of new homes and commercial establishments); predation by birds, cats, and rats; internal and external parasites and pathogens; natural events such as hurricanes; and human-induced disturbances (e.g., poaching, unintentional killing, people moving through and around nesting areas, harassment of nesting birds, stealing of squabs).

Recovery criteria for the plain pigeon have not been met because efforts have not been initiated to establish two distinct populations of the plain pigeon; the existing plain pigeon habitat in Cidra and Cayey has not been secured and it no longer appears to hold the bulk of the plain pigeon population; and steps have not been initiated to commit the Río Abajo Commonwealth Forest, or its equivalent, as a reintroduction and management site for a second plain pigeon population.

The plain pigeon population density declined after 1998, particularly between 2004-2007 (Table 1). Although an increase is evident since 2008, threats have not been reduced or removed. Furthermore, stochasticity may drive population fluctuations at low numbers, which can be exacerbated in the face of climate change, habitat loss and other threatening factors. Overutilization for commercial or recreational purposes and inadequacy of existing regulatory mechanisms are not considered threats to the species. However, habitat modification or destruction, disease or predation, and other natural or manmade factors continue to be threats to the species. Reproductive capacity, survival rate, and resource use and availability may all be important, but data are lacking to elucidate the mechanisms driving the population dynamics of plain pigeons (Rivera-Milán 2011, p. 6). Therefore, this species continues to meet the definition of endangered.

III. RESULTS

A. Recommended Classification:

 X No change is needed.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Revise the Recovery Plan for the Puerto Rican Plain Pigeon.
2. Roost surveys conducted after the listing of the plain pigeon were poorly standardized and variable, making population trend monitoring unreliable. Point and line transect surveys serve as tools to estimate the plain pigeon population density. Therefore, the existing surveillance monitoring program should continue and be refined for management purposes (Rivera-Milán 2011, p. 6). In addition, a well-designed method to census the roosting sites should be implemented to complement the existing line transect surveys.
3. Groups of free ranging plain pigeons as well as fledglings should be fitted with radio transmitters and unique color leg band combinations to determine population movement patterns, habitat use, distribution, dispersal, and survival.
4. Incorporate GIS and remote sensing technologies to refine occupancy and abundance maps, and to identify potential areas to conduct management experiments, including habitat restoration efforts and experimental releases of plain pigeon flocks (cohorts) to increase the chances of survival and nesting outside the traditional center of abundance in east-central Puerto Rico (Rivera-Milán 2011, p. 6).
5. Incorporate existing private landowners programs (e.g., cooperative agreements, conservation plans, conservation easements, habitat mitigation banks, and economic incentives) to promote restoration, management, and conservation of private lands to help on the recovery of the plain pigeon.
6. Determine the effect of known predators (particularly red-tailed hawks), inter-specific competition with the scaly-naped pigeon, and parasites on the plain pigeon to develop management strategies to control possible adverse effects of these potential threats.
7. Contacts should be established with the media (television, radio, and newspaper) to assist in the preparation and dissemination of information on plain pigeon conservation issues. Traditional methods to disseminate information such as mass mailings and newspaper display ads should be explored as possible tools at key junctures to implement outreach plans.
8. Revise the current listing to reflect the taxonomic name change.

V. LITERATURE CITED

- Arnizaut, A., L. Hayes, G. H. Olsen, J. S. Torres, C. Ruiz, and R. A. Pérez-Rivera. 1991. An epizootic of *Tanaisia bragai* in a captive population of Puerto Rican plain pigeons. *Annals of the New York Academy of Science* 6(53):202-205.
- Banks, R. C. 1986. A taxonomic reevaluation of the plain pigeon (*Columba inornata*). *Auk* 103:629-631.
- Banks, R. C., C. Cicero, J. L. Dunn, A.W. Kratter, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2003. Forty-fourth supplement to the American Ornithologists' Union check-list of North American Birds. *The Auk* 120:923-931.
- Bowdish, B. S. 1903. Birds of Porto Rico. *Auk* 20:10-23.
- Capó, C. 1925. The island of Porto Rico: a compilation of facts and some comments on the geography of the country. Globe Publication Co. 121 pp.
- Cumley, R. W. and M. R. Irwin. 1944. The correlation between antigenic composition and geographic range in the Old or the New World of some species of *Columba*. *Amer. Nat.* 78:238-256.
- Danforth, S. 1929. Notes on the birds of Hispaniola. *Auk* 46:358-375.
- Danforth, S. 1931. Puerto Rican Ornithological Records. *The Journal of the Department of Agriculture of Porto Rico. The Insular Experiment Station, Río Piedras*, 107 pp.
- Del Hoyo, J., Elliott, A., and J. Sargatal (Eds.). 1996. Handbook of the birds of the world. Vol. 4. Sandgrouse to Cuckoos. Lynx Edicions, Barcelona. 679 pp.
- Helmer, E. H. 2004. Forest conservation and land development in Puerto Rico. *Landscape Ecology* 19:20-40.
- Gould, W. A., C. Alarcón, B. Fevold, M. E. Jiménez, S. Martinuzzi, G. Potts, M. Quiñones, M. Solorzano, and E. Ventosa. 2008. The Puerto Rico Gap Analysis Project. Volume 1: Land cover, vertebrate, species distribution, and land stewardship. Gen. Tech. Rep. IITF-GTR-39. U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry. Río Piedras, P.R. 165 pp.

- Integrated Taxonomic Information System. 2011. *Patagioenas inornata* (Vigors, 1827). <http://www.itis.gov/> [Accessed November 22, 2011].
- Johnson, K. P. and D. H. Clayton. 2000. Nuclear and mitochondrial genes contain similar phylogenetic signal for pigeons and doves (Aves: Columbiformes). *Molecular Phylogenetics and Evolution* 14:141-151.
- Johnson, K. P., S. de Cort, K. Dinswoodey, A. C. Mateman, C Ten Cate, C. M. Lessells, and D. H. Clayton. 2001. A molecular phylogeny of the dove genera *Streptopelia* and *Columba*. *Auk* 118:874-887.
- Johnston, R.F. 1962. The taxonomy of pigeons. *Condor* 64:69-74.
- Miyamoto, M. M., M. W. Allard, and J. A. Moreno. 1994. Conservation genetics of the plain pigeon (*Columba inornata*) in Puerto Rico. *Auk* 111:910-916.
- Pérez-Rivera, R. 1977a. Nuevos datos sobre la Paloma Sabanera. *Science-Ciencia* 4:77-78.
- Pérez-Rivera, R. 1977b. El “status” de la paloma sabanera [*Columba inornata wetmorei*] en Puerto Rico. *Science-Ciencia* 5:39-40.
- Pérez-Rivera, R. 1978. Preliminary work on the feeding habits, nesting habitat and reproductive activities of the plain pigeon (*Columba inornata wetmorei*) and the red-necked pigeon (*Columba squamosa*), sympatric species: an analysis of their interaction. *Science-Ciencia* 5:89-98.
- Pérez-Rivera, R. A. 1990. Sobre la situación de la paloma ceniza o sabanera (*Columba inornata*) en las Antillas Mayores. *Science-Ciencia* 17:21-25.
- Pérez-Rivera, R. A. and J. Collazo-Algarín. 1976a. Distribución geográfica, hábitos alimentarios y competencia por alimentos de la paloma sabanera de Puerto Rico. *Science-Ciencia* 3:52-55.
- Pérez-Rivera, R. A. and J. Collazo-Algarín. 1976b. Ciclo de vida y algunos de los problemas a que se enfrenta la paloma sabanera de Puerto Rico. *Science-Ciencia* 4:10-19.
- Pérez-Rivera, R., C. R. Ruiz, and D. Galán. 1994. A second experimental release of Puerto Rican plain pigeons. *Reintroduction News* 9:6-7.

- PRDNER. 1999. Plain pigeon field studies. Performance Report: July 1997-December 1998. Project W-16. Puerto Rico Department of Natural and Environmental Resources. 15 pp.
- PRDNER. 2000. Departamento de Recursos Naturales y Ambientales. Delimitación del hábitat de la paloma sabanera (*Columba inornata wetmorei*) dentro de los municipios de Cidra, Comerío y Caguas, Puerto Rico. 73 pp.
- PRDNER. 2003. Population densities of columbid species in Puerto Rico and Vieques. Annual Performance Report: January-December 2002. Project W-21. Puerto Rico Department of Natural and Environmental Resources. 26 pp.
- PRDNER. 2005. Monitoring of game bird species in Puerto Rico. Annual Performance Report: January-December 2004. Project W-21. Puerto Rico Department of Natural and Environmental Resources. 36 pp.
- PRDNER. 2007. Population densities of game and non-game columbids in Puerto Rico and Vieques. Annual Performance Report: April 2005-March 2006. Project W-21. Puerto Rico Department of Natural and Environmental Resources. 35 pp.
- Ramos-González, O. M. 2001. Assessing vegetation and land cover changes in northeastern Puerto Rico: 1978-1995, *Caribb. J. Sci.* 37:95-106.
- Ridgway, R. 1916. The Birds of North and Middle America. U.S. Nat. Mus. Bull., No. 50, part 7.
- Rivera-Milán, F. F. 1996. Nest density and success of Columbids in Puerto Rico. *Condor* 98:100-113.
- Rivera-Milán, F. F. 2001. Transect surveys of Columbid nests on Puerto Rico, Vieques, and Culebra Islands. *Condor* 103:332-342.
- Rivera-Milán, F. F. 2011. Peer-review comments on the 5-year review for the Puerto Rican plain pigeon (*Patagioenas inornata wetmorei*). U.S. Fish and Wildlife Service, Division of Migratory Bird Management. Laurel, MD. 12 pp.
- Rivera-Milán, F. F., C. A. Ruiz, J. A. Cruz, M. Vázquez, and A. J. Martínez. 2003a. Population monitoring of plain pigeons in Puerto Rico. *Wilson Bull.* 115:45-51.
- Rivera-Milán, F. F., C. A. Ruiz, J. A. Cruz, and J. A. Sustache. 2003b. Reproduction of plain pigeons (*Columba inornata wetmorei*) in east-central Puerto Rico. *Auk* 120:466-480.

Ruiz-Lebrón, C. 1994. Boletín de Cacería. Departamento de Recursos Naturales y Ambientales. Proyecto W-15. p. 6.

Ruiz-Lebrón, C., D. J. Galán-Kercadó, and R. A. Pérez-Rivera. 1995. Segunda liberación experimental de palomas sabaneras en Cidra, Puerto Rico. *El Pitirre* 8: 5-7.

U.S. Fish and Wildlife Service (USFWS). 1982. Puerto Rican Plain Pigeon Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 52 pp.

Wetmore, A. 1916. Birds of Porto Rico. U.S. Depart. Agric. Bull. 326. 140 pp.

Wetmore, A. 1927. Scientific Survey of Porto Rico and the Virgin Islands. *New York Academy of Sciences* 9:392-394.

Wetmore, A. 1938. Bird remains from the West Indies. *Auk* 56: 52-55.

U.S. FISH AND WILDLIFE SERVICE

Puerto Rican plain pigeon or paloma sabanera (*Patagioenas inornata wetmorei*)
5-YEAR REVIEW

Current Classification Endangered

Recommendation resulting from the 5-Year Review

X No change is needed

Review Conducted By Drs. Jorge E. Saliva and José A. Cruz-Burgos, Caribbean Ecological Services Field Office

FIELD OFFICE APPROVAL:

Edwin E. Muñoz, Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve Edwin Muñoz Date Nov 8, 2011

REGIONAL OFFICE APPROVAL:

Cynthia Dohner, Lead Regional Director, Fish and Wildlife Service

CD Approve Cynthia Dohner Date 11/22/11

FY 2019 APPROVAL*

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approved  Date 5/14/2019

In 2014, Southeast Region Field Supervisors have been delegated authority to approve 5-year reviews that do not recommend a status change.

Field Supervisor signature on this document reflects:

1. We have no new information received, no new public comments, and the original five factor analysis remains an accurate reflection of the species current status.
2. We have obtained a small amount of new information that we have summarized in Addendum 1, received no new public comments, and the original five factor analysis remains an accurate reflection of species current status.

Appendix A

Summary of peer review for the 5-year review of the Puerto Rican Plain Pigeon or paloma sabanera (*Patagioenas inornata wetmorei*)

Marelisa T. Rivera, CESFO Assistant Field Supervisor, reviewed this 5-year review internally and provided editorial and technical comments that were included in the document. Dr. Frank A. Rivera-Milán, Office of International Affairs, USFWS, also reviewed this document and provided comments. Most comments and recommendations provided by Dr. Rivera-Milán were incorporated into the document and cited accordingly. The reference for his review comments was included in the Literature Cited section of the 5-year review and is available in the file of the Puerto Rican Plain Pigeon.

Additionally, we sent this 5-year review to three outside peer reviewers (see below) via electronic mail. Reviewers were selected based on their qualifications and knowledge of the species. We indicated our interest in all comments the reviewers may have about the plain pigeon, particularly any new additional information on the status and current threats to the species. We did not receive any comments from these peer reviewers.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Puerto Rican plain pigeon or Paloma sabanera
(*Columba (Patagioenas) inornata wetmorei*)

Addendum 1. Summary of new information obtained since the 2011 Five Year Review

The following information updates the referenced sections of the 2011-5-year status review for this species (Service 2011). Sections of the 2011-5-year review with no new information are not included in this addendum.

C. Update information

1. Biology and Habitat

- a) Is there relevant new information regarding the species' abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g. age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends? Yes**

Between 2011 and 2015, the Puerto Rico Department of Natural and Environmental Resources (PRDNER) conducted monitoring efforts to determine the status of several columbid species in Puerto Rico, including the Puerto Rican plain pigeon (PLPI; PRDNER, 2012, 2013, 2014, and 2015). The Puerto Rican plain pigeon (PLPI) shows a clumped spatial distribution, with most individuals occurring in east-central Puerto Rico at high densities, and some individuals scattered across the Island at low densities (Figure 1; PRDNER 2012; F. Rivera-Milán, Service, 2018a, pers. comm.). Thus, for this species PRDNER focused their survey efforts on east-central where their survey region covers 110,000 hectares (ha) (271,816 acres (ac)) (F. Rivera-Milán, Service, 2018a, pers. comm.).

Based on the distribution of the PLPI, we requested Dr. Frank Rivera-Milán (biologist with the U.S. Fish and Wildlife Service, Division of Migratory Birds), who has historically analyzed the columbid survey data collected by PRDNER, to provide the abundance estimate he calculated for the PLPI in east-central Puerto Rico between 2011 and 2018 (Table 1).

The PLPI density and population size fluctuated between 0.051 individuals/hectare (ind/ha) (5,578 individuals) in 2011, and 0.039 ind/ha (4,257 individuals) in 2017 (Table 1). A survey conducted during April-June 2018, after Hurricane María, showed that the PLPI density and population size declined to 0.006 ind/ha and 660 individuals, respectively. This decline represents more than 85 percent reduction of the species in the east-central region of Puerto Rico (Rivera-Milán, Service, 2018b, pers. comm.). According to Rivera-Milán (Service, 2018b, pers. comm.), this is the lowest abundance estimate since monitoring of the species began in 1986. The east-central region was surveyed again in August 2018, and according to this data and that of April-June 2018, little reproduction occurred after the hurricane, and, therefore, the population probably continued declining (Rivera-Milán, Service, 2018b, pers. comm.).

The PLPI abundance has fluctuated historically, decreasing after hurricanes Hugo in 1989 and Georges in 1998 (PRDNER 2014; Rivera-Milán *et al.* 2016). Members of the family Columbidae share life-history characteristics (e.g., hatch-year maturity of females, multiple brooding, extended nesting), which allow for rapid population changes or short-term fluctuations, resulting from successful reproduction in years with abundant resources (Rivera-Milán, Service, 2018a, pers. comm.). Short-term PLPI survival after a hurricane apparently depends on the species' capacity to disperse and find food (Rivera-Milán *et al.* 2003). For example, after hurricane María, 10 PLPI individuals were observed in a private property at the municipality of San German in southwest Puerto Rico (A. J. Martínez, PRDNER, 2018, pers. comm.). Unfortunately, no additional information is available about these birds. However, catastrophic events like Hurricane María may affect the abundance and availability of resources, hence, negatively affect the species life-history characteristics.

Vilella and Weitzel (2018) conducted a rapid assessment of geographic distribution and habitat conditions of the PLPI after Hurricane María in five municipalities of east-central Puerto Rico (i.e., Aibonito, Aguas Buenas, Cayey, Cidra, and Comerío). These researchers indicated that before Hurricane María, PRDNER's data on PLPI presence along survey routes averaged 50 individuals or more. However, surveys conducted during their rapid assessment suggest the PLPI detections were reduced by more than 50 percent (i.e., 15-17 individuals) in those municipalities (Vilella and Weitzel 2018). However, Rivera-Milán (Service, 2018b, pers. comm.) warned that this rapid assessment is inadequate to assess PLPI population state before/after the hurricane because count data needs to be adjusted for changes in detection probability to avoid confounding detection and abundance. Despite this statistical concern, the findings from Vilella and Weitzel (2018) suggest Hurricane María did have a negative impact on the PLPI.

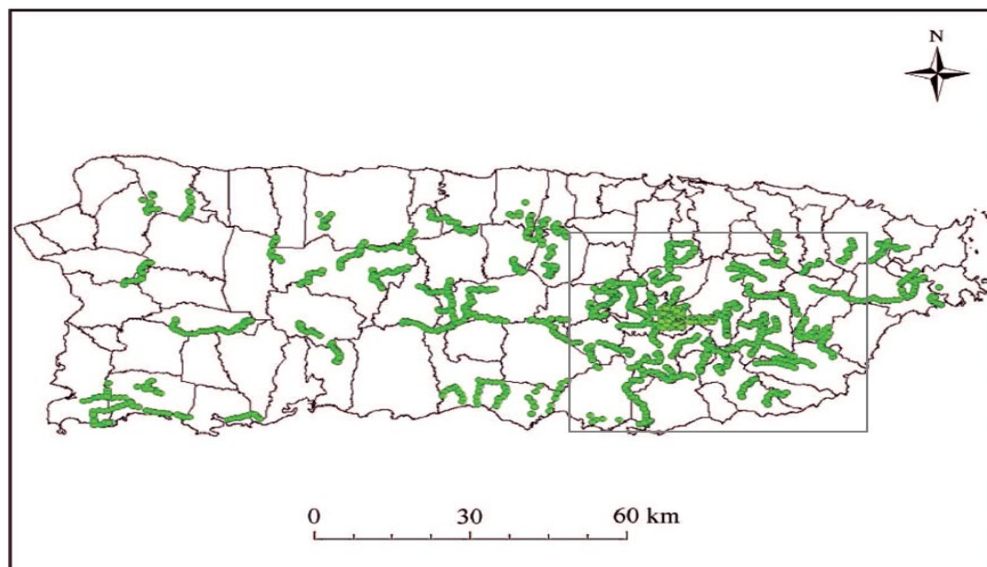


Figure 1. Map of Puerto Rico showing columbid survey stations. Area within the square depicts the PLPI center of abundance in east-central Puerto Rico (PRDNER 2012, Rivera-Milán *et al.* 2016).

Table 1. PLPI density and abundance estimates based on point-transect distance sampling data collected by PRDNER in east-central Puerto Rico during 2011-2018 (Rivera-Milán, Service, 2018a and 2018b, pers. comm.).

Year	D	SE ¹	CV	N	SE ²
2011	0.051	0.020	0.395	5,578	2,203
2012	0.039	0.015	0.384	4,257	1,633
2013	0.026	0.013	0.496	2,849	1,412
2014	0.044	0.017	0.396	4,836	1,915
2015	0.035	0.015	0.420	3,896	1,636
2016	0.037	0.016	0.423	4,081	1,726
2017	0.039	0.017	0.428	4,257	1,822
2018	0.006	0.003	-	660	290

Notes: D = density, SE¹ = standard error density, CV= coefficient of variation, N = population estimate in east-central Puerto Rico and SE² = standard error population estimate.

2. Threat Factor Analyses

In the 2011 5-year status review, the PLPI was considered threatened by destruction, modification, or curtailment of its habitat or range (Factor A); disease and predation (Factor C); and by other natural or manmade factors affecting its continued existence (Factor E). Currently, we believe that these threats continue to apply.

During the past 5 years, we have reviewed several transportation and small development projects throughout the PLPI range with potential impacts to the species' habitat. We provided technical assistance and worked with Federal partners on ESA Section 7 consultations to avoid and minimize impacts to this species and its habitat. Besides the protections provided by the Act, the PLPI and its habitat are protected through Commonwealth Law No. 241 and Regulation 6766, whose protections extend to both public and private lands. These laws and regulations provide regulatory mechanisms for habitat protection and mitigation throughout established project evaluation processes. These mechanisms provide a regulatory framework for the implementation of conservation recommendations that could reduce the impacts of urban development on the species and its habitat.

However, as we stated in the 2011 5-year status review, the PLPI is not widely distributed, and unmitigated development have caused land cover changes that could have affected the reproduction of the species through loss and fragmentation of second growth forests in east-central Puerto Rico (Rivera-Milán *et al.* 2003). Although the forest cover on the Island has increased during the past decades, reaching 54.8 percent in 2014 (Marcano-Vega 2017), the PLPI appears to have been affected by previous deforestation and habitat fragmentation. In fact, a recent study found that between 2000-2010, while human population declined around protected areas in Puerto Rico, the number of houses continued to increase (Catro-Prieto *et al.* 2017). This finding highlights that despite the

existence of regulatory mechanisms habitat modification through small-scale development continues to pose a threat to the PLPI habitat. Furthermore, the impacts from Hurricane María exacerbated the human-induced habitat modification by causing extensive damage on the cover forest of Puerto Rico (Feng *et al.* 2018, Hu and Smith 2018). An initial impact estimate indicated that Hurricane María may have cause mortality and severe damage to 23-31 million trees across the Island (Feng *et al.* 2018).

According to Rivera-Milán (Service, 2018b, pers. comm.), in addition to habitat loss and modification, other main conservation threats to the PLPI include illegal hunting, and nest depredation by rats (*Rattus rattus*) and other nest predators like the pearly-eyed thrasher (*Margarops fuscatus*). Nest predation appears to be more important than predation of adults and juveniles by raptors like the red-tailed hawk (*Buteo jamaicensis*) (Rivera-Milán, Service, 2018b, pers. comm.).

Regarding illegal hunting, although also identified during the 2011 5-year status review as a threat, data are lacking to estimate how many PLPIs are illegally hunted each year. Rivera-Milán *et al.* (2016) used abundance estimates to: 1) fit Bayesian state-space model, 2) estimate posterior distributions for population and harvest management parameters, and 3) predict abundance in 2025 as a function of potential illegal hunting in 2015-2024. Using these results, Rivera-Milán *et al.* (2016) stated that PLPI populations recovered quickly after the hurricanes in 1989 and 1998, but decreased sharply at the same time that legally hunting of others columbid species increased between 2008 and 2014, thus, suggesting possible illegal hunting of the PLPI during the columbid hunting season. Moreover, Rivera-Milán *et al.* (2016) suggested that an increase in illegal hunting of the PLPI might be responsible for some of its abundance decline during 2008-2014, and projected that population sustainability of this species might be affected by illegal hunting in 2015-2025. Therefore, these authors recommended the collection of illegal hunting data, and the control of illegal hunting as a management priority. We agree that illegal hunting data is necessary to better address this potential threat to the species, and in fact, control of illegal hunting should be considered a management priority if the data evidence it is a limiting factor for the species.

As showed above, hurricanes are still considered a threat to the PLPI. Short-term PLPI survival after a hurricane apparently depends on the species' capacity to disperse and find food (Rivera-Milán *et al.* 2003). In fact, Rivera-Milán (2011) indicated that the PLPI population never fully recovered from the impact of Hurricane Georges, and the loss of habitat in east-central Puerto Rico. Available information suggests little PLPI reproduction after Hurricane María, probably resulting in a continued population decline after the hurricane (Rivera-Milán, 2018b, pers. comm.).

Recently, two major hurricanes (i.e., Irma and María) struck Puerto Rico, severely affecting forested vegetation throughout east-central Puerto Rico. Hurricane María moved across the island of Puerto Rico from southeast to northwest with sustained winds of 155 miles/hour (250 kilometer/hour) (Vilella and Weitzel 2018). The eyewall of Hurricane María moved through the center of the region occupied by the PLPI in east-central Puerto Rico (Vilella and Weitzel 2018).

Vilella and Weitzel (2018) conducted an overall assessment of the impacts from Hurricane María centered on the main distribution of the PLPI (Aguas Buenas, Aibonito, Cayey, Cidra, and Comerío). They used pre and post-hurricane Landsat 8 imagery of the Island and utilized a spectral mixture analysis to quantify a change in the non-photosynthetic vegetation to evaluate the deforestation severity in those five municipalities. The results indicated that the five municipalities had areas of forested land that sustained greater than a 90% increase in dead vegetation after Hurricane María (Vilella and Weitzel 2018). Overall, the municipalities of Cayey and Aguas Buenas suffered the most impact on vegetation, with 7,520.94 and 6,441.75 ha (18,585 ac and 15,916 ac) of deforestation caused by hurricane disturbance, respectively (Vilella and Weitzel 2018). However, the vegetation was not evenly damaged across the whole region. According to Vilella and Weitzel (2018), the northeastern and southeastern sections of the study area encompassed the largest area with most severe deforestation.

Available information suggests little PLPI reproduction after Hurricane María probably resulting in a continued population decline after the hurricane (Rivera-Milán, Service, 2018b, pers. comm.). Such reduced reproduction was likely due to the vast deforestation caused by the hurricane in addition to the direct mortality of PLPI individuals from the hurricane winds and rain.

According to Rivera-Milán (Service, 2018a, pers. comm.), Hurricane María occurred at a moment in which the PLPI population was at low numbers, and a decline similar or larger to the one that occurred after Hurricane Georges would be difficult to compensate for because of other additive mortality factors (e.g., habitat loss or degradation, predation, human-induced threats). As a columbid species, the PLPI can increase rapidly from one year to another, however, it would need favorable foraging and nesting conditions (F. Rivera-Milán, Service, 2018a, pers. comm.), which most certainly are not currently present due to the effects of Hurricane María on its habitat. As a result, the species can decline sharply, making it vulnerable to extinction (F. Rivera-Milán, Service, 2018a, pers. comm.).

Synthesis

Since 2011, the PLPI population in east-central Puerto Rico was estimated between 5,578 individuals in 2011 and 4,257 individuals in 2017, with a notable decline to 660 individuals in 2018 after Hurricane María.

As part of this review, we assessed the five factor analysis, and continue to believe the main factors threatening the PLPI include: Factor A (destruction, modification, and curtailment of habitat or range), Factor C (disease or predation), and Factor E (other natural or manmade factors affecting its continued existence). Although the species and its habitat are currently protected by regulatory mechanisms, the PLPI continues to be threatened by transportation and other small development projects with potential impacts on the species' habitat. However, in future development projects these possible effects may be ameliorated by conservation recommendations and habitat mitigation efforts that could be implemented as part of the project evaluation processes established by the Commonwealth of Puerto Rico. In addition, the PLPI is

currently threatened by nest predation by predators like rats, pearly-eyed thrashers, and red-tailed hawks. Natural events such as hurricanes and human-induced threats like possible illegal hunting, certainly contribute to abundance fluctuations of the species. Moreover, although threats due to inadequacy of regulatory mechanisms can be further reduced, law enforcement and outreach efforts are needed to explain to private landowners, hunters, and the general public the importance to protect the species and its habitat. PLPI population declines have been documented after past hurricanes. Recently, Hurricane María hit Puerto Rico causing severe deforestation within the main range of the PLPI in east-central Puerto Rico. Post-hurricane data on the abundance and distribution of the PLPI showed a decline in the species population.

A relationship between the PLPI population decline and an increase of legal hunting of columbids between 2008 and 2014 was been suggested by Rivera-Milán *et al.* (2016). These authors developed a model suggesting that an increase of illegal hunting may be partially responsible for the PLPI abundance decline. However, the collection of illegal hunting data is vital to certainly determine its effect on the species and for future the management and recovery of this species.

Based on the most recent available information, we continue to believe the PLPI remains as an endangered species under ESA.

Recommendations for future actions

The following are recommendations additional to those included in the 2011-5 year status review to help the recovery of the PLPI.

- Continue population monitoring and update modeling to assess population state post-Hurricane María.
- Determine species dispersion, and daily and seasonal movements. We recommend using satellite telemetry.
- Continue working with private land-owners on the implementation of conservation measures that result in restoration and protection of habitat for the species.
- Conduct management actions to enhance reproductive success, which is a key demographic parameter for pigeons due to life-history traits (e.g. multiple brooding and extended nesting).
- Continue nest predator control at nesting sites in east-central Puerto Rico.
- Conduct a study to gather data on illegal hunting in Puerto Rico to determine its effects on the PLPI and minimize illegal hunting through hunter education and law enforcement in east-central Puerto Rico.

- Work with State partners and universities to gather potential data on illegal hunting and work to improve education to the local community about this unique listed species.
- Generate density gradient map and update GAP map, correcting count data for detection probability.
- Conduct a structured decision making workshop to determine management options, including captive breeding for the species.
- Relate post-hurricane PLPI survey data to the model developed by Vilella and Weitzel (2018) to determine the effect of the habitat impacted by the hurricane on the species.
- Estimate juvenile and adult survival to help develop management strategies for the species.

Literature Cited

- Castro-Prieto, J., S. Martinuzzi, V. C. Radeloff, D. P. Helmers, M. Quiñones, and W.A Gould. 2017. Declining human population but increasing residential development around protected areas in Puerto Rico. *Biological Conservation* 209:473-481.
- Feng, Y., R. I. Negrón-Juárez, C. M. Patricola, W. D. Collins, M. Uriarte, J. S. Hall, N. Clinton, and J. Q. Chambers. 2018. Rapid remote sensing assessment of impacts from Hurricane María on forests of Puerto Rico. *PeerJ Preprints* 6:e26597v1
<https://doi.org/10.7287/peerj.preprints.26597v1>
- Hu, T. and S. B. Smith. 2018. The impact of Hurricane María on the vegetation of Dominica and Puerto Rico using multispectral remote sensing. *Remote Sensing* 2-20.
 doi:10.3390/rs10060827
- Marcano-Vega, H. 2017. Forests of Puerto Rico, 2014. Resource Update FS-121. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 4 pp.
- Martínez-Muñoz, A. J., Puerto Rico Department of Natural and Environmental Resources, Bureau of Fisheries and Wildlife, San Juan, Puerto Rico. E-mail to U. S. Fish and Wildlife Service, July 10, 2018.
- Puerto Rico Department of Natural and Environmental Resources (PRDNER). 2012. Monitoring and Management of Game Birds Species in Puerto Rico. Annual Performance Report. 25 pp.
- PRDNER. 2013. Monitoring and Management of Game Birds Species in Puerto Rico. Annual Performance Report. 25 pp.
- PRDNER. 2014. Monitoring and Management of Game Birds Species in Puerto Rico. Annual Performance Report. 25 pp.

- PRDNER. 2015. Monitoring and Management of Game Birds Species in Puerto Rico. Annual Performance Report. 11 pp.
- Rivera-Milán, F. F., 2011. Peer-review comments on the 5-year review for the Puerto Rican plain pigeon (*Patagioenas inornata wetmorei*). U.S. Fish and Wildlife Service, Division of Migratory Bird Management. Laurel, MD. 12 pp.
- Rivera-Milán F. F., 2018a. Personal communication. U.S. Fish and Wildlife Service, Division of Migratory Bird Management. Laurel, MD. E-mails to U. S. Fish and Wildlife Service, April 13-25, 2018.
- Rivera-Milán F. F., 2018b. Personal communication. U.S. Fish and Wildlife Service, Division of Migratory Bird Management. Laurel, MD. E-mail to U. S. Fish and Wildlife Service, October 29, 2018.
- Rivera-Milán, F. F., C. A. Ruiz, J. A. Cruz, and J. A. Sustache. 2003. Reproduction of plain pigeons (*Columba inornata wetmorei*) in east-central Puerto Rico. *Auk* 120:466-480.
- Rivera-Milán, F. F., G. S. Boomer, and A. J. Martínez. 2016. Sustainability assessment of Plain Pigeons and White-crowned Pigeons illegally hunted in Puerto Rico. *The Condor: Ornithological Applications* 118: 300-308.
- U.S. Fish and Wildlife Service (Service). 2011. Puerto Rican plain pigeon or paloma sabanera (*Patagioenas inornata wetmorei*) 5-Year Review. Atlanta, Georgia. 25 pp.
- Vilella F.J. and S.L. Weitzel. 2018. A GIS-based rapid assessment of geographic distribution and habitat conditions of the endangered Puerto Rico plain pigeon *Patagioneas inornata wetmorei* after Hurricane Maria. Final Report. U.S. Geological Survey, Mississippi Cooperative Fish and Wildlife Research Unit, Mississippi State University. 12 pp.
- Vilella F.J. 2018. Personal communication. U.S. Geological Survey, Biological Resources. Mississippi Cooperative Fish and Wildlife Research Unit. E-mail to U. S. Fish and Wildlife Service, October 29, 2018.

Summary of Peer Review

Peer review method

The Service chose the outside peer reviewers based on their qualifications and knowledge of the species. We indicated our interest in all comments the reviewers may have about the PLPI, specifically in any additional information on the status and current threats to the species. The deadline for submission of peer review comments was October 31, 2018. Comments were received from two independent peer reviewers during the comment period.

List of Peer Reviewers

Alexis J. Martínez, Department of Natural and Environmental Resources, Bureau of Fisheries and Wildlife, San Juan, Puerto Rico. Email: ajmartinez@drna.pr.gov

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Francisco J. Vilella, U.S. Geological Survey, Biological Resources. Mississippi Cooperative Fish and Wildlife Research Unit. Email: fvilella@usgs.gov

Summary of Peer Review Comments

We received comments from two of the three peer reviewers solicited. Both provided editorial comments and suggestions for clarification throughout the draft document. We incorporated most of the comments and recommendations provided directly into this addendum.

In addition, Dr. Frank F. Rivera-Milán provided a research article titled “Sustainability assessment of Plain Pigeons and White-crowned Pigeons illegally hunted in Puerto Rico”) that we reviewed and included to the species file.

Peer review comments

1) Dr. Francisco J. Vilella expressed that the information on PLPI population estimates may present a false sense of security and perhaps, an inaccurate perspective on the species’ true status. He indicated that the abundance estimate of thousands of PLPI presented in this document cannot be reconciled with any other sources of information available for the species, which albeit less statistically rigorous, would point to the same conclusion.

Dr. Vilella further indicated that the estimates presented in this document suggest the species should be considered as recovered given that these estimates exceed the population goal presented in the PLPI Recovery Plan by an order of magnitude. He indicated that this is likely not a problem with the approach used, but with the interpretation, particularly when deriving PLPI population estimates. Dr. Vilella emphasized that he has no problem with the methods and approach used by Dr. Rivera-Milán to derive density (D), only with the PLPI abundance estimates (N).

Response to Peer Review Comments

1) The PLPI population estimate provided by Dr. Rivera-Milán is the best available information on the status of the species currently available to the Service. Dr. Rivera-Milán designed the survey method employed by PRDNER for all columbid species in Puerto Rico, including the PLPI, and he is the only researcher that has statistically analyzed such data. Although it is true that those numbers do not compare to other information sources, the numbers in those other sources has not been collected with the same method nor has been statistically analyzed the same way. Therefore, we believe they are not comparable.

The numbers of PLPI abundance estimated by Dr. Rivera-Milán take into account the size of the surveyed area (i.e., 110,000 ha in east-central Puerto Rico), which might represent some limitations as not all the habitat within east-central Puerto Rico is suitable and occupied by the PLPI. In fact, there is evidence the PLPI occurs in particular areas in the municipalities within this area. Therefore, estimating an abundance considering all habitats equally occupied might result in a high abundance of the species.