Mariquita or yellow-shouldered blackbird
(*Agelaius xanthomus*)

5-Year Review:
Summary and Evaluation

Photo by: Félix López

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

5-YEAR REVIEW
Mariquita or yellow-shouldered blackbird (*Agelaius xanthomus*)

I. GENERAL INFORMATION

A. Methodology used to complete the review: Section 4(c)(2) of the Endangered Species Act of 1973 (Act), as amended, states that the Secretary of the Interior shall conduct, at least once every five years, a review of all listed species (known as a five-year review) to determine if any such species should be removed from the Federal list of threatened and endangered species; or be changed in status from threatened to endangered, or endangered to threatened. This five-year review was accomplished using information obtained from the species' recovery plan, peer-reviewed scientific publications, several unpublished research projects, unpublished field observations by U.S. Fish and Wildlife Service (Service), State and other experienced biologists, and personal communications. On September 21, 2007, the Service also published a notice in the *Federal Register* (72 FR 54061) announcing the 5-year review of the mariquita or yellow-shouldered blackbird, and requesting new information concerning the species. This review includes information from the period between the last approved revised recovery plan for the species (1996) until the present (2010). A 60-day comment period was opened. No information on this species was received from the public. The draft of this document was distributed for peer review and comments received were addressed (see Appendix A). This following review was prepared by the Service's lead Recovery biologist for this species.

B. Reviewers

Lead Region: Kelly Bibb, Southeast Region, Atlanta, Georgia. (404) 679-7132

Lead Field Office: Dr. Jorge E. Saliva, Caribbean Ecological Services Field Office, Boquerón, Puerto Rico. (787) 851-7297, extension 224

C. Background

1. FR Notice citation announcing initiation of this review: September 21, 2007; 72 FR 54061

2. Species Status: 2010 Recovery Data Call: Improving. Data gathered during a post-breeding census in August 2007 showed approximately 994 mariquitas in southwestern Puerto Rico (municipalities of Cabo Rojo and Lajas), an increase from 2004 (759 individuals). In Salinas (southeastern Puerto Rico), 113 individuals were observed during the post-breeding census of 2005, a slight increase from 2004 (97 individuals). The principal listing factor threatening the mariquita (nest parasitism by shiny cowbirds), is being managed or reduced. This information suggests that the status of the species is improving.

3. Recovery Achieved: 2 (2 =26-50 percent of recovery objectives achieved).

4. Listing History

Original Listing
FR notice: 41 FR 51019
Date listed: November 19, 1976
Entity listed: Species
Classification: Endangered

5. Associated rulemakings: None.

6. Review History: The Yellow-shouldered Blackbird (*Agelaius xanthomus*) Revised Recovery Plan, approved and signed on November 12, 1996 (U.S. Fish and Wildlife Service 1996), is the most recent comprehensive analysis of the species status and is used as a main reference document for this 5-year review.

On July 7, 1987, the Service reported the completion of its review of species listed as endangered or threatened before 1976 and in 1979 and 1980; and found that there were no substantial data to suggest a change in status for any of the 39 plants and 423 animal species, including the mariquita (50 CFR 25522). In addition, on July 7, 1987 (50 CFR 25523), the Service announced the review of all species listed in 1976, 1977, 1981 or 1982, to ensure that the Lists of Endangered and Threatened Wildlife and Plants accurately reflected the most current status of each species. The Service conducted a five-year review for the mariquita in 1991 (56 FR 56882). In this review, the status of many species was simultaneously evaluated with no in-depth assessment of the five factors or threats as they pertain to the individual species. The notice stated that the Service was seeking any new or additional information reflecting the necessity of a change in the status of the species under review. The notice indicated that, if significant data were available warranting a change in a species' classification, the Service would propose a rule to modify the species' status. No change in the mariquita's listing classification was found to be appropriate.

Recovery Data Call: 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, and 2010.

7. Species' Recovery Priority Number at start of review (48 FR 43098): 2. The mariquita is recognized as a species with a high degree of threat and a high recovery potential.

8. Recovery Plan:
Name of plan: Yellow-shouldered Blackbird (*Agelaius xanthomus*) Revised Recovery Plan.
Date issued: November 12, 1996.

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 new 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.

Although the mariquita has a revised recovery plan, delisting recovery criteria could not be set when the recovery plan was finalized and approved, because critical demographic information for a reliable population viability model was lacking. However, the following interim recovery criteria for delisting were developed by Collazo *et al*. (1996): 1) enhance reproductive success to ≥ 0.96 daily survival for eggs and chicks; and 2) reduce shiny cowbird (*Molothrus bonariensis*) parasitism to ≤ 20 percent. These interim criteria should be maintained for at least 5 years in the artificial structures. Objective and measurable recovery criteria could be developed after modeling data are obtained from natural nests in the Boquerón Commonwealth Forest (BCF) administered by the Puerto Rico Department of Natural and Environmental Resources (PRDNER), and at least two additional areas in Puerto Rico, including Mona Island.

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 (present or threatened destruction, modification, or curtailment of its habitat or range; overutilization for commercial, recreational, scientific or educational purposes; disease or predation; inadequacy of existing regulatory mechanisms; and other natural or manmade 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.

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.

The revised recovery plan established that the criteria for delisting will be developed after modeling data are obtained from natural nests in the BCF and at least two additional areas in Puerto Rico, including Mona Island. Interim recovery criteria included in the recovery plan are:

1. Reproductive success should be enhanced to ≥ 0.96 daily survival for eggs and chicks

2. Shiny cowbird parasitism should be reduced to ≤ 20 percent.

These interim criteria have been partially met. A daily survival rate of 96% for eggs and chicks has not been achieved. To attain such survival rate, a portion of the mariquita breeding population has to raise a second brood. A program to monitor individually-marked mariquita pairs, to determine if they produced a second brood and their breeding success, has not been conducted. Shiny cowbird parasitism, however, has been reduced from 100% in 1982 to less than 3% (1996-1999) in southwest Puerto Rico, likely due to a reduction in cowbirds as a result of trapping and egg removal efforts.

C. Updated Information and Current Species Status

1. Biology and Habitat

The yellow-shouldered blackbird (*Agelaius xanthomus*), also known as "la mariquita de Puerto Rico" or "capitán", is a diurnal blackbird endemic to Puerto Rico and its adjacent islands, and one of the eleven species belonging to the *Agelaius* genus of the Icteridae family. The mariquita is a glossy black bird with a small yellow humeral patch around its "shoulders" outlined by a white margin. Immature individuals possess a duller coloration and a brown abdomen. Although plumage coloration is indistinguishable between the sexes, sexual dimorphism is present in this species with males being larger than females. Adult mariquitas measure from 7.8 inches (in) (20cm) to 9.1 in (23 cm); and, on average, males weighs 1.45 ounces (oz) (41 grams (g)) and females 1.23 oz (35 g). The species was once commonly found in the coastal forests of the archipelago of Puerto Rico, but during the early 20th century, Puerto Rico's coastal forests were destroyed to allow for the development of sugar cane plantations. Following the decline of the sugar industry after the 1930s, the coastal areas were developed for housing. At present, the species is primarily limited to four areas: Mona and Monito islands, where a subspecies developed (*A. x. monensis*); and three populations in eastern, southern, and southwestern Puerto Rico. Although these locations are considered coastal subtropical dry forests, during the non-breeding season, the species has been observed as far inland as the mountain towns of Lares and Ciales, and in subtropical wet forests. The mariquita is a non-migratory bird, but a portion of the population from the main island moves from coastal areas to inland areas during the non-breeding season to feed. Mariquitas are omnivorous, but some scientists consider the species as arboreal insectivores since the majority of their diet consists of insects belonging to the orders Lepidoptera, Orthoptera, Homoptera, Coleoptera, Diptera, Dermaptera, and Hymenoptera. They also eat arachnids, unidentified mollusks, and plant matter including fruits, seeds, and nectar from various plant species. Aside from natural material, the species also consumes processed foods such as cattle ration, human food (cooked rice and sugar), dog food, and monkey chow, among others.

The mariquita breeding season commonly spans from April to August, but breeding activity has been observed from February to November. The beginning of the species' breeding season coincides with the onset of the rainy season, which explains the fluctuation in the start and end of the breeding season. The species is believed to be

monogamous with a single attempt at nesting per year, and with nesting being performed in loose colonies. Males defend small territories during the nesting period, but before that season, they defend slightly larger territories to repel other males (Cruz-Burgos, pers. comm., 2010). Nests of both Mona and the main islands' subspecies contain from one to four eggs, with an average of three eggs. Eggs are blue-green with brown spots and are incubated for 13 days by the female. Both sexes reach sexual maturity at one year of age. As with other *Agelaius* species, the mariquita usually builds open, cup-shaped nests in trees; but nest locations and shapes may vary depending on location and availability of building materials (*e.g.*, nests on hollows in dead mangroves, or in ledges or crevices near the coastal cliffs). The species uses eight distinct nesting habitats: mud flats and salt flats; offshore red mangrove cays; black mangrove forest; lowland pastures (dry coastal forest); suburban areas; coconut plantations; and coastal cliffs but prefer black mangrove forests for nesting. Nest construction is performed solely by females, and once a nest is initiated, it is almost always finished in about 4 days (Díaz-Rodríguez and Lewis 2006). Díaz-Rodríguez and Lewis (2006) found that, in artificial nest structures, clutch size was 3.43 eggs; feeding of the young was performed by both sexes; and nestlings left the nests 13 to 16 days after hatching.

a. 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), or demographic trends:

When the revised recovery plan was finalized and approved, the mariquita had been reported from the municipalities of Añasco, Barranquitas, Cabo Rojo, Ceiba, Cidra, Ensenada, Guánica, Guayama, Guayanilla, Lajas, Mayagüez, Mona Island, Monito Island, Naguabo, Salinas, San Germán, San Juan, Utuado, and Vieques Island (USFWS 1996). Additional localities later reported were Adjuntas, Aguadilla, Arecibo, Caguas, Carolina, Cataño, Cayey, Ciales, Coamo, Fajardo, Florida, Hormigueros, Juncos, Lares, Loíza, Peñuelas, Ponce, Rincón, Río Grande, San Sebastián, Santa Isabel, and Yauco (Lewis *et al*. 1999; López-Ortiz *et al*. 2008; PRDNER 2009). The largest population is found in southwestern Puerto Rico (Cabo Rojo and Lajas). Banding data indicates that mariquitas may reach 12 years of age in the wild (López-Ortiz *et al*. 2004)

The revised recovery plan states that between 1985 and 1995, an average of about 259 mariquitas were observed during the pre-breeding roost counts, compared to an average of about 353 mariquitas in the post-breeding census in southwestern Puerto Rico (USFWS 1996). In 1995, 15 mariquitas were reported from former Naval Station Roosevelt Roads (NSRR) in Ceiba, 153 from Mona Island, 23 on Monito Island, and 41 in Salinas. In 1992, 13 individuals at a roost site in San Germán.

PRDNER has an ongoing cooperative agreement with the Service to: conduct mariquita population inventories in southwestern (Cabo Rojo- Lajas), eastern (Ceiba), and southeastern (Salinas-Guayama) Puerto Rico; gather information on distribution and abundance of the species; control parasites in artificial nest structures; and control cowbird parasitism (USFWS 1996). PRDNER have conducted pre-breeding (before June) and post-breeding (after July) surveys near known roosting areas in Ceiba,

southwestern, and southeastern Puerto Rico. Table 1 summarizes the results of pre-breeding and post-breeding mariquita surveys. In August 1996, 831 mariquitas were counted in southwestern Puerto Rico (Cabo Rojo, Guánica, Lajas), representing a 26 percent increase from the previous two years; and 770 in February 1997. A total of 396 individuals were observed on Mona Island; the highest number of mariquitas recorded for this island in five years (Falcón *et al*. 1997). In 1997, seven mariquitas were observed in Ceiba, 25 in Salinas, and one in San Sebastián (Falcón *et al*. 1996). Lewis *et al*. (1999) stated that the estimated mariquita population in 1998 consisted of 584 individuals in southwestern Puerto Rico. Between June14 to16, 1999, Díaz (US Navy, pers. comm., 1999) reported 17 mariquitas in the vicinity of the airport at NSRR where the mariquitas were nesting and roosting on buildings and coconut palm trees. During a pre-breeding census on March 27 to 29, 2000, Díaz reported three groups of mariquitas within NSRR: a main group of 18 birds near the airport, a group of 4 individuals around a residential complex, and another group of 2 to 4 birds roosting at a training facility compound (Duren, US Navy, pers. comm., 2000). In Cabo Rojo and Lajas, Falcón *et al.* (2000) recorded 498 mariquitas during the pre-breeding counts in March 2000 and 804 individuals during a post-breeding count in August 1999. They also found: 18 individuals in Guánica; 26 in Ceiba in March 2000 (pre-breeding); 25 in Salinas-Guayama in July 1999 and 36 in June 2000; and 426 on Mona Island in May 2000 (Falcón *et al.* 2000).

A higher count of mariquitas (718) was obtained during a pre-breeding survey in March 2002; whereas the number of mariquitas observed during the post-breeding count of September 2001 was lower than in 1999 (701 individuals) in southwestern Puerto Rico (Falcón *et al.* 2002). They also recorded 15 mariquitas in July 2002 at NSRR. The number of mariquitas observed during the pre-breeding season continued to increase in March 2004 (783 individuals), but decreased from the previous post-breeding count to 657 individuals in August 2003 (López-Ortiz *et al*. 2004). They also recorded 2 individuals at NSRR in March 2003; 97 in Guayama-Salinas in November 2003 and 46 in May 2004; and 97 in Mona and Monito islands in September 2003 (López-Ortiz *et al*. 2004). López-Ortiz *et al.* (2005) recorded 541 mariquitas during a pre-breeding count in March 2005, and 759 individuals in a post-breeding count of September 2004 in southwestern Puerto Rico. Although no pre-breeding count was conducted in 2006, the post-breeding count of September 2005 showed a further increase of 901 mariquitas (Medina-Miranda *et al.* 2006). The pre-breeding count of April 2007 showed 571 mariquitas, whereas the post-breeding count in October 2006 revealed 537 individuals; both smaller numbers than had been recorded in previous years (Medina-Miranda *et al.* 2007).

Reitsma (1998) suggested that the dramatic increase in the number of natural nests of mariquita in southwestern Puerto Rico was due to the success of artificial nest structure management in previous years, which likely caused an increase in dispersal and attempts to start new colonies farther from the main mariquita concentration in Pitahaya, Cabo Rojo. The majority of active nests were found in the Pitahaya area, but many were also found in La Parguera (Lajas), Villa La Mela and Boquerón Beach (Cabo Rojo); and the lone nests found in Mayagüez and Playa Santa (Guánica) document the expanding range

of breeding attempts (Reitsma 1998). In contrast to the estimated mariquita population of 300 individuals in 1982, Cruz *et al*. (2005) estimated the 2004 population in southwestern Puerto Rico to be greater than 800 individuals.

In a study of the growth pattern of nestlings and reproductive biology of the mariquita, Díaz-Rodríguez and Lewis (2006) found that, from a total of 239 chicks hatched in artificial nest structures, 152 (63.6%) fledged, 70 (29.3%) were predated or missing, six (2.5%) were found dead or missing, and the outcome of 11 (4.6%) chicks could not be determined. Overall, 1.06 chicks flew per active nest and 0.35 chicks flew per egg laid. The mariquita exhibits some degree of synchronicity at least in some breeding seasons, and Díaz-Rodríguez and Lewis (2006) found that the success of synchronized nests was the same as nests started before or after the period of synchrony. Synchronicity in their study areas might be triggered by the increase of the available food in the areas, but there was no difference in the degree of success between stages during the breeding season. This may be due to an absence of significant variation in the amount or quality of sites as the season progresses (Díaz-Rodríguez and Lewis 2006).

In summary, the mariquita population in southwestern Puerto Rico is considered improving. The status of the eastern and southern populations is unknown at this time, because sufficient monitoring of these populations has not been conducted. Additional consecutive censuses of these populations are needed to determine their status.

b. Genetics, genetic variation, or trends in genetic variation (*e.g*., loss of genetic variation, genetic drift, inbreeding): No new genetic information is available on the mariquita.

c. Taxonomic classification or changes in nomenclature: None.

d. Spatial distribution, trends in spatial distribution (*e.g*., increasingly fragmented, increased numbers of corridors), or historic range (*e.g*., corrections to the historical range, change in distribution of the species' within its historic range):

When the mariquita recovery plan was approved in 1996, the species had been reported from 19 municipalities. Twenty-two additional localities had been added by 2009; indicating that the known range of the species was greater than previously reported (PRDNER 2009). It is not clear if the apparent increase in the range of the mariquita is a result of population expansion, or an artifact of increasing numbers of scientists, naturalists, and birdwatchers reporting the species.

In a radiotelemetry study of the home range of mariquitas in southwestern Puerto Rico, Lewis *et al*. (1999) found no differences in home range, maximum distance moved, and in core activity areas, between post and pre-breeding seasons for 29 radio-tagged mariquitas. The relationship between home range size and number of locations of radio-tagged mariquitas was negative and non-significant (Lewis *et al*. 1999); although sample variability per location was very high.

Table 1. Summary of pre-breeding (A), post-breeding (B), and breeding (C) mariquita population counts from southwestern (Cabo Rojo- Lajas), eastern (Ceiba), and southeastern (Salinas-Guayama) Puerto Rico. Data not available (---).

Period	Breeding Season	Southwest	East	South	Mona/Monito
1995	A	390	0	---	---
	B	972	0	30	396
	C	---	---	---	---
1996	A	424	---	---	59-62
	B	831	0	10	---
	C	---	---	---	---
1997	A	770	---	---	---
	B	659	---	---	---
	C	---	5	25	241
1998	A	679	---	---	---
	B	488	---	67	---
	C	---	8	---	153
1999	A	464	---	---	---
	B	804	---	---	---
	C	---	17	25	75
2000	A	498	26	---	426
	B	804	22-26	36	---
	C	---	---	30	---
2001	A	540	---	---	92
	B	701	---	---	---
	C	---	---	95	---
2002	A	718	---	---	---
	B	648	---	---	---
	C	---	15		---
2003	A	700	---	37	---
	B	698	---	97	97
	C	---	4	---	81
2004	A	808	2	46	---
	B	759	1	97	---
	C	---	---	---	194
2005	A	541	---	18	---
	B	901	---	113	101
	C	---	---	---	---
2006	A	---	---	---	---
	B	537	---	73	95
	C	---	---	---	---
2007	A	571	---	29	---
	B	994	---	59	260
	C	---	1	---	---

Eight months of radiotelemetry demonstrated that mariquitas spent about four months (September through December) in the area of Pitahaya, primarily rearing their fledglings (Lewis *et al*. 1999). Through the remainder of the non-breeding season, mariquitas moved east to La Parguera, where they stayed until the start of the breeding season. The area of Pitahaya serves for feeding, sheltering, reproduction, and roosting to the mariquita. Although habitat structure is different at La Parguera, mariquitas have the same resources as in Pitahaya, except for the artificial nest structures (Lewis *et al*. 1999). The fact that food resources at Pitahaya are rainfall-dependent has apparently forced mariquitas to identify an alternate food source at La Parguera (*i.e*., feeders) that is available for the pre-breeding season and is independent of rainfall.

e. Habitat or ecosystem conditions (*e.g*., amount, distribution, and suitability of the habitat or ecosystem):

Natural nests of the mariquita may be found on trees (algarroba, *Hymenaea courbari*; black mangrove, *Avicennia germinans*; coconut palm, *Cocos nucifera*; red mangrove, *Rhizophora mangle*; royal palm, *Roystonea borinquena*; úcar, *Bucida buceras*; cactus *Selenicereus* sp); rolón, *Pithecelobium unguis-cati*; and white mangrove, *Laguncularia racemosa*) in the main island, and on ledges and crevices of cliffs and caves in Mona and Monito islands (USFWS 1996; Cruz-Burgos *et al*. 1997; Lewis *et al*. 1999). The species has also been observed nesting in urban areas. In 2000, Falcón *et al.* (2000) recorded for the first time 11 mariquita nests at the Puerto Rico Electric and Power Authority facilities in Aguirre, Guayama, and four additional nests at Baxter Pharmaceutical also in Guayama. Recently, mariquitas have been documented nesting on cavities underneath the docking pier at Playa Pájaros, in Mona Island; seemingly unaffected by human traffic on and near the pier (López, USFWS, pers. comm. 2009).

Reitsma (1998) found that the two tree species most utilized by mariquitas for nesting were black mangrove (29 nests) and coconut palm (41 nests); and closest neighbor distance was double in black mangrove compared to coconut palm. Reitsma (1999) also found more mariquita nests on coconut palm trees (N= 47) and black mangrove (N= 25), but a greater diversity of tree species were documented for nesting in 1999 compared to 1998. Nesting success and fledgling output was highest for the coconut palm nests (Reitsma 1999). Reitsma (1999) found that despite the slightly greater number of active (*i.e*., at least one egg in the nest) mariquita nests in black mangrove at Pitahaya (Lajas), the percent successful nests was much higher in coconut palm trees at Boquerón, Cabo Rojo (60 percent vs. 37.5 percent). Egg loss rates were greater in black mangrove (64 percent) than in coconut palm (25 percent) nests; and consequently much lower fledglings per eggs in black mangrove (0.26) than in coconut palm (0.47) nests (Reitsma 1999). These data suggest that coconut palm trees are important to the reproductive output of mariquitas.

Lewis *et al*. (1999) identified 26 species of trees used by the mariquitas for their daily activities, and found significant differences in the tree species visited between post and pre-breeding seasons. During post-breeding season, mangroves and trees in scrub habitat (*e.g*., mesquite (*Prosopis pallida*), úcar) were more frequently used for foraging, while in

the pre-breeding season the largest amount of plant species used were those found in La Parguera residential area [*e.g*., guayacán (*Guaiacum officinale*), and emajaguilla (*Thespesia populnea*)].

Lewis *et al.* (1999) found mariquitas spent most of the time at Pitahaya (within the Boquerón Commonwealth Forest) during post-breeding, where scrub (88.6 percent) and mangrove (40.7 percent) were the most used habitats. During pre-breeding, mariquitas stayed at La Parguera using residential (91.9 percent) and mesquite stands (79.6 percent) habitats more frequently than these habitats were used in post-breeding (Lewis *et al.* 1999). Mesquite stands (67.3%) and mangrove (45.7%) were used more during the afternoon, while residential habitat was used more during mid-day (51.5%), and scrub used more during morning (39.2%) and afternoon (37.3%) (Lewis *et al.* 1999). When comparing habitat type used, and periods of day in post and pre-breeding seasons separately, similar differences were detected (Lewis *et al.* 1999). Eight months of radiotelemetry demonstrated that mariquitas in southwestern Puerto Rico spend about four months (post-breeding season: September through December) in the area of Pitahaya, and move to La Parguera residential area in the non-breeding season where they stay until the start of the breeding season in late April (Lewis *et al.* 1999).

López-Ortiz *et al.* (2008) found that, although inundated black mangrove macro-habitat was less abundant, it was the most important habitat that mariquitas used for nesting in southwestern Puerto Rico; followed by suburban (developed) habitats, and red mangrove macro-habitat. The relative frequencies of natural nests to macro-habitat were negatively related and differed significantly from the frequencies of artificial nest structures to macro-habitats (López-Ortiz *et al.* 2008). Even though more artificial nest structures were located in red mangrove macro-habitat, and red mangrove was the wetland type with the highest vegetative cover, mariquitas preferred inundated black mangrove (López-Ortiz *et al.* 2008). Used and random trees in mangrove macro-habitats were very similar in height and species type. In suburban macro-habitats, Puerto Rican palmetto (*Sabal causiarum*) was preferred over coconut palm trees (López-Ortiz *et al.* 2008). López-Ortiz *et al.* (2008) point out the importance of conserving black mangrove habitat because it is usually closer to uplands than the red mangrove and perhaps for this reason it is more prone to deforestation for land development. Another explanation for the use of black mangrove may be its proximity to upland areas where mariquitas can forage for food for their chicks (Cruz-Burgos, pers. comm., 2010).

Rainfall appears to be an important factor determining the onset of breeding, number of active nests, and nest-site selection (Reitsma 1999). The number of natural nests found during 1996-1997 (3 nests) decreased from 1994-1995 (18 nests); possibly as an artifact of rainfall activity (Falcón *et al.* 1997). The drier conditions in 1999 compared to 1998 resulted in significantly more nests in coconut palm trees than in the drier black mangrove habitat (Reitsma 1999).

f. Other:

Reitsma (1998) monitored 44 natural nests in the Pitahaya black mangrove forest (Cabo Rojo-Lajas) and found an overall nest success of 63% (1.5 % lower than artificial structures) with an egg loss rate of 34%, a chick loss rate of 24%, and a fledging success rate of two fledglings per successful nest. Egg loss was higher for natural nests by 8.5%, but chick loss and parasitism rates were lower by 4.3% and 5%, respectively (Reitsma 1998). In 1999, Reitsma monitored 57 of 99 natural nests and found that the overall nest success was 47% (down from 63% in 1998), with an egg loss rate of 47% (increased from 34% in 1998), a chick loss rate of 40% (up from 24% in 1998), and a fledging success rate of 1.78 fledglings per successful nest (down from 2.0 fledglings per nest in 1998). Although artificial nest structures are intensively and successfully managed (cowbird control, parasite removal, nest mite control, and terrestrial predator control), Reitsma (1998) found no significant difference in the percent successful nests between artificial and natural nests (artificial nests success greater than natural nests by 1.5%). However, in 1999, the nesting success rate for natural nests was lower than in artificial nest structures; with an overall success rate of 69% for 107 artificial nest structures compared to 47% for natural nests. Egg loss was higher for natural nests by 10%, and chick loss was also higher by 27% (Reitsma 1999).

Reitsma (1999) suggested that the data on the number of fledglings produced in artificial nest structures demonstrate the continued critical role of the artificial nest structure program. In 1998, the total number of fledged young from artificial nest structures was 299 compared to only 56 (15.7%) from natural nests. During the 1998 and1999 breeding seasons, mariquitas produced 104 fledglings from monitored natural nests compared to 563 from artificial nest structures (Reitsma 1999). Reitsma (1999) found a pattern of nesting success that appears to be linked to food availability. When comparing nest success between mariquita nests on the east (south of the Aerostat) and west (pond areas near the boat launch) of Pitahaya (Lajas), he found greater nest success in the east, where food abundance on black mangrove leaf surfaces increased steadily and were consistently much higher than in the west. The areas of high arthropod abundance in the east are much greater than in the west (Reitsma 1999). López-Ortiz *et al*. (2002) also found that nests in artificial structures were 17% more successful than nests found in natural substrates; and egg loss was 31% higher for natural nests than nests in artificial structures in 1999. There was 30% fewer nests with chick loss in artificial structures compared to natural substrates (López-Ortiz *et al*. 2002).

Lewis *et al.* (1999) recorded 11 activities in the mariquita, and found differences in foraging, resting, and vocalization among three daily periods. Mariquitas foraged more often in the morning and afternoon than the mid-day period, rested more frequently during mid-day, and vocalized more during the afternoon. When comparing activities among habitat types, differences were found in foraging, feeding, resting, preening, bathing, and drying (Lewis *et al.* 1999). Foraging was observed more frequently in mesquite stands and scrub habitats, feeding was more frequent in residential areas, resting and preening were more often observed in mangrove and residential areas; whereas bathing and drying were only observed in mangrove (Lewis *et al.* 1999). Afternoon followed by mid-day were the periods when more numerous or larger flocks were observed (Lewis *et al.* 1999). Out of 511 radio-tracking observations where visual

contact was made with the mariquita, in 283 observations (55.4%) they were flocking with either grackles and/or cowbirds (Lewis *et al.* 1999).

PRDNER has been monitoring mariquita nests in artificial nest structures and natural nests simultaneously, between 1996 and 2009 (Table 2). In 1996, 64.76% of nests built in artificial structures were active and 76% of these were successful (at least one chick fledged); however, fledglings per successful nest (1.84) and overall breeding success (39%) were the lowest recorded since 1994 (Falcón *et al.* 1997). All of the three monitored natural nests failed in 1997 (Falcón *et al.* 1997). Falcón *et al.* (2000) found that, from a total of 267 nests in artificial nest structures in 2000, 249 (93%) were active and 104 (42%) were successful. A total of 835 eggs were laid, and 465 (56%) were lost. A total of 370 mariquita chicks were produced, 280 of which fledged and 90 were lost; for an overall nest success of 34% (Falcón *et al.* 2000). Natural nest surveys were conducted throughout southwestern Puerto Rico in 2000; however, not all nests found were available for monitoring, and a total of 104 nests were found (Falcón *et al.* 2000). From 54 natural nests monitored, 76% were active and 49% were successful; but number of chicks fledged was not recorded (Falcón *et al.* 2000). In 2002, mariquitas used 97% of the artificial nest structures; they laid a total of 879 eggs (up from the previous count in 2000), and lost 45% of them (Falcón *et al.* 2002). The total number of chicks produced in artificial nest structures was 484, of which 378 (78%) fledged (Falcón *et al.* 2002). They monitored 39 natural nests, and found that 72% were active, 32% were successful, and 89 % (25/28) of the chicks produced fledged for a nest success of 33% (Falcón *et al.* 2002).

A total of 273 artificial nest structures were used in April 2004, and 266 (97%) of these were active (López-Ortiz *et al*. 2004). López-Ortiz *et al*. (2004) recorded a total of 371 chicks produced in artificial nest structures, of which 263 (71%) fledged; and they monitored 39 natural nests where they found that only 9 (2.3%) were successful. In 2005, López-Ortiz *et al*. (2005) monitored 380 active nests in artificial structures, and 215 of them (56.6%) were successful. The total number of chicks produced in artificial structures was 720, and 78.1% of these fledged López-Ortiz *et al*. (2005). However, out of 120 natural nests monitored, only 29 (24.2%) were successful; and out of 124 chicks produced 62 (50%) fledged (López-Ortiz *et al*. 2005). Medina-Miranda *et al.* (2006) monitored 245 artificial nest structures in 2006; 96% of which were active, and about 67% successful. The number of chicks produced increased from the previous census to 349, and 286 (82%) of these fledged (Medina-Miranda *et al.* 2006). They also monitored 12 natural nests, 10 of which were active (83%) and about 40% successful (Medina-Miranda *et al.* 2006). Medina-Miranda *et al.* (2007) monitored 311 active artificial nest structures (62% of which were successful), and they found 34 active natural nests, but their success was not monitored.

Table 2. Nesting data from artificial and natural mariquita nests in southwestern Puerto Rico.

Period	Type of nest	# active nests	# eggs	% fledging success
1996-1997	Artificial	82	258	39
	Natural	3	---	0
1999-2000	Artificial	249	835	33
	Natural	54	155	49
2001-2002	Artificial	254	879	43
	Natural	28	76	33
2003-2004	Artificial	266	821	32
	Natural	39	130	15
2004-2005	Artificial	385	1,283	44
	Natural	120	352	18
2005-2006	Artificial	234	677	42
	Natural	10	9	0
2006-2007	Artificial	311	1,031	81
	Natural	34	---	---

2. Five Factor Analysis (threats, conservation measures, and regulatory mechanisms)

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

The revised recovery plan identified the destruction of mariquita feeding, roosting, and nesting habitat as the major threat to the species (USFWS 1996); stating that destruction of mariquita foraging and nesting habitat on the mainland for residential and tourist development, as well as agricultural activities continued in southwestern Puerto Rico. It further indicates that the use of La Parguera waters, cays, and shoreline is incompatible with the needs of the species for roosting and nesting in the area. The direct, indirect, and cumulative impacts of unauthorized floating houses, additional unauthorized structures in the cays and shoreline, boats, sailboats, and personal watercrafts on the mariquita roosting areas in La Parguera have not been evaluated (USFWS 1996). Although the threat of authorized and unauthorized structures in and around cays used by the mariquita has been reduced due to actions implemented by the Corps of Engineers and PRDNER, disturbance caused by recreational boaters in and around the mangrove cays of La Parguera (*e.g.,* illegal anchoring and tying of vessels in the mangrove) continues. Upland development around La Parguera has increased since the completion of the revised recovery plan.

In 2006 and 2007, the Service actively participated in the disposal process of the Roosevelt Roads Naval Station. As part of a consultation under section 7 of the ESA,

approximately 4,006 acres of both wetland and upland habitats were protected through land transfer agreement for conservation, designation of special zoning, and implementation of species-specific conservation recommendations; as part of the critical habitat for the mariquita.

Most of the areas where mariquitas have been observed in southern Puerto Rico (Salinas and Guayama), however, are abandoned pasturelands interspersed with patches of forests or isolated trees in private lands, previously used for cattle grazing and agricultural crops. No conservation agreements have been implemented to restore these areas to coastal dry forest, and manage these lands as mariquita habitat.

The destruction, modification, or curtailment of the mariquita habitat or range continues to be a factor threatening this species. Overall, most of the habitat used by mariquitas is found in private lands. Although mariquitas use protected forests in southwestern Puerto Rico, foraging and nesting activities are also prevalent in private lands. Most of the habitat used by mariquitas for foraging, roosting, and nesting in Salinas and Guayama are vacant private farms with patches of secondary forest or agricultural fields. Therefore, the magnitude of this threat is moderate and the immediacy of threat to the species is imminent, because the nesting population within the favorite nesting grounds in Pitahaya within BCF has increased, but available roosting and foraging habitat within and adjacent to La Parguera continues to be threatened by development pressure.

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

This factor is not considered a threat to the species.

(c) Disease or predation;

The revised recovery plan states that nest infestation by two species of blood-feeding mites (*Ornithonyssus bursa* and *Androlaelaps casalis*) may lead to nest abandonment by adult mariquitas and premature nest desertion by young birds (USFWS 1996). Lice (*Philopterus agelaii*, *Machaerilaemus* sp., and *Myrsidea* sp.) may also affect nesting mariquitas, particularly those in cavity (covered) nests and re-used nests from the previous breeding event (Cruz-Burgos *et al.* 1997). During 1996-1997, mite infestation in artificial nest structures was controlled using pesticides (Sevin® 5%), before the appearance of eggs and after hatching (Falcón *et al.* 1997).

Avian pox was identified in the revised recovery plan as a potential problem for the mariquita (USFWS 1996). Mariquitas infected with avian pox had significantly lower survival rate than uninfected birds (USFWS 1996). López-Ortiz *et al.* (2004) found two dead chicks in an artificial nest structure, and the preliminary necropsy report revealed avian pox as the cause of death.

Falcón *et al.* (1997) stated that the major causes of egg failure in artificial nest structures during 1996-1997 were disappearances (egg missing), abandonment (unpunctured eggs more than two weeks old and without parents in the vicinity), and failure to hatch. In

1999 to 2000, the major causes of egg failure were disappearance, followed by not hatched, abandoned, and punctured (Falcón *et al.* 2000); and similar results were observed in 2001-2002 (Falcón *et al.* 2002). The reasons for disappearance, abandonment, and failure to hatch are not known, but predation and presence of avian and mammalian predators around artificial nest structures was suspected; and has been suspected (Díaz and Lewis 2006) or observed on other occasions (DeLuca *et al.* 2010, unpub. data).

The revised recovery plan indicates that the black rat (*Rattus rattus*) is an important predator of mariquitas; being the major cause of egg and chick loss in certain breeding areas (USFWS 1996). Rats climb artificial nest structures and either prevent mariquitas from using nest structures, remove or eat the eggs and chicks, or cause adult nest abandonment (Cruz-Burgos *et al*. 1997). Although rat predation is controlled in artificial structures by using rat-excluding devices (metal guards on supporting poles) (USFWS 1996), natural nests continue to be threatened by rats. López-Ortiz *et al*. 2004 documented predation by rats as the main cause of nest failure in natural nests. The 22% lower success of mariquitas in natural nests compared to artificial nest structures, coupled with nest predation being the greatest cause of nest failure, suggests that predator deterrents on artificial nest structures may be important in maintaining high nest success in artificial nest structures (Reitsma 1999). The refurbishing of artificial nest structures to better deter nest predators was likely the best explanation for increased numbers of fledglings in 1999 compared to 1998, despite the decline in nesting attempts. This is further supported by the reduction in both egg and chick losses due to rat predation in artificial nest structures in 1999 compared to 1998 (Reitsma 1999). Reitsma (1999) suggests that the ability to manage for nest mortality factors in artificial nest structures continues to be an important component of mariquita recovery, especially in a year of high predation of natural nests. In addition, López-Ortiz *et al*. (2002) state that the high nesting success in artificial nest structures may be effective in helping the species to recover. Artificial nest structures are the principal source of new individuals to the mariquita southwestern population, and continued management will be needed to further increase the breeding population and reproductive output (López-Ortiz *et al*. 2002).

Cruz-Burgos *et al*. (1997) believe that predation is one of the most important factors affecting natural nests, and suspected that mariquitas shape their nests in part as a response to potential predation by pearly-eyed thrashers (*Margarops fuscatus*). Likewise, Reitsma (1998) found that predation was the greatest cause of nest failure (37.5%) for all mariquita nests known to fail. He inferred predation by a combination of circumstantial evidence including broken eggs, dislodged nests, observation of predators (*e.g*., feral cat near nesting area, rat coming out of a mariquita nest, pearly-eyed thrasher pecking at mariquita chick in a nest), stage of nest combined with condition of nest at subsequent visit, and predator tracks around the nesting area (probably Rhesus monkeys, *Macaca mulatta*) (Reitsma 1998). Falcón *et al.* (2000) suggested that Rhesus monkeys may have been responsible for the highest percentage of egg loss found in 10 years. Monkey tracks were observed in different breeding areas where eggs were lost, where active nests were found on the ground, and where chicks disappeared. Additionally, monkey feces were collected in a funnel metal device located on an artificial nest structure (Falcón *et al.*

2000). Falcón *et al.* (2002) observed Rhesus monkeys, their tracks and feces within a few meters of artificial nest structures, and they suspected that approximately 100 mariquita eggs in more than 30 nest structures disappeared due to monkey activities. Falcón *et al.* (2002) indicate that monkeys represent a high jeopardy to the mariquita, and suggest that a monkey control program be initiated as soon as possible in the mariquita breeding areas. In 2004, an adult patas monkey (*Erythrocebus patas*) was observed during a few minutes while it was being harassed by several mariquitas, while the monkey was trying to grab the birds in flight (López-Ortiz *et al*. 2005). Nests of other bird species that use black mangrove areas for nesting are also depredated by monkeys (Vincenty 2006), pointing at the importance of monkeys as avian nest predators in black mangrove forests of the southwest.

López-Ortiz *et al*. (2002) also reported that the main cause of egg failure and chick loss was predation. Besides the previously-reported predators, López-Ortiz *et al*. (2002) indicated that other possible predators of eggs, fledgling, or adult mariquitas also seen near the artificial nest structures were smooth-billed ani (*Crotophaga ani*), mangrove cuckoo (*Coccyzus minor*), yellow-billed cuckoo (*C. americanus*), black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*N. violaceus*), osprey (*Pandion haliaetus*), and red-tailed hawk (*Buteo jamaicensis*). They further suggested that the greater predation found in natural nests compared to artificial nest structures could be caused by rats, cats, and avian predators (*e.g*., pearly-eyed thrashers) not found near the artificial nest structures (López-Ortiz *et al*. 2002).

Predation was the most common reason for nest failure in artificial structures during the 2000-2001 breeding season at Pitahaya (Díaz-Rodríguez and Lewis 2006). Forty-two percent of nests were lost during incubation, while 25% were lost during the nestling phase. However, although the areas studied by Díaz-Rodríguez and Lewis (2006) were in close proximity to one another and both had the same landscape, nest outcome differed greatly. They could not determine the reason for the difference; however, they suspected that feral monkeys may have located one of the areas and consumed the nests contents (Díaz-Rodríguez and Lewis 2006).

Although the revised recovery plan does not identify predators of adult mariquitas, a number of reports indicate that avian predators and mammalian predators pose a risk to adult mariquitas. McKenzie and Noble (1990) reported 14 attacks on foraging flocks of icterids in mesquite woodland. Of these, only one was successful and the prey was a female cowbird and the predator an American kestrel (*Falco sparverius*). Miranda (1995) also reported an American kestrel taking in flight an adult mariquita with apparent pox virus lesions in its eyes. Feral cats (*Felis catus*) (Reitsma 1998), merlin (*Falco columbarius*), red-tailed hawks, and small Indian mongoose (*Herpestes auropunctatus*) (Lewis *et al*. 1999), may prey on adult mariquitas. López-Ortiz (PRDNER, pers. comm., 2010) suggested that the introduced green iguana (*Iguana iguana*) and the constrictor boa (*Boa constrictor*), which are known to consume bird eggs and chicks and have been found in close proximity to mariquita nesting areas, may also prey on eggs and chicks of the mariquita.

Based on the above, the magnitude of threat of disease and predation on the mariquita is high, and the immediacy of threat to the species is imminent.

(d) Inadequacy of existing regulatory mechanisms;

In 1999, the Commonwealth of Puerto Rico approved the Law # 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, regulate permits, regulate hunting activities, and regulate exotic species among others. In 2004, the Puerto Rico Department of Natural and Environmental Resources 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). The mariquita has been included in the list of protected species and designated as "endangered". This regulation under Article 2.06 prohibits collecting, cutting, removing, among other activities, listed animals within the jurisdiction of Puerto Rico.

Federal regulations also protect the mariquita. 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.

PRDNER proposed to designate natural critical habitat for the mariquita, due to the vulnerability and endemic status of this species (PRDNER 2009). Two or more of the following criteria were necessary for an area to be proposed as natural critical habitat: the area had to be within a specific location where the species is found or where it could be re-introduced; scientific information establishing that the area possesses essential biotic and abiotic characteristics for the conservation of the species must be available, and that it is in need of protection or special management; and the historic distribution of the species (PRDNER 2009). In addition, they took into account recurrent sighting, nesting, feeding, and roosting reports. The proposed natural critical habitat for the mariquita consists of 21 segments; following a counter-clockwise direction from the northwest to the southeast and ending on the northeast of Puerto Rico, and including Mona and Monito islands (PRDNER 2009). This proposed critical habitat designation included locations within the municipalities of Cabo Rojo, Ceiba, Guánica, Guayama, Lajas, Mayagüez (including Mona and Monito islands), Salinas, and Santa Isabel (PRDNER 2009).

Based on the presence of Federal and Commonwealth laws and regulations protecting the mariquita, and the absence of evidence supporting lack of enforcement of regulations to protect the mariquita or governmental measures to prevent destruction of its habitat, we believe that inadequacy of existing regulatory mechanisms is not a threat to the mariquita.

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

The revised recovery plan identified invasion of nesting areas by Caribbean martins (*Progne dominicensis*) as one of the two most important threats to the mariquita. Caribbean martins were responsible for the loss of ten mariquita eggs in artificial nest structures, and 17 eggs of Caribbean martins were found in 18 mariquita nests (Falcón *et al.* 2002). Although two artificial nest structures were used by Caribbean martins during the mariquita breeding season in April 2007, egg loss due to nest piracy by Caribbean martins was not found (Medina-Miranda *et al*. 2007).

Observations of mariquitas tending and caring for English sparrow (*Passer domesticus*) fledglings suggest that mariquitas are pre-disposed to brood and raise nestlings from other bird species; a behavior that is exploited by the shiny cowbird, *Molothrus bonariensis* (Ramos-Alvarez and López-Ortiz 2009). The extensive nest parasitism of the mariquita by the shiny cowbird (a species that migrated into Puerto Rico in the 1940s) was the most crucial factor in the decline of the mariquita in Puerto Rico at the time of listing (USFWS 1996); however, significant reductions in cowbird parasitism have been experienced after the cowbird control program by PRDNER was established in 1982. Reitsma (1998) did not find cowbird parasitism in natural nests, and stated that the low parasitism rates he observed in natural nests were likely the result of the successful cowbird removal program (Reitsma 1998). Reitsma (1999) found that cowbird nest parasitism was low for both artificial nest structures and natural nests; occurring only in one natural nest. Cowbird reduction is critical, but the low incidence of parasitism in natural nests in the 1998 and 1999 breeding seasons (1.4%) was encouraging (Reitsma 1999). Cowbird parasitism rates fell from 100% in 1982 to less than 3% in southwestern Puerto Rico (overall average from 1996 to 1999 in both artificial nest structures and natural nests) (López-Ortiz *et al*. 2002). No cowbird nest parasitism was recorded in 2002 (Falcón *et al.* 2002). In a three-year period (2000-2001, and 2003), parasitism frequency in a non-managed area was higher (52.4%, 11 of 21 nests) than in the managed area (3.1%, 29 of 927 nests) (Cruz *et al*. 2005). Díaz-Rodríguez and Lewis (2006) also found that brood parasitism by shiny cowbirds was not significant in artificial nest structures during 2000-2001. Higher parasitism rates in non-managed areas, as compared to those in managed areas, suggests that cowbirds still pose a threat to mariquita populations (Cruz *et al*. 2005). Large numbers of cowbirds have not been reported from Mona or Monito islands (Cruz *et al*. 2005), and López-Ortiz (PRDNER, pers. comm., 2010) hypothesizes that predation by American kestrels has prevented the establishment of cowbirds on Mona Island.

The lower cowbird parasitism rates and increase in the mariquita population in managed areas can be attributed to a decrease in the local cowbird population due to trapping of adult cowbirds and removal of their eggs (Cruz *et al*. 2005; López-Ortiz *et al*. 2006; Medina-Miranda 2008). In addition, López-Ortiz *et al*. (2006) suggested that removal of cowbird offspring from mariquita nests has resulted in host shifting, because cowbird offspring may be imprinting to other available hosts such as the yellow warbler (*Dendroica petechia*). Porrata-Doria (2006) suggested that the non-specificity of the female cowbird in its laying season resulted in an increase in nest parasitism of other species with previously documented zero or near to zero parasitism rates in Puerto Rico. Cowbirds typically roost in association with mariquitas and Antillean grackles in offshore cays in Lajas, and sometimes follow them to feeding or nesting grounds. Consequently,

it is possible for gravid cowbird females to gain access to areas managed for the mariquita, and since cowbird eggs and chicks have been removed exclusively from mariquita nests, cowbird chicks might still be fledging from other hosts such as the yellow warbler (Vincenty 2006). It is possible that anti-parasitic strategies of mariquitas may not vary with continued removal of cowbirds in managed areas, but rather that cowbird parasitism success at other species nests may result in progressive selection against parasitism of mariquita nests (Medina-Miranda 2008).

Besides nest parasitism, mariquitas may face competition for nest-sites with other bird species. Cruz-Burgos *et al*. (1997) mentioned that part of the reason for mariquitas to build nests covered by leaves in coconut palm forests is to avoid competition for nesting space from grackles (*Quiscalus niger*) and rock doves (*Columba livia*). Because mariquitas usually select the upper fronds of palms for nesting, Reitsma (1998) indicated that pruning of the lower fronds of coconut palm trees may remove grackles and doves that nest on the lower palm fronds.

Human activities have indirectly and directly affected the mariquita population. Reitsma (1998) reported breeding failure of a mariquita nest at Villa La Mela, Cabo Rojo, due to pruning of coconut palm fronds. During pre-breeding, Lewis *et al.* (1999) reported a total of ten artificial feeding areas in La Parguera, where people provided mariquitas with a variety of food items (*e.g*., granulated sugar, bread, cooked rice, cooked fish, cake). Although not many residents of Barrio Corozo, Cabo Rojo, provided mariquitas with food, mariquitas took advantage of secondary food sources such as waste grain from chicken pens, seeds from pet birds, and dog food (*i.e*., cooked rice and small dry pellets) (Lewis *et al*. 1999). Saliva (2002, pers. obs.) reported a group of 10-12 mariquitas feeding on Chinese food at a residential area in Boquerón, Cabo Rojo. The impact of non-natural sources of food on the long-term health of the mariquita population is unknown; and although food searching in human settlements may result in survival and growth of the Pitahaya mariquita population (Lewis *et al.* 1999), it may result in behavioral changes that prevent the natural dispersal of the species.

Mariquitas have been observed foraging in cultivated fields where insecticides are commonly applied to the crops. Therefore, some authors believe that mariquitas may be negatively affected by such insecticides (Lewis *et al.* 1999).

Inclement weather has been implicated in nest failure and mortality of mariquitas. After Hurricane Georges in 1998, there was an estimated 29% reduction in the mariquita population of southwestern Puerto Rico (Reitsma 1999). In 1999, one mariquita nest in black mangrove was lost due to rain, and four nests in coconut palm trees were lost due to high winds (Reitsma 1999).

Based on the above, we believe that the magnitude of threat from other natural or manmade factors is moderate, and the immediacy of this threat to the mariquita is non-imminent.

3. Synthesis

The mariquita was listed as endangered in 1976; and its revised recovery plan was approved on November 12, 1996. The Service considers the mariquita population to be improving because the population has been increasing since 1995, and some of the major threats to the species have been greatly reduced (*e.g.*, shiny cowbird nest parasitism and Caribbean martin nest piracy).

Over utilization for commercial, recreational, scientific, or educational purposes and the inadequacy of existing regulatory mechanisms are not threats to the mariquita. However, modification of mariquita habitat through upland development around La Parguera and recreational use of offshore roosting areas, continue to threaten this species. Mite infestations in artificial nest structures affect mariquita reproductive output, and avian pox results in mortality of young and adult mariquitas. Nest predators including pearly-eyed thrashers, rats, cats, and monkeys contribute to nest failure; whereas other possible predators such as smooth-billed ani, mangrove cuckoo, yellow-billed cuckoo, black-crowned night heron, yellow-crowned night heron, osprey, merlin, American kestrel, mongoose, and red-tailed hawk threaten the eggs, fledgling, or adult mariquitas. Meanwhile, Antillean grackles and rock doves compete with mariquitas for nest-sites in coconut palm forests. The impact of Caribbean martins on nesting mariquitas has been reduced through modifications of artificial nest structures. Human activities, such as pruning of trees, use of pesticides, and both intentional and unintentional feeding with non-natural foods, have indirectly and directly affected the species. Inclement weather is believed to have contributed to nest failure and mortality of mariquitas. Continued management and control of shiny cowbirds is necessary to minimize nest parasitism. Based on the above five factor analysis, the mariquita still meets the definition of an endangered species because habitat destruction or modification, disease or predation, and other natural or manmade factors continue to endanger its continued existence throughout a significant portion of its range.

III. RESULTS

A. Recommended Classification:

__X__ No change is needed.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Re-instate the color-banding program to determine fidelity to nesting areas, range expansion, and the use of natural nests in areas other than the natal sites. The color-banding program and monitoring of banded birds was halted, due to changes in program priorities, and reduction of budget and work force.

2. Continue to search for nests throughout the breeding season in areas were nesting has been documented in the past and in new areas.

3. Monitor breeding success in natural nests. A minimum of 30% of the coconut palm nests should be monitored in order to obtain some representative data on nest success in palm trees.

4. The current status of the eastern and southern mariquita populations is unknown, because sufficient monitoring of these populations has not been conducted. Therefore, additional consecutive censuses of these populations are needed to determine their status.

5. Accelerate dispersal of breeding mariquitas to new areas (*e.g*., Bioluminescent Bay, Boquerón Commonwealth Forest, Cabo Rojo salt flats, and Montalva Bay), by attracting them using artificial nest structures. One or two of these new areas should be selected as experimental areas to locate artificial structures. The impact of predators, competitors, and parasites on the population dynamics of the mariquita at the selected areas should be evaluated, to determine if competitor and predator/parasite management techniques are necessary.

6. Repeat nest site characterization studies at all sites, especially eastern and southwestern Puerto Rico, to accurately determine nest site characteristics that relate to the probability of nest success (*e.g*., food availability).

7. Effective public education and outreach programs are key to the recovery of the mariquita. For example, personnel in charge of pruning coconut palm trees should be made aware of the presence and nesting activities of mariquitas, and learn how to distinguish them from grackles. Likewise, an education campaign should be implemented for communities where nesting mariquitas have been reported (*e.g*., Barrio Corozo, Cabo Rojo), which may ultimately result in more information about mariquitas breeding in more developed areas.

8. Avoid pruning of coconut palm trees during the mariquita breeding season. If pruning during the mariquita breeding season is necessary for safety reasons, a biologist must inspect palm trees to be pruned and ensure that active mariquita nests are not present.

9. Monitor coconut palm nests using improved monitoring methods such as tree bikes that allow determining the fate of nests while avoiding the premature fledging of chicks.

10. Implement agreements with land owners of the secondary forest adjacent to Pitahaya, the property in front of the Club Náutico de La Parguera, and the land of the Club Tiro de La Parguera for the protection of those important feeding grounds. Since areas dominated by scrub vegetation do not appear to be preferred habitat for mariquitas, trees such as mesquite, úcar, and rolón should be planted within these private land areas.

11. Conduct study to determine food availability (*i.e*., insects and fruits) in the area of Pitahaya to determine at what extent that food would sustain a growing population of mariquitas, particular during breeding.

12. Establish management practices at the Cabo Rojo National Wildlife Refuge to enhance food availability during drought conditions. Irrigation of mesquite woodland would attract adult moths to rear their caterpillars, producing food for the mariquitas and possibly inducing them to nest at the refuge.

13. Determine the extent of primate predation on mariquita nests (possibly using hidden motion-sensing cameras), and implement management control measures to prevent predation by primates on the breeding areas.

14. Conduct genetic studies to determine if genetic differentiation between mainland and Mona-Monito populations exists.

15. Utilize radio-telemetry to obtain information on dispersal and inter-mixing between the small eastern and southern mariquita populations.

16. PRDNER Forest Managers at Commonwealth Forests where the mariquita is found should be involved in all aspects of the mariquita Recovery Program based on resources and agency priorities; including the planning and implementation of management practices that would benefit this species.

17. A revision of the species recovery plan is warranted, given the available new information on the biology of the mariquita.

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U.S. FISH AND WILDLIFE SERVICE

Mariquita or yellow-shouldered blackbird (*Agelaius xanthomus*) 5-year review

Current Classification Endangered

Recommendation resulting from the 5-Year Review

X No change is needed

Review Conducted By Dr. Jorge E. Saliva, Caribbean Ecological Services Field Office

FIELD OFFICE APPROVAL:

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

Approve _____ Date Jan 7, 2011

REGIONAL OFFICE APPROVAL:

for Cynthia Dohner, Lead Regional Director, Fish and Wildlife Service

Approve _____ Date 2-2-11

Appendix A

Summary of peer review for the 5-year review of the mariquita or yellow-shouldered blackbird (*Agelaius xanthomus*)

Marelisa T. Rivera and Edwin E. Muñiz reviewed this 5-year review internally. They mostly provided editorial comments. The Service sent this 5-year review to four outside peer reviewers (see below) via electronic mail, once the comments were added to the document. 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 mariquita, specifically in any additional information on the status and current threats to the species.

The deadline for submission of peer review comments was August 31, 2010. Comments were received from two independent peer reviewers during the comment period. Peer reviewers' comments (C) and the Service's responses (R) are provided below.

List of peer reviewers

Dr. José A. Cruz-Burgos
adelannoy@yahoo.com

PRDNER Yellow-shouldered Blackbird Recovery Program (Mr. Ricardo López-Ortiz, rlopez@drna.gobierno.pr; Ms. Roseanne Medina-Miranda, rmedina@drna.gobierno.pr; and Ms. Katsí Ramos-Alvarez, kramos@drna.gobierno.pr)

Dr. Leonard Reitsma
leonr@plymouth.edu

William V. DeLuca
wdeluca@eco.umass.edu

Comments by Dr. José Cruz-Burgos:

Dr. Cruz-Burgos provided several editorial suggestions, some of which were incorporated into the document.

C: *Sondra observó una en Ciales*. [Reviewer refers to Ms. Sondra Vega observing a mariquita in the municipality of Ciales, Puerto Rico]

R: This information was incorporated into the document.

C: *Males defend small territories during the nesting period, but before that season, they defend slightly larger territories to repel other males.*

R: The comment was incorporated into the document.

C: *Creo que debes separar pre-breeding de post. Como esta creo que causa confusión.* [Reviewer suggested that pre-breeding and post-breeding data be separated]

R: Pre-breeding and post-breeding survey data are separated in Table 1.

C: *Debes eliminar esta oración, ya que puede prestarse a confusión. Esto sucedió pq había unas mariquitas con pocas localizaciones y otras con muchas. No obstante, se decidió utilizar todos los pajaros para el análisis porque era mas importante la info tratándose de una sp en peligro. Lo ideal seria tener un minimo de 30 localizaciones por animal. Yo tuve pajaros con 10, 15, etc.* [Reviewer suggested eliminating a sentence regarding a literature citation because it could be misleading. He indicates why it is confusing]

R: Text was modified to reflect that results may not be conclusive due to the large variability in the samples.

C: *What months? From XX to XX*. [In reference to the period when mariquitas spend most of their time at Pitahaya]

R: Period was included in the document.

C: *Where? In the vicinity of the nesting tree? Or, more tree spp. were used for nesting?*

R: More tree species were used for nesting.

C: *O sea, que aunque hubo mas nidos en palmas, la cantidad de nidos activos fue mayor en mangle negro? Te pregunto pq los datos de arriba indican que hubo mas nidos en palmas que en mangle y esto puede confundir.* [In reference to the number of active nests in black mangrove compared to coconut palm trees]

R: Compared to other tree species, there were more nests on both black mangroves and coconut palm trees. Although there were more active nests in black mangrove, nesting success was higher in coconut palm trees.

C: *En realidad todos los nidos son naturales, lo que es artificial es la estructura*.[Reviewer indicates that all nests are natural, what is artificial is the structure]

R: Correct.

C: *Also more vulnerable to the edge effect. Otra explicacion para el uso del mangle negro pudiera ser precisamente, que su cercania a upland le permite a las mariquitas buscar alimento en el scrub hábitat para las crias*. [Reviewer comments that another explanation for the use of black mangrove may be its proximity to upland areas where mariquitas can forage for food for their chicks]

R: The comment was incorporated into the document.

C: *Esta info es muy valiosa. Se le ha dado seguimiento?*
[Reviewer indicates that data on egg and chick loss found in Reitsma (1999) are very valuable and he questions if someone has followed up on it].

R: The Service is not aware of any additional information on this.

C: *Si pero la cantidad de nidos artificiales es mayor. Si es asi, la comparación no es justa.*
[Reviewer comments that a comparison between fledging success in artificial and natural nests is not fair, because the number of artificial nests is larger]

R: Although there was a greater number of artificial nests, Reitsma (1999) monitored the fate of 100% of the 57 active natural nests that he studied. The Service believes that this sample size is sufficient to draw comparisons between fledging success in artificial and natural nests.

C: *No entiendo bien esta comparacion del este y oeste de Pitahaya. A que lugar especifico se refiere? Que tipo de hábitat es? Un mapa ayudaría*. [Reviewer requests clarification on text concerning what specific areas comprise east and west Pitahaya, respectively, and what type of habitat is found on each]

R: Document was modified to include clarification. However, Reitsma (1999) does not specify the type of habitat found in each area.

C: *What threat is moderate? What is the immediacy of threat to the species?*

R: The magnitude of threat from destruction, modification, or curtailment of habitat for the mariquita is moderate. Immediacy refers to the criticality of a threat to a species. This threat is imminent, because actions or protection mechanisms to reduce this threat to the mariquita are not sufficient or appropriate. The species main population is currently known from privately owned lands that continue to be subjected to residential development and habitat modification.

C: *Esta oracion da la impresion de que basado en estos datos es que se identifica a la golondrina como la segunda amenaza para la mariquita. A mi entender, la perdida de solo 10 huevos de YSBL no hace a la golondrina una amenaza inminente*. [Reviewer indicates that the sentence "Caribbean martins were responsible for the loss of ten mariquita eggs in artificial nest structures, and 17 eggs of Caribbean martins were found in 18 mariquita nests" gives the impression that it was based on these data that the species' recovery plan identified the Caribbean martin as the second threat to the mariquita. He believes that the loss of 10 mariquita eggs does not constitute an imminent threat]

R: The document does not mention Caribbean martin nest parasitism as an imminent threat to the mariquita. The Service concurs that it is not an imminent threat, because of the sporadic occurrence of nest piracy and the new design of artificial nest structures that reduces nest parasitism.

C: *Esta recomendacion se debe discutir. En principio no estoy muy de acuerdo (costo, quien lo haría, continuar la dependencia de las mariquitas a estructuras artificiales). Quizas seria apropiado de manera experimental. En una o dos areas.*

[Reviewer indicates that, in principle, he does not agree with recommendation because of costs and personnel needed for this project, and the dependency of mariquitas on artificial structures. He suggests that it may be appropriate as an experiment in one or two areas]

R: The suggestion was incorporated into the document.

C: *Añadir las propiedades en el camino hacia Pitahaya. Estos terrenos han sido vendidos y el hábitat está siendo modificado. La mariquitas utilizan esta vegetación como corredor para moverse hacia Las Palmas y Corozo.* [Reviewer suggests including private lands along the Pitahaya road because they are important mariquita corridors between Las Palmas and Corozo wards]

R: A recommendation within the document already incorporates this suggestion.

C: *Cuan practico seria esto? Como se sabria cuanto consume una mariquita para determinar cuantas se sostendrian con x cantidad de insectos y frutos. Se que para patos se ha deteminado los "duck use days" pero para otros pajaros no se. Por otra parte, en breeding se alimentan mas de insectos que de frutos. Para mi lo mas esencial es trabajar con los dueños de terrenos para mejorar el hábitat.* [Reviewer questions the practicality of recommendation to conduct a study of mariquita food availability. He believes that the most essential thing is to work with private land owners to improve habitat]

R: The Service considers that, although a food availability study is difficult and may not appear to be practical, it is a valid recommendation that should be considered. Although the Service does not prioritize recommendations, it concurs that working with private landowners to improve mariquita habitat is essential for the species.

C: *Solo por curiosidad, pq A. Falcon es primer autor en estos informes?* [Reviewer questions, out of curiosity, why A. Falcón is the first author in some reports]

R: A. Falcón appears as the first author because that is how the reports were submitted to the Service.

Comments by Mr. William V. DeLuca:

C: *I think it would be good to clearly emphasize the importance of ensuring the protection of Pitahaya and any other sites in the SW heavily used as breeding locations by YSBL. It seems as though these sites may be acting as population sources facilitating their breeding range expansion and could act to replenish the population if it is reduced due to something like a*

natural disaster (hurricane). I know the SW is undergoing a ton of development, so emphasizing this point might be important.

R: The comment was incorporated into the Recommendation Section.

C: *I would disagree with the statement "Since areas dominated by scrub vegetation do not appear to be appropriate habitat for mariquitas" in number 10. We often observed YSBL foraging on the fruit (bright red) of one of the cactus species in the adjacent upland scrub habitat. Sorry I forget the cactus species name, but I'm sure we mentioned this in one of the reports.*

R: Sentence modified to "Since areas dominated by scrub vegetation do not appear to be preferred habitat for mariquitas..."

Comments by Dr. Leonard Reitsma:

C: *What about palms at public beaches* [as a preferred nesting site]?

R: Coconut palm trees at public beaches are also a favorite breeding site for mariquitas, but the majority of the literature suggests that they prefer black mangrove areas for nesting.

C: *I think this is a good synopsis of the population data laid out in the preceding paragraphs.*

R: We acknowledge the comment.

C: [Reviewer refers to the lack of genetic information as an area that needs greater funding]

R: The recommendation section was modified to include the gathering of genetic information on the species.

C: *Is this based upon any quantified data either for habitat, landscape mosaic, or food availability?* [Reviewer refers to the statement that body size influences the species' home range may not be applicable where additional sources of food may not be readily available, and the species may be forced to expand its home range]

R: Following Lewis *et al*. 1999, it is based on food availability.

C: *This nearly exact wording was already used earlier. Perhaps it deserves double-billing under different headings if appropriate for each.* [Reviewer refers to third paragraph of page 10]

R: Information and data may be repeated more than once within the document, when necessary to explain an issue or support a statement.

C: *How many total were found in 2002? Was there a perceived reduction in the number of natural nests from 01 to 02?*

R: Falcón *et al*. (2002) found a total of 39 natural nests. Comparisons with 2001 could not be made because the lack of manpower was a major drawback to obtain an estimated number of natural nests in 2002.

C: *So has funding for natural nest searching and monitoring waned?*

R: Funding has not increased. Other project priorities have prevented the allocation of additional funds for nest searching and monitoring.

C: *Did 1998 data intentionally get excluded from this table?* [Reviewer refers to Table 2 of nesting data from artificial and natural mariquita nests in southwestern Puerto Rico]

R: No, 1998 data were not intentionally excluded. The Service did not receive a report on nest data for 1998 from PRDNER.

C: *Did this end after that year and if so, why?* [Reviewer refers to the application of insecticides to artificial nest structures to control mite infestations]

R: No. Application of insecticides to control nest mites continued after 1997.

C: *I'd reword this a bit for more clarity, particularly the second phrase of the sentence.* [Reviewer refers to Medina-Miranda (2008) statement that is possible that anti-parasitic strategies of mariquitas may not vary with continued removal of cowbirds in managed areas, but rather that the manifestation of such strategies may not be favored]

R: The document was modified to clarify the statement.

C: *I think these data actually come from the DNER, right?* [Reviewer refers to population size data after Hurricane Georges]

R: Yes, but it is cited in Reitsma 1999.

C: *And ideally at stable levels of effort.* [Reviewer refers to recommendation to continue to search for nests throughout the breeding season for new areas around and between the areas were nesting has been documented in the past.]

R: The interested agencies attempt, as much as possible, to maintain the same level of effort despite budgetary constraints.

C: *Would also be nice to connect the dots between these small pops and the larger SW pop through telemetry, i.e., outfit inds in smaller pops with transmitters.* [Reviewer refers to recommendation to conduct additional consecutive censuses to determine the status of the eastern and southern populations]

R: The recommendation was added in the document.

C: [Reviewer refers to attracting mariquitas to new areas by placing artificial nest structures as a good idea]

R: We acknowledge the comment.

C: *any natural land cover adjacent to Pitahaya should be a priority since YSBBs overflow into these scrubs habitats for feeding.*

R: The document was modified to reflect this comment.

C: *And perhaps expedite increase in plant species known to provide food during the breeding season.* [Reviewer refers to recommendation to conduct study to determine food availability]

R: Pending the results of the food availability study, the interested agencies and private landowners may consider the selective planting of preferred mariquita plant species in the Pitahaya area.

Comments by PRDNER Yellow-shouldered Blackbird Recovery Program (in addition to editorial suggestions in the text):

C: *No se indica los años que comprende el documento (ej. 1997-2001)*. [Reviewers indicate that the period of review is not specified in the first page]

R: The first page of this document does not indicate the period of revision included in this five-year review. However, Section IA "Methodology used to complete this review" states that this review includes information from the period between the last approved revised recovery plan for the species (1996) until the present (2010).

C: *No se especifica el propósito de este documento*. [Reviewers indicate that the objective of a five-year review is not specified]

R: Language was incorporated in Section IA "General Information", to reflect the Service's objective in completing a five-year review of the species.

C: *¿Por qué en español?* [Reviewers ask why the document is using the Spanish name of the yellow-shouldered blackbird ("mariquita") throughout the document, instead of its English common name.]

R: The Spanish common name "mariquita" is used throughout this five-year review because the Service prefers to use plain, simple language that it is easily understood by a wider audience. Since this species is endemic to Puerto Rico, the Service believes that the term mariquita is more familiar to the general public who has more contact with the species.

C: *(municipalities of Cabo Rojo and Lajas).* [Reviewers suggest inclusion of two municipalities in southwestern Puerto Rico]

R: The recommendation was added in the document.

C: *Enumerar estos cinco factores (1,..5).* [Reviewers suggest that the five listing factors be listed in this section, because there is no prior indication in the document of what the five factors encompass]

R: The recommendation was added in the document.

C: *No se ha observado en Pitahaya*. [Reviewers comment that the pearly-eyed thrasher has not been observed in Pitahaya]

R: We acknowledge the comment. However, the pearly-eyed thrasher is a very common, widespread bird throughout southwestern Puerto Rico, including lowland habitats that are connected and similar to Pitahaya (such as the Caribbean Islands National Wildlife Refuge). Therefore, there is high probability that this species, which is known to prey upon eggs and chicks of other bird species, is also found in Pitahaya.

C: *Se puede comentar sobre la publicación de Ramos-Álvarez K. 2009. Volantones de Gorriones Ingleses (Passer domesticus) atendidos por la Mariquita de PR.* [Reviewers suggest including information on English sparrow parasitism found in Ramos-Alvarez and López-Ortiz 2009]

R: The document was modified to include reviewers' suggestion.

C: *Involucrar a los oficiales de Manejo*. [Reviewers suggested an additional recommendation to involve PRDNER Forest Managers in the mariquita recovery program]

R: The amount of involvement is determined by the Secretary of PRDNER and the priorities and resources of their agency. We cooperate closely with all state and territory agencies in implementing recovery.