DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[FWS–R9–IA–2008–0117; 96100–1671–0000–B6]

RIN 1018–AV76

Endangered and Threatened Wildlife and Plants; Listing Three Foreign Bird Species From Latin America and the Caribbean as Endangered Throughout Their Range

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to list three species of birds from Latin America and the Caribbean—the Andean flamingo (*Phoenicoparrus andinus*), the Chilean woodstar (*Eulidia yarrellii*), and the St. Lucia forest thrush (*Cichlherminia lherminieri sanctaeluciae*)—as endangered under the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*). This proposal, if made final, would extend the Act's protection to these species. The Service seeks data and comments from the public on this proposed rule.

DATES: We will accept comments received or postmarked on or before February 23, 2009. We must receive requests for public hearings, in writing, at the address shown in the **FOR FURTHER INFORMATION CONTACT** section by February 9, 2009.

ADDRESSES: You may submit comments by one of the following methods:

- Federal eRulemaking Portal: *http://www.regulations.gov*. Follow the instructions for submitting comments.
- U.S. mail or hand-delivery: Public Comments Processing, Attn: FWS–R9–IA–2008–0117; Division of Policy and Directives Management; U.S. Fish and Wildlife Service; 4401 N. Fairfax Drive, Suite 222; Arlington, VA 22203.

We will not accept comments by e-mail or fax. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see the Public Comments section below for more information).

FOR FURTHER INFORMATION CONTACT: Rosemarie Gnam, Division of Scientific Authority, U.S. Fish and Wildlife Service, 4401 N. Fairfax Drive, Room 110, Arlington, VA 22203; telephone 703–358–1708; facsimile 703–358–2276. If you use a telecommunications device for the deaf (TDD), call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Public Comments

We intend that any final action resulting from this proposal will be as accurate and as effective as possible. Therefore, we request comments or suggestions on this proposed rule. We particularly seek comments concerning:

(1) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to these species and regulations that may be addressing those threats.

(2) Additional information concerning the taxonomy, range, distribution, and population size of these species, including the locations of any additional populations of these species.

(3) Any information on the biological or ecological requirements of these species.

(4) Current or planned activities in the areas occupied by these species and possible impacts of these activities on these species.

You may submit your comments and materials concerning this proposed rule by one of the methods listed in the **ADDRESSES** section. We will not consider comments sent by e-mail or fax or to an address not listed in the **ADDRESSES** section.

If you submit a comment via *http://www.regulations.gov*, your entire comment—including any personal identifying information—will be posted on the Web site. If you submit a hardcopy comment that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy comments on *http://www.regulations.gov*.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Division of Scientific Authority, 4401 N. Fairfax Drive, Room 110, Arlington, VA 22203; telephone 703–358–1708.

Background

Section 4(b)(3)(A) of the Act requires us to make a finding (known as a ''90-day finding'') on whether a petition to add a species to, remove a species from, or reclassify a species on the Federal Lists of Endangered and Threatened Wildlife and Plants has presented substantial information indicating that the requested action may be warranted. To the maximum extent practicable, the finding must be made within 90 days following receipt of the petition and published promptly in the **Federal Register**. If we find that the petition has presented substantial information indicating that the requested action may be warranted (a positive finding), section 4(b)(3)(A) of the Act requires us to commence a status review of the species if one has not already been initiated under our internal candidate assessment process. In addition, section 4(b)(3)(B) of the Act requires us to make a finding within 12 months following receipt of the petition on whether the requested action is warranted, not warranted, or warranted but precluded by higher priority listing actions (this finding is referred to as the ''12-month finding''). Section 4(b)(3)(C) of the Act requires that a finding of warranted but precluded for petitioned species should be treated as having been resubmitted on the date of the warranted but precluded finding, and is, therefore, subject to a new finding within 1 year and subsequently thereafter until we publish a proposal to list or a finding that the petitioned action is not warranted. The Service publishes an annual notice of resubmitted petition findings (annual notice) for all foreign species for which listings were previously found to be warranted but precluded.

Previous Federal Actions

On November 24, 1980, we received a petition (1980 petition) from Dr. Warren B. King, Chairman of the International Council for Bird Preservation (ICBP), to add 60 foreign bird species to the List of Threatened and Endangered Wildlife (50 CFR 17.11(h)), including two species (the Chilean woodstar and the St. Lucia forest thrush) that are the subject of this proposed rule. In response to the 1980 petition, we published a positive 90-day finding on May 12, 1981 (46 FR 26464), for 58 foreign species, noting that 2 of the foreign species identified in the petition were already listed under the Act, and initiated a status review. On January 20, 1984 (49 FR 2485), we published a 12-month finding within an annual review on pending petitions and description of progress on all species petition findings addressed therein. In that notice, we found that all 58 foreign bird species from the 1980 petition were warranted but precluded by higher priority listing actions. On May 10, 1985, we published the first annual notice (50 FR 19761), in which we continued to find that listing all 58 foreign bird species from the 1980 petition was warranted but precluded. In our next annual notice, published on January 9, 1986 (51 FR 996), we found that listing 54 species from the 1980 petition, including the 2 species that are the subject of this proposed rule, continued to be warranted but precluded, whereas new information caused us to find that listing 4 other species in the 1980 petition was no longer warranted. We published additional annual notices on the remaining 54 species included in the 1980 petition on July 7, 1988 (53 FR 25511); December 29, 1988 (53 FR 52746); and November 21, 1991 (56 FR 58664), in which we indicated that the Chilean woodstar and the St. Lucia forest thrush, along with the remaining species in the 1980 petition, continued to be warranted but precluded.

On May 6, 1991, we received a petition (hereafter referred to as the 1991 petition) from ICBP, to add 53 species of foreign birds to the List of Endangered and Threatened Wildlife, including the Andean flamingo, also the subject of this proposed rule. In response to the 1991 petition, we published a positive 90-day finding on December 16, 1991 (56 FR 65207), for all 53 species, and announced the initiation of a status review. On March 28, 1994 (59 FR 14496), we published a 12-month finding on the 1991 petition, along with a proposed rule to list 30 African birds under the Act (15 each from the 1980 petition and 1991 petition). In that document, we announced our finding that listing the remaining 38 species from the 1991 petition, including Andean flamingo, was warranted but precluded by higher priority listing actions. On January 12, 1995 (60 FR 2899), we published the final rule to list the 30 African birds and reiterated the warranted-but-precluded status of the remaining species from the 1991 petition. We made subsequent warranted-but-precluded findings for all outstanding foreign species from the 1980 and 1991 petitions, including the three species that are the subject of this proposed rule, as published in our annual notice of review (ANOR) on May 21, 2004 (69 FR 29354), and April 23, 2007 (72 FR 20184).

Per the Service's listing priority guidelines (September 21, 1983; 48 FR 43098), our 2007 ANOR identified the listing priority numbers (LPNs) (ranging from 1 to 12) for all outstanding foreign species. The LPNs for the three species of birds in this proposed rule are as follows: Andean flamingo (LPN 2), Chilean woodstar (LPN 4), and St. Lucia forest thrush (LPN 3).

On January 23, 2008, the United States District Court for the Northern District of California ordered the Service to issue proposed listing rules for five foreign bird species, actions which had been previously determined to be warranted but precluded: Andean flamingo (*Phoenicoparrus andinus*), black-breasted puffleg (*Eriocnemis nigrivestis*), Chilean woodstar (*Eulidia yarrellii*), medium tree finch (*Camarhynchus pauper*), and St. Lucia forest thrush (*Cichlherminia lherminieri sanctaeluciae*). The court ordered the Service to issue proposed listing rules for these species by the end of 2008.

On July 29, 2008 (73 FR 44062), we published in the **Federal Register** a notice announcing our annual petition findings for foreign species. In that notice, we announced listing to be warranted for 30 foreign bird species, including the 5 species that are subject to the January 23, 2008, court order and the 3 species which are the subject of this proposed rule. The medium tree finch and black-breasted puffleg are the subject of separate proposed rules, which published in the **Federal Register** on December 8, 2008 (73 FR 74434 and 73 FR 74427, respectively).

Species Information and Factors Affecting the Species

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act. The five factors are: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence.

Below is a species-by-species analysis of these five factors. The species are considered in alphabetical order, beginning with the Andean flamingo, and followed by the Chilean woodstar and the St. Lucia forest thrush.

I. Andean flamingo (Phoenicoparrus andinus)

Species Description

Flamingos (Phoenicopteridae) are gregarious, long-lived birds that inhabit saline wetlands and breed in colonies (del Hoyo 1992, pp. 509–519; Caziani *et al.* 2007, pp. 277). The Andean flamingo is the largest member of the Phoenicopteridae family in South America, reaching an adult height of 3.5 feet (ft) (110 centimeters (cm)) (Fjeldså and Krabbe 1990, p. 86). This waterbird is native to low-, medium-, and high-altitude wetlands in the Andean regions of Argentina, Bolivia, Chile, and Peru (BirdLife International (BLI) 2008, p. 1; del Hoyo 1992, p. 526), where it is locally known as ''*flamenco andino*,'' ''*parina grande*,'' ''*pariguana*,'' ''*pariwana*,'' and ''*chururu*'' (BLI 2006, p. 1; Castro and Varela 1992, p. 26; Davison 2007, p. 2; del Hoyo 1992, p. 526; Sáenz 2006, p. 185).

An adult Andean flamingo has a pale yellow face and pale pink coloring overall. Its upper plumage is brighter pink, with a deeper pink to wine red-colored neck, breast, and wing-coverts (feathers on the upper wing), and prominent black tertial feathers (feathers on the posterior portion of the wing). The bill is pale yellow with a black tip, and the legs and feet are yellow (BLI 2008, p. 1; del Hoyo 1992, p. 526). Young Andean flamingos are grayish in color and achieve full adult plumage in their third year (del Hoyo 1992, p. 526).

Andean flamingo is one of three flamingo species that is endemic to the high Andes of South America (Johnson *et al.* 1958, p. 299; Johnson 1967, p. 404; del Hoyo *et al.* 1992, p. 508; Line 2004, pp. 1–2; Caziani *et al.* 2007, p. 277; Arengo in litt. 2007, p. 2). All flamingos have pink plumage to varying degrees (del Hoyo 1992, p. 508). The Andean flamingo is distinguished from other South American flamingos by its size (being the largest in the area), leg coloring (being the only flamingo with yellow legs), and wing coloring (having prominent black tertial feathers that form a ''V'' when the flamingo is not in flight) (BLI 2008, p. 1; del Hoyo 1992, p. 526). Andean flamingos are long-lived (see Habitat and Life History) (BLI 2008, p. 2; del Hoyo *et al.* 1992, p. 517).

Taxonomy

The Andean flamingo was first taxonomically described as *Phoenicopterus andinus* (Phoenicopteridae family), by Rodulfo Philippi in 1854 (Philippi 1860, p. 164; Hellmayr 1932, p. 448). In 1856, Bonaparte split the genus *Phoenicopterus*, placing the Andean flamingo in a separate genus, as *Phoenicoparrus andinus*, along with the sympatric (species inhabiting the same or overlapping geographical areas) James' flamingos (*P. jamesi*) (Hellmayr and Conover 1948, pp. 273–278; Jenkin 1957, p. 405). In 1990, Sibley and Monroe (1990, p. 311) suggested the Andean flamingo should be returned to the genus *Phoenicopterus*, based on the close genetic relatedness among all flamingo species (Sibley and Ahlquist 1989, as cited in Ramsen *et al.* 2007, p. 18). However, many contemporary researchers maintain that the Andean flamingo should remain within the genus *Phoenicoparrus*, based on bill morphology and the lack of a hind toe (BLI 2008, p. 1; Caziani *et al.* 2007, p. 276; del Hoyo *et al.* 1992, pp. 508–509; Fjeldså and Krabbe 1990, p. 86; Mascitti and Kravetz 2002, pp. 73–83; Valqui *et al.* 2000, p. 110). Therefore, we accept the species as *Phoenicoparrus andinus*, which is also consistent with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) species database (UNEP–WCMC 2008b, p. 1).

Habitat and Life History

Andean flamingos are native to the Andes Mountains, from southern Peru and southwestern Bolivia to northern Chile and northwestern Argentina. They occupy shallow wetlands, collectively called salars, that are characterized as shallow, often saline, lakes (known locally as ''*lagos*'' or ''*lagunas*'') with exposed salt-flats or mudflats (Boyle *et al.* 2004, pp. 563–564; Caziani *et al.* 2007, pp. 277; Hurlbert and Keith 1979, pp. 328). Andean flamingos also inhabit ''bofedales,'' which are described as wet, marshy, perennial meadowlands (de la Fuente 2002, p. 1; Ducks Unlimited 2007c, p. 1). These wetlands are found at various elevations, including: (1) The high Andes, referred to as ''*altiplanos*'' (Spanish for ''high plains''), generally above 13,123 ft (4,000 meters (m)); (2) the ''*puna*'' (Spanish for ''highlands''), between 9,843 and 13,123 ft (3,000 and 4,000 m); and (3) the lowlands, below 9,843 ft (3,000 m) (Caziani *et al.* 2001, p. 103; Caziani *et al.* 2007, p. 278). Andean flamingos generally occupy wetlands that are less than 3 ft (1 m) deep (Fjeldså and Krabbe 1990, p. 86; Mascitti and Casteñera 2006, p. 331).

Most of the wetlands in which Andean flamingos are found are ''endoreic,'' ''endorheic,'' or closed. This refers to internally-draining water networks prevalent in the Andes that are characterized by rivers or bodies of water that do not drain into the sea, but either dry up or terminate in a basin (Caziani *et al.* 2001, p. 103; Hurlbert and Keith 1979, p. 328). The water levels at these basins expand and contract seasonally and depend in large part on summer rains to ''recharge'' or refill them (Bucher 1992, p. 182; Caziani and Derlindati 2000, pp. 124–125; Caziani *et al.* 2001, p. 110; Mascitti and Caziani 1997, p. 328).

Andean flamingos are altitudinal and opportunistic migrants (Goldfeder and Blanco 2007, p. 190). During the summer (December to January), Andean flamingos generally reside in the puna and altiplano regions of the Andes, at elevations between 11,483 and 14,764 ft (3,500 and 4,500 m). In the winter, they may move to lower elevations—down to 210 ft (64 m) above sea level—along the Peruvian coast and inland to the central plains of Argentina and Bolivia (Blake 1977, p. 207; BLI 2008, pp. 1 and 6; Boyle *et al.* 2004, pp. 563–564, 570–571; Bucher 1992, p. 182; Bucher *et al.* 2000, p. 119; Caziani *et al.* 2006. p. 17; Caziani *et al.* 2007, pp. 277, 279, 281; del Hoyo 1992, p. 514, 519; Fjeldså and Krabbe 1990, p. 85; Hurlbert and Keith 1979, pp. 330; Kahl 1975, pp. 99–101; Mascitti and Bonaventura 2002, p. 360; Mascitti and Castañera 2006, p. 328).

They disperse widely, even while nesting, and can travel long distances, flying from 249 mi (400 km) to 715 mi (1,150 km) daily (Caziani *et al.* 2003, p. 11; Caziani *et al.* 2007, p. 277; Conway 2000, p. 212; del Hoyo 1992, pp. 509–519; Fjeldså and Krabbe 1990, p. 85). Their movements are unpredictable and appear to be influenced by varying environmental conditions affecting the availability of wetlands (Bucher *et al.* 2000, p. 119; del Hoyo 1992, p. 514 and 516; Fjeldså and Krabbe 1990, p. 85). When climatic conditions are favorable, breeding takes place, and when climatic conditions are unfavorable, breeding is abandoned, very limited, or takes place at alternative, less-productive breeding grounds (*e.g.*, Bucher *et al.* 2000, pp. 119–120).

All flamingos are believed to be monogamous, with a strong pair-bonding tendency that may be maintained from one breeding season to the next (del Hoyo 1992, p. 514). Andean flamingos nest at high densities, with breeding colonies consisting of up to thousands of pairs (del Hoyo 1992, p. 526). Andean flamingos reach sexual maturity between 3 and 5 years of age (Bucher 1992, p. 183). Breeding season for the Andean flamingo occurs in the summer, generally from December through February (BLI 2008, p. 2; del Hoyo *et al.* 1992, p. 516; Fjeldså and Krabbe 1990, p. 85; Hurlbert and Keith 1979, pp. 328), although the breeding season may begin as early as October and continue through April (Goldfeder and Blanco 2007, p. 190). Both sexes share in nest-building and nesting (Bucher 1992, p. 182). Nests are built on the miry clay or transient islands of shallow lakes (del Hoyo 1992, pp. 514, 516). Each nest consists of a clay mound, up to 16 inches (in) (40 cm) high, with a small depression on top (del Hoyo *et al.* 1992, p. 516; Fjeldså and Krabbe 1990, p. 85). Flamingos lay a single white egg, usually in December or January, and incubation lasts about 28 days (del Hoyo *et al.* 1992, p. 526). If the egg is destroyed from flooding or predation, the pair may re-clutch (lay a replacement egg), but only if the loss occurs within a few days of the first egg being laid (del Hoyo *et al.* 1992, p. 516).

Chicks remain in the nest 5–12 days, during which time both the parents feed the chick with ''milk'' secretions formed by glands in their upper digestive tracts (Fjeldså and Krabbe 1990, p. 85; del Hoyo *et al.* 1992, p. 513). Feeding is shared by parents, in approximately 24-hour shifts (Bucher 1992, p. 182). When flamingo chicks leave the nest, they form large nursery crèches (groups) of hundreds or thousands of birds that are tended by a few adults (del Hoyo *et al.* 1992, p. 516).

Flamingo breeding habits can vary widely from year to year. Flamingos may breed in large numbers for 2 or more successive years, followed by other years in which there is no known breeding. Not all sexually mature adults breed every year and, even in years of breeding, not all sexually mature adults will participate (Bucher 1992, p. 183). Flamingos are generally considered to have poor breeding success (Fjeldså and Krabbe 1990, p. 85) and Andean flamingos, in particular, have experienced periods of very low breeding success over the past twenty years (Arengo in litt. 2007, p. 2) (See Population Estimates, below). Juvenile mortality rates during dispersal are unknown (Caziani *et al.* 2007, p. 284), and adult survival is considered to be ''very high'' (Fjeldså and Krabbe 1990, p. 85). Andean flamingos are long-lived, with an average lifespan of 20 to 30 years. Some wild adults live up to 50 years (BLI 2008, p. 2; del Hoyo *et al.* 1992, p. 517). Recent trends in breeding success are further discussed under Population Estimates, below.

Andean flamingos are wading filter-feeders, often forming large feeding flocks at wetlands alongside sympatric flamingos, Chilean flamingos (*Phoenicopterus chilensis*), and James' flamingos (del Hoyo 1992, p. 512; Mascitti and Castañera 2006, pp. 328–329). Andean flamingos feed principally on diatoms (microscopic one-celled or colonial algae) (Mascitti and Kravetz 2002, p. 78), especially those in the genus *Surirella* (no common name), which is a dominant component of surface sediments at the bottom of many altiplano lakes in the Andes (Fjeldså and Krabbe 1990, p. 86; Hurlbert and Chang 1983, p. 4768).

Historical Range and Distribution

The Andean flamingo type specimen (the specimen that was first described by Philippi in 1854) was collected from Salar de Atacama, in Antofagasta Province (Chile) (Hellmayr 1932, p. 312). Salar de Atacama is, therefore, referred to as the ''type locality.'' The species was subsequently reported in Argentina in 1872 (Provinces of Jujuy and Tucumán) (Burmeister 1872, p. 364; Hellmayr and Conover 1948, p. 277), Peru (Departments of Salinas and Arequipa) in 1886 (Hellmayr 1932, p 312; Hellmayr and Conover 1948, p. 277; Weberbauer 1911, p. 27), and Bolivia in 1902 (Department of Oruru) (Hellmayr and Conover 1948, p. 277; Johnson *et al.* 1958, p. 289).

The species' movements and distribution within its range were not understood throughout much of the 20th century. Early researchers considered the Andean flamingo to be relatively sedentary (Jenkin 1957, p. 405; Johnson *et al.* 1958, pp. 297–298), with a distribution that did not extend below 10,000 ft (3,048 m) (Hellmayr 1932, p. 25; Johnson 1967, p. 405). Later researchers remarked on the nomadic nature of the species (McFarlane 1975, p. 88) and reported lower limits to the species' distribution (i.e., 8,200 ft (2,500 m)) (Kahl 1975; pp. 99–100). Hurlbert and Keith (1979, pp. 334, 336) noted a seasonal variance in the species' altitudinal distribution, and Bucher (1992, p. 182) noted that migration might take place between Chilean breeding grounds and Argentinian wetlands.

Current Range and Distribution

The current range of the Andean flamingo extends from Peru, through Chile and Bolivia, to Argentina, in wetlands at elevations ranging from 210 to 14,764 ft (64 to 4,500 m) (BLI 2008, pp. 1, 6; Bucher 1992, p. 192; Bucher *et al.* 2000, p. 119; del Hoyo 1992, pp. 514; Fjeldså and Krabbe 1990, p. 85). In 1989, an immature Andean flamingo—that had been banded in Chile earlier that year—was captured in Brazil (Sick 1993, p. 154). There were additional sightings of the Andean flamingo in Brazil in the 1990s (Bornschein and Reinert 1996, p. 807–808). However, the species is considered a non-breeding ''vagrant'' in Brazil (BLI 2008, p. 5).

Its total extent of occurrence (including sites where breeding does not occur) is estimated as 124,711 square miles (mi^2) (323,000 square kilometers (km^2)). The estimated area in which the species is known to breed and reside year-round is 72,973 square miles (mi^2) (189,000 square kilometers (km^2)) (BLI 2008, p. 4).

Their seemingly erratic movements and ability to disperse widely, combined with the harsh climatic conditions and the inaccessibility of their habitat, have made it difficult for researchers to fully understand their seasonal movements and breeding habits (Bucher *et al.* 2000, p. 119; del Hoyo 1992, pp. 514; Fjeldså and Krabbe 1990, p. 85) (see also Habitat and Life History, above). Researchers have long considered Chilean wetlands to be the primary breeding grounds for the species (Bucher *et al.* 2000, p. 119; Ducks Unlimited 2007c, pp. 1–4; Fjeldså and Krabbe 1990, p. 86; Johnson *et al.* 1958, p. 296; Kahl 1975 p. 100). Researchers have only recently confirmed that the species is an altitudinal and opportunistic migrant (Goldfeder and Blanco 2007, p. 190). Simultaneous censuses undertaken since 1997 confirmed that Andean flamingos migrate altitudinally. In the summer, most of the population is concentrated primarily in Chile, and to a lesser extent in Argentina and Bolivia. In winter, the species may converge in certain Chilean and Peruvian wetlands (Valqui *et al.* 2000, p. 111), with relatively large numbers of birds overwintering in Bolivia and Argentina in some years (Caziani *et al.* 2007, pp. 279, 281). Recent banding studies confirmed that Andean flamingos at high-altitude wetlands move to lower altitude lakes, where weather conditions are less severe (Rocha and Rodriguez 2006, p. 12).

Andean flamingos occupy some wetlands year round (where they may or may not breed), some wetlands only during the summer breeding season, and other wetlands only in winter (see Table 1). Recent research established that there is an important, complementary link between breeding and non-breeding wetlands frequented by Andean flamingos (Derlandati 2008, p. 10). Research in Argentina at highland (breeding) and lowland (non-breeding) sites indicated that, regardless of season, Andean flamingos spend the majority of their time eating (Derlandati 2008, p. 10). They will travel to different wetlands to feed, even while nesting (Bucher 1992, p. 182; Caziani *et al.* 2007, p. 277; Conway 2000, p. 212; del Hoyo 1992, pp. 509–519). Research in Argentina at high-elevation breeding sites and low-elevation non-breeding sites indicated that breeding displays at lowland sites were important precursors to successful breeding at high altitude sites (Derlandati 2008, p. 10).

Several Andean flamingo localities in each range country are described below and in Table 1, organized in alphabetical order by country and name of wetland. This is not an exhaustive accounting of all known wetlands occupied by the species, but includes sites that are frequented by the species or are otherwise notable, such as recently discovered breeding sites. In Table 1, ''Type'' indicates whether the site is known as a breeding (B) or non-breeding (NB) wetland. In most cases, NB indicates that the species overwinters at the wetland. However, in some cases, Andean flamingos occupy a wetland year-round, but no breeding occurs there. Habitat information was obtained primarily from Ducks Unlimited (2007a–d) and BirdLife International (2008).

TABLE 1—SELECTED ANDEAN FLAMINGO NESTING AND OVERWINTERING WETLANDS IN ARGENTINA, BOLIVIA, CHILE, AND PERU

Country	Wetland	Department	Elevation in feet/meters	Area in acres/hectares	Type	Description/comments
Argentina	Laguna Brava	La Rioja	13,780 ft/4,200 m.	1,977 ac/800 ha	B/NB	Large lake associated with an endoreic (closed) river basin that includes Laguna de Mulas Muertas.
Argentina	Laguna de Melincué.	Santa Fe	276–295 ft/84–90 m.	29,653 ac/12,000 ha.	NB	One of two lowest-elevation endoreic wetlands frequented by Andean flamingos.
Argentina	Lagunas de los Aparejos.	Catamarca	13,911 ft/4,240 m.	343 ac/139 ha	B/NB	Shallow lagoon in a larger lagoon system that is lacking in aquatic vegetation.

TABLE 1—SELECTED ANDEAN FLAMINGO NESTING AND OVERWINTERING WETLANDS IN ARGENTINA, BOLIVIA, CHILE, AND PERU—Continued

Country	Wetland	Department	Elevation in feet/meters	Area in acres/hectares	Type	Description/comments
Argentina	Laguna de Mar Chiquita.	Córdoba	210–230 ft/64–70 m.	494,211 ac/200,000 ha.	B/NB	This large, permanent, hypersaline, seasonally fluctuating lake is the lowest-elevation locality.
Argentina	Laguna de Mulas Muertas.	La Rioja	13,123 ft/4,000 m.	1730 ac/700 ha	NB	Located near and part of the same endoreic river basin as Laguna Brava.
Argentina	Laguna de Pozuelos.	Jujuy	11,483 ft/3,500 m.	24,710 ac/10,000 ha.	B/NB	Central lake within endoreic basin with lower water levels and extensive mudflats in winter.
Argentina	Laguna Guayatayoc.	Jujuy	12,008 ft/3,660 m.	247,104 ac/100,000 ha.	NB	Part of large salt basin where endoreic waters form shallow, brackish to hypersaline lakes.
Argentina	Laguna Vilama	Jujuy	14,436 ft/4,400 m.	19,768 ac/8,000 ha.	B/NB	Large, permanent endoreic lake, prone to wide water fluctuations and winter freezes.
Bolivia	Lago Poopó	Oruru	12,090 ft/3,685 m.	330,380 ac/133,700 ha.	NB	Large, shallow saline lake in same ancient endoreic river basin as Lago Uru Uru.
Bolivia	Lago Uru Uru	Oruru	12,126 ft/3,696 m.	69,190 ac/28,000 ha.	NB	Along with Lago Poopó, experiences wide fluctuations in water level.
Bolivia	Laguna Colorada	Potosí	13,944 ft/4,250 m.	12,948 ac/ 5,240 ha.	B/NB	Hypersaline endoreic lake fed by streams and thermal springs, with shores that freeze at night.
Bolivia	Laguna Kalina or Busch.	Potosí	14,862 ft/4,530 m.	3,954 ac/1,600 ha.	B/NB	Hypersaline lake associated with the same endoreic water basin as Laguna Colorada.
Bolivia	Laguna de Pastos Grandes.	Oruru	13–15,000 ft/4–4,500 m.	37,066 ac/15,000 ha.	B/NB	Group of small, permanent saline lakes in an ancient caldera fed by underground sources.
Bolivia	Salar de Chalviri	Potosí	14,396 ft/4,388 m.	28,417 ac/11,500 ha.	NB	Basin of many small lakes separated by saltflats; fed by small streams and thermal springs.
Bolivia	Salar de Coipasa	Oruru	12,112 ft/3,692	548,077 ac/221,800 ha.	B/NB	Large salt basin and shallow hypersaline lake, receiving water from Río Lauca.
Chile	Lago del Negro Francisco.	Atacama	13,123 ft/4,000 m.	6,919 ac/2,800 ha.	B/NB	Large high-altitude permanent lake surrounded by bofedales.
Chile	Salar de Ascotán	Antofagasta	12,211 ft/ 3,722 m.	93,406 ac/37,800 ha.	B/NB	High-altitude salt basin with many saline lakes on perimeter, fed by several freshwater springs.
Chile	Salar de Atacama.	Antofagasta	7,546 ft/2,300 m	691,895 ac/280,000 ha.	B/NB	Endoreic salt basin with fluctuating water levels from summer storms and snowmelt.
Chile	Salar de Coposa	Tarapacá	12,376 ft/3,730 m.	21,003 ac/8,500 ha.	B/NB	Endoreic salt with small lagoon that fluctuates greatly in size.
Chile	Salar de Huasco	Tarapacá	13,123 ft/4,000 m.	14,826 ac/ 6,000 ha.	B/NB	Salt basin receiving summer rains and fed by snow melt bogs and bofedales.
Chile	Salar de Surire	Tarapacá	13,583 ft/4,140 m.	61,776 ac/25,000 ha.	B/NB	Permanent saline lake.
Peru	Lago Parinacochas.	Ayacucho	10,738 ft/3,273 m.	16,556 ac/6,700 ha.	NB	Shallow, large brackish endoreic lake and marshes with exposed salt flats in dry season.
Peru	Laguna de Loriscota.	Puno	15,299 ft/4,663 m.	8525 ac/3,450 ha.	NB	Permanent, shallow hypersaline lake surrounded by bofedales.
Peru	Laguna Salinas	Arequipa	14,091 ft/4,295 m.	17,544 ac/7,100 ha.	NB	Semi-permanent, shallow hypersaline lake with freshwater springs and bofedales on perimeter.

Argentina: Several wetlands in Argentina provide year-round habitat for the Andean flamingo (see Table 1). The species breeds and overwinters regularly at Laguna de Pozuelos and Lagunas de Vilama (Caziani & Derlandati 2000, p. 121; Caziani *et al.* 2001, p. 113; Caziani *et al.* 2006, p. 13; Caziani *et al.* 2007, p. 279; Ducks Unlimited 2007a, pp. 1–4). The Vilama wetlands system (Lagunas de Vilama) is comprised of nine lakes: Arenal, Caiti, Catal, Cerro Negro, Colpayoc, Isla Grande, Palar, Pululos, and Vilama (Caziani and Derlindati 2000, p. 122;

Caziani *et al.* 2001, p. 103). During a 3-year study, Andean flamingos occupied 8 of the 9 lakes, but were especially concentrated on Laguna Vilama and Laguna Catal (Caziani and Derlindati 2000, p. 125). Caziani *et al.* 2001 (p. 104) determined that the Vilama wetland system provided a variety of spatial and seasonal ecological conditions on the landscape level, such that a range of options existed from which Andean flamingos could select habitat at any given time during the year. They further suggest that similar landscape-level relationships between wetlands exist, even when the wetlands are not located within the same basin (Caziani *et al.* 2001, p. 110). The Lagunas de Vilama wetland has harbored up to 30 percent of Andean flamingos during the breeding season (Caziani & Derlandati 2000, p. 121; Caziani *et al.* 2006, p. 13).

In recent decades, the species has nested or overwintered in locations not previously recorded. In January 1998, the first account of Andean flamingos nesting was reported at Laguna Brava (Bucher *et al.* 2000, p. 119). Long known as an overwintering site for the species (Caziani *et al.* 2007, p. 279), Laguna Brava has continued to provide isolated nesting sites (de la Fuente 2002, p. 6). Also in January 1998, large numbers of non-breeding birds were reported at Laguna de Mulas Muertas, just 4 mi (7 km) from Laguna Brava (Bucher *et al.* 2000, p. 120). Researchers attribute both the large number of breeding birds at Laguna Brava and the large number of non-breeding birds at Laguna de Mulas Muertas to unusual rainfall patterns that year (Bucher *et al.* 2000, p. 120). In March 2001, chicks were observed at Lagunas de los Aparejos (Caziani *et al.* 2007, pp. 279, 283), part of a lagoon system with Laguna Azul and Laguna Negra (BLI 2008, p. 50). Normally known as a nesting site for the James' flamingo (Childress 2005, p. 6), this may now be a nesting site for the Andean flamingo as well (BLI 2008, p. 50).

Andean flamingos overwinter at both high- and low-elevation wetlands in Argentina. Laguna Guayatayoc is a high-elevation overwintering site for Andean flamingos (Ducks Unlimited 2007a, pp. 1–4), where the species has sometimes been reported in relatively large numbers (Caziani *et al.* 2001, p. 116; Caziani *et al.* 2007, p. 279). Laguna de Mar Chiquita is the lowest-elevation wetland frequented by the Andean flamingo (Bucher et al 1992, p. 119; Caziani *et al.* 2007, p. 279; Derlindati 2008, pp. 6–7). Long known as an overwintering site, researchers report that a small group of Andean flamingos (about 100 individuals) may reside there year round (BLI 2008, p. 1; Bucher 1992, pp. 179, 182), and breeding has recently been reported there (Childress *et al.* 2005, p. 6). Laguna de Melincué is another low-elevation overwintering site for Andean flamingos (Caziani *et al.* 2007, p. 279). Although breeding has not been reported there (Childress *et al.* 2005, p. 6), the species engages in nuptial displays vital to reproductive success in the breeding colonies (Derlindati 2008, p. 9). Researchers estimated that 17 percent of the world population of Andean flamingos overwintered at Laguna de Melincué in winter 2005 and 2006 (Romano et al 2006, p. 17).

Bolivia: There are at least 10 flamingo nesting sites in Bolivia (Caziani *et al.* 2006, p. 13). Laguna Colorada is a high-altitude wetland where Andean flamingos remain year-round and where they have recently nested with greater frequency (see Factor B) (BLI 2008, p. 1; Caziani *et al.* 2006, p. 13; Caziani *et al.* 2007, p. 279; Davison 2007, p. 1; Ducks Unlimited 2007b, pp. 14; Kahl 1979, p. 100). Laguna Kalina (also known as Laguna Calina and Laguna Busch) has recently figured prominently as a nesting location. Chicks were first reported there in 1997 (Valqui *et al.* 2000, p. 112), and nesting has been reported there, at small but consistent rates, in 2004, 2005 and 2006 (Childress *et al.* 2005, p. 6; Childress *et al.* 2006, p. 5; Childress *et al.* 2007a, p. 7).

Laguna de Pastos Grandes is another lake system that includes Salar de Pastos Grandes, Laguna Ramaditas, Laguna Hedionda, Laguna Cañapa, Laguna Cachi, Laguna Khara, Laguna ChullunCani, and Laguna Khar Khota (Ducks Unlimited 2007b, p. 13). This wetland complex provides breeding and non-breeding habitat.

Non-breeding year-round wetlands in Bolivia include: Lago Uru Uru (Ducks Unlimited 2007b, p. 5–8; Kahl 1975, p. 100; Mølgaard *et al.* 1999; Rocha *et al.* 2006, p. 18); Salar de Chalviri (Ducks Unlimited 2007b, pp. 17–20; Hurlbert & Keith 1979, p. 331); Lago Poopó, a known locality since 1921 (Caziani *et al.* 2007, p. 279; Hellmayr & Conover 1948, p. 277; Johnson 1967, p. 404); and Salar de Coipasa, a wintering site of known importance for all three South American flamingo species since the mid-20th century (Johnson 1967, p. 404; Ducks Unlimited 2007c, p. 9). These lakes are hydrologically connected through the Titicaca-Desaguadero-Poopó-Salar de Coipasa (TDPS) basin, a large endoreic (closed) basin shared between Peru, Bolivia, and Chile (Jellison *et al.* 2004, p. 11). Several Andean flamingo wetlands are connected to this hydrological basin through rivers, including: Lago Poopó (Bolivia), which is connected to Lago Titicaca (Peru) through Río Desaguadero; Salar de Coipasa (Bolivia), which is connected to Lago Poopó through Río Laca Jahuira River (Jellison *et al.* 2004, p. 11); and Lago Uru Uru, which is fed by Río Desaguadero (Ducks Unlimited 2007b, p. 5). In 2000, more than 50 percent of the known population of Andean flamingos overwintered at Lagos Uru Uru and Poopó (Caziani *et al.* 2007, p. 279).

Chile: There are at least a dozen Andean flamingo breeding sites in Chile (Childress *et al.* 2006, p. 7). Salar de Atacama, where the Andean flamingo type specimen was obtained in 1854 (Hellmayr 1932, p. 312; Philippi 1860, p. 164), has been a consistent and primary breeding ground (Bucher *et al.* 2000, p. 119; Childress *et al.* 2007a, p. 7; Ducks Unlimited 2007c, pp. 1–4; Johnson *et al.* 1958, p. 296). Several other sites have figured consistently and prominently over the years, including Salar de Surire, Salar de Huasco, and Salar de Ascotán (Fjeldså and Krabbe 1990, p. 86; Johnson *et al.* 1958, p. 296; Kahl 1975 p. 100). Andean flamingos were first observed at Salar de Surire in the early 1970s (McFarlane 1975, p. 88). The first report of breeding (observation of chicks) there occurred in 1997 (Valqui *et al.* 2000, p. 112), and breeding has continued there at increasing numbers (Caziani *et al.* 2007, p. 283). Laguna Ascotán differs from most other Andean flamingo wetlands, as it is fed by 13 fresh-water springs as well as several brackish lagoons (Vilina and Martínez 1998, p. 28). Salar de Coposa has long served as breeding and overwintering habitat for the Andean flamingo (Caziani *et al.* 2007, p. 279; Johnson 1958, p. 297; Kahl 1975 p. 100).

Salar de Atacama, Salar de Coposa, Salar de Huasco, Salar de Negro Francisco, and Salar de Surire also provide year-round habitat for the Andean flamingo (Caziani *et al.* 2006, p. 13; Caziani *et al.* 2007, p. 279; Ducks Unlimited 2007c, pp. 5–8; Johnson 1958, p. 296). In 1998 and 2000, between 3,500 and 4,500 birds overwintered at these sites (Caziani *et al.* 2007, p. 279).

Peru: Andean flamingos frequent several wetlands in Peru (BLI 2008, pp. 5, 72, 74–75, 78; Ducks Unlimited 2007d, pp. 21, 25, 29; Jameison and Bingham 1912, p. 14; Ricalde 2003, p. 91). Although BirdLife International reports breeding sites in Peru (2008, p. 2), the Flamingo Specialist Group reported no known nesting sites or evidence of breeding at Peruvian wetlands in 2005, 2006, or 2007 (M. Vlaui Munn, in litt., as cited in

Childress *et al.* 2005, p. 6; Arengo in litt., as cited in Childress *et al.* 2006, p. 6; Arengo in litt., as cited in Childress *et al.* 2007a, p. 7). The species frequently overwinters at Laguna Salinas, Laguna de Loriscota, and Lago Parinacochas, among other locations (Caziani *et al.* 2007, p. 279; Ducks Unlimited 2007d, p. 21, 25, 29–30; Jameison and Bingham 1912, p. 14). It is estimated that nearly 20 percent of the global population overwinters in Peru (Ricalde 2003, p. 91).

Recent Trends in Distribution: In 1997, 50 percent of the breeding population was distributed among three sites in Chile (Salar de Surire, Laguna Maricunga, and Laguna Negro Francisco) and two sites in Argentina (Pozuelos, and Vilama) (Caziani *et al.* 2007, p. 279). In the summer of 2005, 50 percent of the breeding population was located in 5 separate wetlands-Negro Francisco (Chile), Salar de Surire (Chile), Lagunas de Vilama (Argentina), Laguna Colorada (Bolivia) and Salar de Atacama (Chile) (Caziani *et al.* 2006, p. 13).

Population Estimates

Between 1965 and 1968, Charles Cordier's estimate of the Andean flamingo population varied by an order of magnitude, from 50,000 to 500,000 (as cited in Johnson 1967, p. 404; as cited in Kahl 1975, p. 100). In 1975, Kahl (1975, p. 100) estimated the total population to be 150,000 individuals. This estimate was based on (1) previous estimates; (2) the fact that the largest number of individuals Kahl had seen in one place (Lago Uru Uru, Bolivia) was 18,000 individuals; and (3) that, at most sites, he observed the Andean flamingo to be less numerous than the Chilean flamingo and James' flamingo. In 1986, the population was estimated to be less than 50,000 individuals and declining (Johnson 2000, p. 203). However, the accuracy of earlier population estimates has never been confirmed. According to Arengo (in litt. 2007, p. 2), member of the Altoandino Flamingo Conservation Group (Grupo de Conservación Flamencos Altoandinos), previous historical population estimates were based on extrapolations of data that are not considered to be reliable. Experts consider the figure of between 50,000 to 100,000 individuals may have been accurate until the mid-1980s (BLI 2008, p. 1). Although the figure of 150,000 (e.g., Fjeldså and Krabbe 1990, p. 86) was still being reported in the 1990s, an estimate of 50,000 is considered a more accurate figure (Arengo in litt. 2007, p. 2; BLI 2008 p. 1; del Hoyo *et al.* 1992, p. 526), and experts believe that the species underwent a severe reduction from the mid-1980s to the late 1990s (BLI 2008, pp. 1, 5).

The first simultaneous census of Andean flamingos was conducted in 1997 (Valqui *et al.* 2000, p. 110). Using a comprehensive sampling design and conducting simultaneous surveys at over 200 wetlands in Peru, Bolivia, Chile, and Argentina, researchers counted 33,918 Andean flamingos in January 1997; 27,913 in January 1998; 14,722 in June 1998; and, 24,442 in July 2000 (Caziani *et al.* 2007, p. 279). In the summer of 2005, a total of 31,617 Andean flamingos were counted (Caziani *et al.* 2006, p. 13). Recent censuses estimate the global population at around 34,000 individuals (Caziani *et al.* 2006, pp. 276–287; Caziani *et al.* 2007, pp. 13–17).

According to Arengo (in litt. 2007, p. 2), long-term population trends have been difficult to establish, given the unreliability of previous population estimates. However, given that the global population sizes of all other flamingo species are estimated above 100,000 individuals, experts consider the Andean flamingo to be the rarest of the 6 flamingo species (Arengo in litt. 2007, p. 2).

Nesting sites: In the last decade, small groups of Andean flamingos have been reported intermittently nesting at a greater variety of sites, including: Laguna Brava and Lagunas de Vilama (Argentina) (Bucher *et al.* 2000, p. 119; Caziani *et al.* 2006, p. 13; Derlindati 2008, pp. 6–7); Laguna Colorada and Laguna Kalina (Bolivia) (Caziani *et al.* 2007, p. 279; Childress *et al.* 2005, p. 6; Childress *et al.* 2006, p. 5; Childress *et al.* 2007a, p. 7; Rodriguez Ramirez 2006, as cited in Arengo in litt. 2007, p. 2); and Salar de Punta Negra and Salar de Huasco (Chile) (Bucher *et al.* 2000, p. 119; Caziani *et al.* 2007, p. 279; Valqui *et al.* 2000, p. 112). In recent years, Andean flamingos have been recorded from 25 wetlands complexes, but there were fewer than 100 individuals at many of these sites (Caziani *et al.* 2007, p. 281). Only 12 wetlands contained more than 100 Andean flamingos at any one of the four sampling periods from 1997 to 2000, and breeding has been consistently reported at only 2 of these sites (Arengo in litt. 2007, pp. 2–3; Bucher *et al.* 2000, p. 119; Caziani *et al.* 2007, pp. 279–281; Valqui *et al.* 2000, p. 112).

Breeding success: Productivity estimates from intensive studies of breeding sites in Chile indicate marked fluctuations over the past 20 years, with periods of very low breeding success (Arengo in litt. 2007, p. 2). In 1987, a high of around 15,000 chicks fledged, followed by 10 years of relatively low productivity (fewer than 800 chicks fledged per year on average), and a recent increase to an average of 3,000 chicks fledged since 2000 (Rodriguez Ramirez 2006, Amado *et al.* 2007, as cited in Arengo in litt. 2007, pp. 1–3). Between 1997 and 2001, successful breeding (based on the observation of 2–3-month-old chicks) was documented only at three wetlands and, in those wetlands, a total of only 12,801 chicks were produced—Salar de Surire (Chile; 9,200 chicks), Salar de Atacama (Chile; 3,378 chicks), and Aparejos (Argentina; 223 chicks) (Caziani *et al.* 2007, p. 283).

The most recent simultaneous census data indicates that a total of 2,338 chicks survived at breeding colonies located in Argentina, Bolivia, and Chile during the 2006–2007 breeding season (December to February) (Childress *et al.* 2007a, p. 7). In Argentina, eight sites were surveyed, six of which are known Andean flamingo breeding sites. Of these, breeding was attempted at one site, but was unsuccessful. No breeding was reported in Peru during the 2006–2007 breeding season. Of 4 sites surveyed in Bolivia, 3 of which are known Andean flamingo nesting grounds, breeding occurred at two sites (Laguna Colorada and Kalina) producing total of 1,800 chicks. In Chile, breeding was attempted at four sites in Salar de Atacama. A total of 2,900 pairs of Andean flamingos laid eggs but only 538 chicks survived.

Conservation Status

The Andean flamingo is the rarest of six flamingo species worldwide (family Phoenicopteridae). The IUCN considers the Andean flamingo to be ''Vulnerable'' because (1) it has undergone a rapid population decline, (2) it is exposed to ongoing exploitation and declines in habitat quality, (3) and, although exploitation may decrease, the longevity and slow breeding of flamingos suggest that the legacy of past threats may persist through generations to come (BLI 2008, p. 1). Long-lived species with slow rates of reproduction and ongoing poor breeding success, such as that being experienced by the Andean flamingo, can quickly decline towards extinction when reproduction does not keep pace with mortality (BLI 2008, p. 2; Bucher 1992, p. 183; del Hoyo *et al.* 1992, p. 517) (see Population Estimates, above).

Summary of Factors Affecting the Andean Flamingo

A. The Present or Threatened Destruction, Modification, or Curtailment of the Species' Habitat or Range

Andean flamingos occupy shallow, saline wetlands in the lowland, puna, and altoandino regions of the Andes (see Table 1) (BLI 2008, pp. 1, 6; Bucher 1992, p. 192; Bucher *et al.* 2000, p. 119; del Hoyo 1992, pp. 514; Fjeldså and Krabbe 1990, p. 85). Andean flamingos are altitudinal migrants and alternate between wetlands based largely on environmental conditions and especially the availability of water (Bucher 1992, p. 182; Bucher *et al.* 2000, p. 119; del Hoyo 1992, pp. 514; Fjeldså and Krabbe 1990, p. 85; Goldfeder and Blanco 2007, p. 190; Hurlbert and Keith 1979, pp. 334, 336; Rocha and Rodriguez 2006, p. 12). During the summer breeding season (December to January), Andean flamingos occupy high-elevation wetlands in Chile, Argentina, and Bolivia. During the winter, they may stay at the high-elevation wetlands, or move to lower elevations in Argentina, Bolivia, and Peru (Blake 1977, p. 207; BLI 2008, pp. 1 and 6; Boyle *et al.* 2004, pp. 563–564, 570–571; Bucher 1992, p. 182; Bucher *et al.* 2000, p. 119; Caziani *et al.* 2006. p. 17; Caziani *et al.* 2007, pp. 277, 279, 281; del Hoyo 1992, p. 514, 519; Fjeldså and Krabbe 1990, p. 85; Hurlbert and Keith 1979, pp. 330; Kahl 1975, pp. 99–101; Mascitti and Bonaventura 2002, p. 360; Mascitti and Castañera 2006, p. 328).

The wetlands occupied by Andean flamingos are utilized on a landscape level (Derlandati 2008, p. 10). Andean flamingos prefer water that is less than 3 ft (1m) deep (Fjeldså and Krabbe 1990, p. 86; Mascitti and Casteñera 2006, p. 331) and rely on the variety of habitat options at wetland complexes throughout the species' range to select optimal nesting and feeding sites. Beginning in 2002, researchers conducted a multi-year Andean flamingo dispersal study, to determine overwintering sites and spatial and temporal movements (Caziani *et al.* 2003, p. 11; Johnson and Arengo 2004, pp. 9, 15). Andean flamingos in Argentina were tracked using satellite transmitters, and results were highly variable. One bird stayed at the origination site (the actual location of which was undisclosed) another bird traveled 715 mi (1,150 km) over a 4-day period, using more than four sites in the process (Caziani *et al.* 2003, p. 11). The habitats visited included salar lakes, rivers and flooded areas. Flamingos were more mobile during summer to autumn (January-May), moving between sites often, and less mobile in winter. The birds in this study overwintered at Laguna de Mar Chiquita (Argentina), Lago Poopó (Bolivia), and Salar de Atacama (Chile) (Caziani *et al.* 2003, p. 11).

Between 1997 and 2001, 98 percent of Andean flamingo chicks were produced in two Chilean wetlands—Surire (9,200 chicks) and Atacama (3,378 chicks) (Caziani *et al.* 2007, p. 283). In the 2006–2007 breeding season, 75 percent of the surviving chicks were produced at Laguna Kalina and Laguna Colorada (1,800 chicks) (Bolivia), and the other 25 percent at Salar de Atacama (538 chicks) (Chile). Sites where breeding does not occur serve as important staging areas for pre-reproduction mating displays and as feeding locations for non-breeding flamingos and even breeding flamingos at nearby sites (Derlandati 2008, p. 10). Andean flamingos travel to different wetlands to feed, even while nesting (Bucher 1992, p. 182; Caziani *et al.* 2007, p. 277; Conway 2000, p. 212; del Hoyo 1992, pp. 509–519).

The Andean region where the Andean flamingo occurs is characterized by an extensive series of endoreic (closed) water systems that drain internally, that are recharged primarily by summer rains, that contract seasonally, and that may occasionally dry out completely (see Factor E) (Bucher 1992, p. 182; Caziani and Derlindati 2000, pp. 124–125; Caziani *et al.* 2001, p. 110; Mascitti and Caziani 1997, p. 328).

Mineral extraction, water contamination, water extraction, and water diversion from mining, agriculture, urban development, and increasing tourism are ongoing activities that negatively impact wetland habitats that support Andean flamingos throughout the species' range (Arengo in litt. 2007, p. 2; Childress *et al.* 2007a, p. 5; Goldfeder and Blanco 2007, p. 193).

Mineral extraction: There are ongoing mining operations to extract salt, borax, ulexite, sulphur, sodium carbonate, lithium, and several other minerals at many of the wetlands occupied by the Andean flamingo. Mineral extraction and prospecting are ongoing at these wetlands, including: Salars de Atacama and Surire (Chile) (Corporación Nacional Forestal 1996a, p. 9; Rundel and Palma 2000, pp. 270–271)—the two breeding sites that accounted for 98 percent of the chick production during the period 1997–2001 (Caziani *et al.* 2007, p. 283)—and Lago Uru Uru (Bolivia) (Soto 1996, p. 7; Ugarte-Nunez and Mosaurieta-Echegaray 2000, p. 135)—the site that had the largest number of Andean flamingos ever recorded in one wetland (Kahl 1975, p. 100). Prospecting and digging for minerals and underground water—involving road building which makes it possible for people to reach places that were formerly inaccessible—are ongoing at Laguna Negra (Corporación Nacional Forestal 1996c, pp. 10–11).

Argentinean wetlands—including Laguna Brava, Laguna Pozuelos, and Lagunas de Vilama, where Andean flamingos breed and live year-round—are also under mining pressure (BLI 2008, p. 553; Caziani *et al.* 2001, p. 106; de la Fuente 2002, p. 8; Ducks Unlimited 2007a, p. 4; Goldfeder and Blanco 2007, p. 193).

In Bolivia, there are proposals to exploit lithium, potassium, and borium from Salar de Coipasa (Ducks Unlimited 2007b, p. 11) and Pastos Grande (New World Resource Corp 2008, p. 1)—both known breeding and overwintering sites for the Andean flamingo. Bolivia contains an estimated 50 percent of the world's supply of the lithium that is used to make batteries for portable electronic equipment. The largest known lithium deposit in the world is located in the Bolivian altiplano—the Pastos Grandes concession (New World Resource Corp 2008, p. 2). Lithium can be extracted directly from the saline water in the alitplano salars; this water is referred to by the mining industry as ''brine.'' The brine is pumped through a series of evaporation ponds to concentrate the lithium (New World Resource Corp 2008, p. 4). Obtaining lithium from brine is considered more cost-effective in the mining industry than the other alternative, extracting lithium from hard rock (New World Resource Corp 2008, p. 4). Nearly all the world's supply of brine-derived lithium comes from the Chilean and Argentinean altiplanos (New World Resource Corp 2008, p. 4).

Intensive exploitation of natural resources has degraded the soil and ecology of the region, resulting in extensive erosion, river sedimentation, soil salinization, silting up of lakes, and water imbalances in watersheds that contribute to extreme fluctuations in water flows (Jellison *et al.* 2004, p. 14). In the past, Andean flamingos have abandoned breeding sites undergoing alteration from mining. Laguna Ascotán was once considered a breeding site for the species (Johnson *et al.* 1958, p. 296; Kahl 1975 p. 100). The birds abandoned the site in the mid-20th century, which Johnson (1958, p. 296) attributed to the resumption of borax extraction. Today, Andean flamingos continue to feed at the site (Vilina and Martínez 1998, p. 28) but there are no reports of nesting.

Water Contamination: Water resources at many salars have been contaminated, largely as the result of chemical pollution produced by the mining and metallurgical industries. The waters of the Titicaca-Desaguadero-Poopó-Salar de Coipasa (TDPS) hydrological system have been polluted by mining and metal foundry activities (Jellison *et al.* 2004, p. 11; Ricalde 2003, p. 91). This water system includes the important Bolivian overwintering sites, Lagos Poopó and Uru Uru—where more than 50 percent of the known population of Andean flamingos overwintered in 2000 (Caziani *et al.* 2007, p. 279). The area has been mined for silver, lead, zinc, copper limestone, antimony, iron, gold, tin, and uranium (Rocha 2002, p. 10). Lago Poopó, Lago Uru Uru, and the lower Río Desaguadero have concentrations of heavy metals above the limits permitted for human consumption (Apaza *et al.* 1996, Organization of American States/United Nations Environment Programme (OAS/UNEP) and the Bi-national Authority of Lago Titicaca (Autoridad Nacional del Lago Titicaca (ALT)) 1999, Van Ryckeghem 1997—as cited in Rocha 2002, p. 10). Because Lago Poopó is located at the terminal end of the endoreic (closed) TDPS drainage system, pollutants are more likely to concentrate there (Jellison *et al.* 2004, p. 120; Ronteltap *et al.* 2005, p. 3) and the lake has been contaminated by mining activities for a long time (Adamek *et al.* 1998). Mine pollution has led to lake water lead concentrations that are 300 times higher in Lago Poopó than the average concentrations detected in other lakes in the world and fish in the lake test positive for heavy metal residues (Cardoza *et al.* 2004, as cited in Jellison *et al.* 2004, p. 120). Water contamination in Lago Poopó was further exacerbated in year 2000, when 39,000 barrels of crude oil spilled in the lake. The native community Uru Morato, which has lived along the lake for 5,000 years, reported that the flamingoes did not lay eggs there that year ''for the first time in thousands of years'' (Jellison *et al.* 2004, p. 13).

Tourism and increasing human population to support the mining industry has destroyed habitat and further contaminated water supplies. Ecotourism is prevalent at many wetlands inhabited by the Andean flamingo, most of which are exceptional sites for viewing biodiversity and wildlife, including Argentina—at Laguna de Mar Chiquita (Ducks Unlimited 2007a, p. 22); Laguna Brava, where tourism includes the use off-road vehicles (BLI 2008, p. 40); and Lagunas de Vilama (Caziani *et al.* 2001, p. 106). Increasing amounts of pollution from surrounding towns that support ecotourism and the mining industry wash into wetlands during the rainy season and are carried into the lake by wind. Ugarte-Nunez and Mosaurieta-Echegaray 2000 (p. 139) noted an absence of flamingos in areas where refuse enters the Laguna Salinas (Peru). Inadequate sewage systems at growing urban centers pollute the salars (Jellison *et al.* 2004, p. 11). Pollution of the water in the TDPS system is problematic where towns are concentrated on the shores of the lakes (Ronteltap *et al.* 2005, p. 5). As of 2004, the TDPS water system, of which Lagos Poopó and Uru Uru are a part, supported a population of nearly 3 million people (Jellison *et al.* 2004, p. 14). At Lago Titicaca, wastewater is causing eutrophication—whereby excessive nutrients stimulate excessive plant growth, reducing the dissolved oxygen in the water as the plants decompose, causing other organisms to die—over approximately 3,954 acres (ac) (1,600 hectares (ha)) in the Puno Bay, and in another portion of the lake, leakage from former oil wells continues to degrade wildlife habitat (IRENA 1996, p. 9). Sewage from the city of Oruro and the neighboring towns of Challapata, Huari, and Poopó empties into Lagos Poopó and Uru Uru, causing organic and bacteriological pollution (Ducks Unlimited 2007b, p. 7; Liberman *et al.* 1991, OAS/UNEP and ALT 1999—as cited in Rocha 2002, p. 10).

In addition, illegal dumping of agrochemicals has severely impacted wetlands and the species that depend on them. In 2000, at Mar Chiquita (Argentina), Bucher reported that 30 tons of Lindane, an insecticide, was illegally dumped at the northern end of the lake, jeopardizing the entire closed lake system (Johnson and Arengo 2001, p. 38). Industrial pollutants and pesticides have caused large-scale die-off of flamingos. Childress *et al.* (2007b, p. 30) reported that tens of thousands of lesser flamingos (*Phoenicopterus minor*) were killed in July 2004 by industrial heavy metals and pesticides at feeding lakes in Kenya and Tanzania. A massive bird die-off of unspecified species of birds at Miramar in February 2004 (located in Córdoba, where Laguna de Mar Chiquita is located) may have been caused by the dumping of excess agrochemicals into the water, which penetrated the soil (BLI 2008, pp. 36–37).

Given that pollutants and pesticides have been known to cause die-offs of other species of flamingos and other bird species, it is likely that such contamination could have lethal effects on Andean flamingos. For instance, although in 1997 Laguna de Pozuelos was among 5 wetlands that harbored 50 percent of the breeding population of Andean flamingos, the number of Andean flamingos on Laguna de Pozuelos has diminished greatly since 1993 (Caziani and Derlindati 2000, p. 122). Pollution from mining wastes and erosion due to overgrazing, combined with desiccation of the lake (see Factor E), is negatively affecting the wetland at Laguna de Pozuelos (Argentina), where Andean flamingos breed and reside year-round (Laredo 1990, as cited in Adminstration de Parques Nacionales 1994, p. 2). In the 2006–2007 breeding season, no breeding was detected at this lake (Childress *et al.* 2007a, p. 7).

Water Extraction and Diversion: Water is extracted from wetlands for use by the mining industry, to facilitate lakebed resource exploitation, and to meet increasing human demand. Mining companies hold water concessions at Laguna Negra (Chile) (Corporación Nacional Forestal 1996c, pp. 10–11). Water extraction is an intrinsic part of lithium mining in Argentina, Bolivia and Chile (New World Resource Corp 2008, p. 4) (see Mineral Extraction). Underground water has been pumped from Salar de Punta Negra (Chile) for use in a large copper mining operation (Line 2004, p. 4). In the past decade, Andean flamingos have bred intermittently at Salar de Punta Negra (Caziani *et al.* 2006, p. 13; Caziani *et al.* 2007, p. 279, 283; Johnson *et al.* 1958, p. 296; Kahl 1975 p. 100). The shallow wetlands preferred by Andean flamingos are subject to high rates of evapotranspiration (Caziani and Derlindati 2000, p. 122), and water extraction hastens desiccation of these wetlands. In these arid closed-basin systems, groundwater extraction is unsustainable (Messerli *et al.* 1997, p. 233; Research and Resources for Sustainable Development (Recursos e Investigación para el Desarrollo Sustentable (RIDES)) 2005, p. 14).

Wetlands have been drained to facilitate excavation on the lakebed surface (Ugarte-Nunez and Mosaurieta-Echegaray 2000, p. 135). Excavation can drastically alter the water levels of these shallow lakes, creating areas that are unsuitable for foraging and nesting and allowing human access to areas that were once inaccessible (Corporación Nacional Forestal 1996c, p. 11). Furthermore, there have been reports of flamingos dying when they became stuck in the mud brought up from the bottom of the lake by mining operations (Ugarte-Nunez and Mosaurieta-Echegaray 2000, p. 137).

Urbanization and tourism have intensified groundwater use (Jellison *et al.* 2004, p. 11), as hotels and restaurants have been established in the villages and towns surrounding the salars and lagunas (RIDES 2005, p. 21). An influx of tourists at Laguna Colorada (Bolivia) has resulted in noticeable increased water consumption (Rocha and Eyzaguirre 1998, p. 8). At Salar de Atacama, the maximum volume available for extraction from the basin is estimated by the average annual recharge rate of 177 cubic feet per second (ft^3/s) (5 cubic meters per second (m^3/s)), yet the rights to 219 ft^3/s (6.2 m^3/s) of water have been allocated (RIDES 2005, pp. 15–16). The number of people visiting remote Salar de Surire (Chile), a primary Andean flamingo breeding site, was under 1,000 as of 1995, and is increasing (Soto and Silvestre 1996, p. 7). Recent estimates indicate that over 50,000 people visit Salar de Atacama (Chile) and surrounding areas each year. Based on the recharge estimates, continued increases in water use levels commensurate with increasing tourism would not be sustainable (RIDES 2005, p. 21).

The gradual loss of water from the basin reduces the surface area of the lake and the total amount of habitat available to the Andean flamingo. Ugarte-Nunez and Mosaurieta-Echegaray (2000, p. 135) found that the number of flamingos at Laguna Salinas (Peru) was strongly correlated to the proportion of the lake covered with water (1997: r^2=0.73; 1998: r^2=0.72), indicating that loss of surface area influences flamingo abundance. Lago Parinacochas (Peru), long known as an important overwintering site for Andean flamingos, is being drained as part of a water development project in Peru (Ducks Unlimited 2007d, p. 31). The TDPS in Bolivia and Peru, which Lagos Poopó and Uru Uru belong to, provides drinking water and cleaning water, transportation, industry and irrigation-in addition to providing habitat for flora and fauna (Ronteltap *et al.* 2005, p. 5).

The extraction of water for human consumption has exacerbated ongoing drought conditions throughout Andean flamingo habitat since the early 1990s (see Factor E) (Caziani and Derlindati 2000, pp. 124–125; Caziani *et al.* 2001, p. 110; Mascitti and Caziani 1997, p. 328). In Chile, where Andean flamingo breeding colonies are found and where mineral and hydrocarbon exploration and exploitation have increased in the last two decades, both the number of successful breeding colonies and the total production of chicks of Andean flamingos have declined since the 1980s (Parada 1992, Rodríguez and Contreras 1998—as cited in Caziani *et al.* 2007, p. 284). Of 2,900 pairs of Andean flamingos that attempted to breed in Chilean wetlands in the 2006–2007 season, only 538 chicks were produced (Childress *et al.* 2007a, p. 7).

Water from salars has been diverted to support agriculture. Rio Lauca, which feeds Salar de Coipasa (Bolivia), has been diverted near its source in Chile for irrigation purposes (Ducks Unlimited 2007c, pp. 9–11). This has resulted in a considerable reduction in the flow of water into Salar de Coipasa and is contributing to the desiccation of the Salar (Ducks Unlimited 2007b, p. 11).

Rio Desaguadero is a 230 mi-long (370 km) river that once flowed from Lago Titicaca to Lago Poopó but recently changed direction and now flows into Lago Uru Uru (Ducks Unlimited 2007b, p. 5). This is attributed to water level reductions caused by an ongoing drought since the early 1990s (see Factor E) and by diversion for irrigation (Jellison *et al.* 2004, p. 14). In 2004, Rio Mauri, a major tributary of the Rio Desaguadero was diverted to Peru (Armando *et al.* 2004, as cited in Jellison *et al.* 2004, p. 14). These water shortages exacerbate the contamination and extraction problems for Lagos Poopó and Uru Uru, mentioned above.

Research has shown that drastic water level changes can significantly alter the seasonal altitudinal movements of the Andean flamingo (Mascitti and Caziani 1997, pp. 324–326). In January 1996, Caziani & Derlindati (2000, p. 124) reported that a colony of unidentified flamingo nests at Lagunas Vilama, where Andean and James' flamingo are known to breed, were found on dry land—probably due to an unexpected retraction of the lake—leaving 1,500 abandoned nests, some of which had eggs from that season.

Increased urbanization and mining have increased infrastructure development. At Lagunas Brava and Mulas Muertas (breeding and overwintering sites, respectively), in Argentina, an international road to connect Argentina with Chile has been under construction. This road passes near the shores of Lagunas Brava and Mulas Muertas and through the bofedales that feed the two lakes, decreasing the available area suitable for Andean flamingo nesting and foraging and disrupting hydrological recharge system by altering the wet meadows that feed the two lakes (de la Fuente 2002, p. 8). At Laguna Salinas (Peru), which provides habitat for all three Andean flamingo species (Ducks Unlimited 2007d, p. 26), a mining road bisects the lake and construction excavations have reduced flamingo habitat availability (Ugarte-Nunez and Mosaurieta-Echegaray 2000, pp. 137–138). Increased road construction to support mining and tourism also facilitates predator access to nesting grounds (Corporación Nacional Forestal 1996a, pp. 12) (Factor C).

Agriculture and Grazing: Lowland wetlands that serve as important overwintering sites for the Andean flamingo are subject to agricultural pressures (Derlindati 2008, pp. 1, 7). Laguna Melincué (Argentina), for instance, lies in the heart of Argentina's agricultural zone (Romano *et al.* 2006, p. 17). The forested lands are being cleared and pastures have been and continue to be planted with cash crops in the areas surrounding Mar Chiquita (Argentina) (BLI 2008, p. 36).

Cattle grazing occurs adjacent to Andean flamingo habitat in Argentina, where the species breeds and overwinters, including Laguna Brava (de la Fuente 2002, p. 8) and Laguna Pozuelos (Adminstration de Parques Nacionales 1994, p. 1). At Laguna Brava, ranching activities are considered small-scale (comprising 300 heads of cattle), in part, because the area surrounding the lake is uninhabited (de la Fuente 2002, p. 8). At Laguna Pozeulos, grazing has resulted in severe soil erosion, especially along the shore and increased siltation of the lake (Adminstración de Parques Nacionales 1994, p. 1; Ducks Unlimited 2007a, p. 4). In Bolivia, livestock management (llamas and alpacas) continues to be a problem in the bofedales surrounding Laguna Colorada (Ducks Unlimited 2007b, p. 14; Flores 2004, pp. 25–26).

These activities have contributed to the alteration and degradation of vital Andean flamingo habitat. Long-lived species with slow rates of reproduction, such as the Andean flamingo, can appear to have robust populations, but can quickly decline towards extinction if reproduction does not keep pace with mortality (BLI 2008, p. 2; Bucher 1992, p. 183; del Hoyo *et al.* 1992, p. 517). Andean flamingos have temporally sporadic and spatially concentrated breeding patterns, and their breeding success and recruitment are low (Caziani *et al.* 2007; Childress *et al.* 2005, p. 7; Childress *et al.* 2006, p. 7; Childress *et al.* 2007a, p. 7). Successful reproduction is spatially concentrated in just a few wetlands (Childress *et al.* 2005, p. 7; Childress *et al.* 2006, p. 7; Childress *et al.* 2007a, p. 7; Valqui *et al.* 2000, p. 112). In the case of Andean flamingos, Conway (W. Conway, as cited in Valqui *et al.* 2000, p. 112) suggests that a stable population can be maintained if the species' breeding success is good every 5–10 years. Recent productivity estimates indicate that the species has experienced very low breeding success over prolonged periods (Arengo in litt. 2007, p. 2; Amado *et al.* 2007, Rodriguez Ramirez 2006—as cited in Arengo in litt. 2007, pp. 1–3). An examination of the species' nesting sites and breeding success (see Population Estimates, above) indicates that, despite an increased number of nesting sites, the species' breeding success remains low (Arengo in litt. 2007, p. 2; Caziani *et al.* 2007; Childress *et al.* 2005, p. 7; Childress *et al.* 2006, p. 7; Childress *et al.* 2007a, p. 7). Valqui *et al.* 2000 (pp. 111–112) postulated that reproduction in the Andean flamingo, a species which prefers to nest at high densities and once nested in huge colonies at Salar de Atacama (Fjeldså and Krabbe 1990, p. 86; Johnson *et al.* 1958, p. 296; Kahl 1975 p. 100), is being inhibited by the more dispersed nature of the population and occupation of smaller lakes.

Summary of Factor A

Salar habitat throughout the Andean flamingo's range has been and continues to be altered as a result of natural resource exploitation. Andean flamingos require a variety of available habitats over large areas in order to find optimal foraging and nesting sites, given unpredictable seasonal fluctuations. Mining has resulted in direct loss of habitat due to excavations of lakebeds, has increased water extraction, and has caused water pollution. Wetlands throughout Andean flamingo habitat have been drastically altered by water extraction for mining, agriculture, and human consumption. Flamingos are sensitive to fluctuating water levels, and intentional diversion of water from these endoreic (closed) wetlands exacerbates natural seasonal fluctuations and reduces habitat options. Wetlands are contaminated from mining spoils, sewage and agriculture pollution. Wetland complexes occupied by Andean flamingos that are hydrologically connected become affected by pollutants and by diminished water levels on a landscape level. Resource extraction and water contamination have had and continue to have significant impacts on the water quality and the availability of wetlands that are critical to the lifecycle of the Andean flamingo. Andean flamingo breeding patterns are temporally sporadic, successful reproduction is spatially concentrated, and their breeding success and recruitment are low. Continued and pervasive habitat destruction throughout the species' range in recent decades coincides with the species' drastic population reduction, as noted by experts (See Population Estimates, above). The negative impacts of habitat destruction on Andean flamingos on the reduction of the species' range and population numbers are intensified by an ongoing drought (Factor E). Lowered water levels could lead to disease outbreaks and can increase the flamingo's susceptibility to predation (Factor C). Therefore, we find that destruction and modification of habitat are threats to the continued existence of the Andean flamingo throughout its range.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Hunting for local consumption: Andean flamingos are hunted throughout their range for use as food or medicine and in rituals. Johnson (1967, p. 405) described flamingo hunting activities by the Montaro Indians at Lago Poopó (Bolivia) and by the Chipayas at Laguna Coipasa (Bolivia), who hunted the species for food and for its feathers, which were sold as dance ornaments). In the late summer, the Chipayas also rounded up groups of young flamingos and slaughtered them for their fat, which was boiled down and sold as a remedy for tuberculosis (Johnson 1967, p. 405).

Flamingo hunting continues today throughout the species' range (Valqui *et al.* 2000, p. 112). Quantities of wild birds, including flamingos, are still sold in the markets in Argentina, Bolivia, and Chile (Barbarán 2004, p. 6; Sáenz 2006, p. 103). In 2006, birds sold for between 25–50 Bolivianos (Bs) ($3–6 U.S. Dollars (US$)) (Sáenz 2006, p. 89).

On the Argentinean (Departments of Salta and Jujuy)/Bolivian border (Potosí)—where several Andean flamingo wetlands are found, including Laguna Pozuelos (Argentina), Laguna Colorada, and Salar de Chalviri (both in Bolivia)—locals use flamingo feathers as medicinal incense and for costumes; they eat flamingo meat and use the fat for medicine (Barbarán 2004, p. 11). Hunting is also ongoing at Lagunas de Vilama (Argentina), where the species breeds and overwinters (BLI 2008, p. 553).

At Salar de Atacama (an Andean flamingo breeding site in Chile), flamingos are hunted for their feathers (Corporación Nacional Forestal 1996a, pp. 8–9). Flamingos are used in local rituals associated with rain, birth, death, and illnesses by indigenous cultures that have long inhabited the Salar de Atacama region (Castro and Varela 1992, p. 22).

At Laguna Salinas (an overwintering site in Peru), hunters have killed flamingos for target practice or just ''to get a close look at one'' (Ugarte-Nunez and Mosaurieta-Echegaray 2000, p. 137). Increased road construction to support mining and tourism (Factor A) also facilitates hunting access to nesting grounds (Corporación Nacional Forestal 1996a, p. 12). At Lago Titicaca (Peru), localized hunting may occur (Ducks Unlimited 2007d, p. 27). Excessive hunting is also a problem at Lago Parinacochas (an overwintering site in Peru) (Ducks Unlimited 2007d, p. 23). Hunting pressure on flamingos has been described as ''intense'' at Negro Francisco (Chile) and poaching is a problem at Mar Chiquita (Argentina); both are Andean flamingo breeding grounds (Bucher 1992, p. 183, Corporación Nacional Forestal 1996c, p. 11; Goldfeder and Blanco 2007, p. 193).

Indiscriminant hunting of Andean flamingos continues at Lago Poopó (an Andean flamingo overwintering site in Bolivia) (Rocha 2002, p. 10). Around Lagos Poopó and Uru Uru, flamingos are still trapped using traditional techniques—a slip-knot rope strung across the shores of the lake (Sáenz 2006, pp. 88–89). Locals, such as the Urus, who live near Lagos Poopó and Uru Uru, prefer Andean flamingos above all other waterfowl, presumably for their fat content (Sáenz 2006, p. 185). Flamingo blood might be used medicinally and feathers for adornment (Sáenz 2006, pp. 88–89). Locals at Lagos Poopó and Uru Uru hunt flamingos to sell to miners, who make oil from the bird to cure tuberculosis (Morrison 1975, p. 81). One trapper noted that ''long ago'' it was possible to trap up to 15 flamingos per day at Lago Poopó, but that this was no longer the case (Sáenz 2006, p. 89).

Direct removal through hunting of Andean flamingo juveniles and adults has immediate and direct consequences on the already small size of the Andean flamingo population. The Andean flamingo experienced a severe population reduction since the 1980s (BLI 2008, pp. 1, 5), with the number of birds decreasing from 50,000 to 100,000 individuals (BLI 2008, p. 1) to the current estimate of 34,000 (Caziani *et al.* 2006, pp. 276–287; Caziani *et al.* 2007, pp. 13–17). Hunting further reduces the number of individuals. All flamingos are believed to be monogamous, with a strong pair-bonding tendency that may be maintained from one breeding season to the next (del Hoyo 1992, p. 514). Hunting can destroy pair bonds and disrupt mating from one season to the next. Because not all sexually mature adults breed every year and, even in years of breeding, not all sexually mature adults will participate (Bucher 1992, p. 183), removal of those adults that are nesting greatly reduced their already poor breeding success (Fjeldså and Krabbe 1990, p. 85). Andean flamingos are long-lived, with slow rates of reproduction and poor breeding success (BLI 2008, p. 2; Bucher 1992, p. 183; del Hoyo *et al.* 1992, p. 517). Stable populations can be maintained only if the species' breeding success is good every 5–10 years (William Conway, Wildlife Conservation Society, Bronx, New York, as cited in Valqui *et al.* 2000, p. 112). Removal of juveniles from the population contributes to the already low rate of chick production (as further discussed under Egg Collection, below). Experts believe that ongoing exploitation, coupled with habitat decline, and the species' rapid population decline and slow breeding render this species vulnerable to extinction in the wild (BLI 2008, p. 1). Finally, given the species' sensitivity to human disturbance (see Factor E), Andean flamingos are negatively affected by disturbance from hunting-related activities, even when they are not directly targeted (CONAF, Region II, as cited in Instituto Nacional de Recursos Naturales (INRENA) 1996, p. 11; de la Fuente 2002, p. 8; Valqui *et al.* 2000, p. 112).

Hunting for international trade: In 1975, the Andean flamingo was listed in Appendix II of CITES (UNEP–WCMC 2008b, p. 1). Appendix II includes species that are not necessarily threatened with extinction, but may become so unless trade is subject to strict regulation to avoid utilization incompatible with the species' survival. International trade in specimens of Appendix-II species is authorized through permits or certificates under certain circumstances, including verification that trade will not be detrimental to the survival of the species in the wild and that specimens in trade were legally acquired (UNEP–WCMC 2008a, p. 1). For information on how CITES functions to regulate trade, see Factor D.

Bucher (1992, p. 183) described a smuggling operation that involved trade in live Andean flamingos with birds captured at Laguna de Mar Chiquita (a breeding site in Argentina) and transported out of the country as captive-bred specimens (specimens that were not taken out of the wild) forged CITES documents. Based on CITES documentation, trade records indicate that a total of 77 Andean flamingo specimens have been traded internationally since the species was listed in 1975 (United Nations Environment Programme-World Conservation Monitoring Centre (UNEP–WCMC) 2008c, pp. 1–2). Thirty-six specimens were traded as non-living specimens—all were exchanged for scientific purposes and involved trade with Chile and Argentina—3 specimens from Chile (in 1985) and 25 specimens from Argentina (in 2004); 1 shipment of 250 grams of specimens from Chile (possibly blood samples, in 1997); 1 body (probably a museum specimen, in 1989); and 2 feathers (which appear to be the same specimen—imported to the U.S. from Chile in 2000 and returned to Chile in 2001) (UNEP–WCMC 2008c, pp. 1–2).

Forty-one of the 77 specimens were live shipments. Eighteen of the specimens originated from one Andean flamingo range country (Bolivia) and were exported in three shipments—in 1977, 1978, and 1981. Sixteen of the birds were traded for scientific purposes; trade for scientific purposes generally indicates a transaction involving a zoo, where primary research on captive breeding is undertaken. There is no indication as to the origin of the remaining 23 live specimens (i.e., the country from which the specimens originated), so that we are unable to determine unequivocally whether live specimens were exported from Argentina under false CITES documentation. Of these 23, only 3 specimens were traded for commercial purposes: In 1979, when France exported a single live individual to Great Britain; in 1980, when the United States exported 4 live individuals to Great Britain; and, in 1982, when Great Britain exported 27 birds to Germany. There has been no trade in live specimens since 1982 (UNEP–WCMC 2008c, pp. 1–2).

Since 1997, the Andean flamingo has been protected throughout Europe by the European Commission (EC) Regulation 338/97 (Eur-Lex 2008, p. 24). For species listed under Annex B, imports from a non-European Union country must be accompanied by a permit that is only issued if the Scientific Authority has determined that trade in the species will not be detrimental to its survival in the wild. According to Dr. Ute Grimm (German Scientific Authority to CITES (Fauna), Bonn, Germany, in litt. 2008, p. 1), there have been no imports of Andean flamingos since this legislation went into effect (Grimm in litt. 2008, p.1). Thus, we cannot conclude that CITES trade documents were used to smuggle live birds from Argentina, and the trade data does not suggest that this is the case.

Egg collection: There is a long history of collecting flamingo eggs in the altiplano region. Eggs are harvested for subsistence use and for sale in local markets (Barbarán 2004, p. 6; BLI 2008, p. 56; Rocha 2002, p. 10; Sáenz 2006, p. 89). Walcott (1925, pp. 354–357) provided a detailed account of egg collecting at Laguna Colorada (Bolivia), as described by a local Puna Indian. According to this account, the locals knew when the Andean flamingos began nesting for the season and a group of 8 to 10 villagers would camp at the lake long enough to gather the eggs. They gathered nearly every egg, burying the ones that they could not carry, so that the birds would not incubate them, and returning later to retrieve the buried eggs. The eggs were baked in clay ovens on site before being transported back to their village. Another early 20th century account noted that flamingo eggs were sold as far back as 1903 in a market at San Pedro de Atacama (Chile) (Walcott 1925, pp. 354, 360)—this is the nearest town to Salar de Atacama, the type locality of the Andean flamingo (Hellmayr 1932, p. 312). Eggs were harvested once, twice, or several times a season (Johnson *et al.* 1958 pp. 291, 298; Walcott 1925, pp. 354–356). Accounts describe the annual practice of harvesting eggs, with entire families journeying to the lake to set up camp from December to February (Barfield 1961, p. 96; Johnson *et al.* 1958 pp. 291–292).

Egg collecting has become an established part of the local culture (Barbarán 2004, p. 6; Rocha 2002, p. 10). Egg collecting has been reported at several wetlands throughout the Andes that are critical to the Andean flamingo's life cycle, including: Laguna de Pozuelos (Argentina) (Administration de Parques Nacionales 1994, p. 2); Lagunas de Vilama (Argentina) (BLI 2008, p. 553; Caziani *et al.* 2001, p. 106); Lago Poopó (Bolivia); Lago Uru Uru (Bolivia) (Sáenz 2006, p. 89); Laguna Colorada (Bolivia) (Hurlbert and Keith 1979, p. 332; Johnson *et al.* 1958, p. 292; Rocha and Eyzaguirre 1998, p. 1); and Salar de Atacama (Chile) (Hurlbert and Keith 1979, pp. 332–333; Johnson *et al.* 1958, p. 298). Egg collection may also occur at Lago Titicaca (Peru) (Ducks Unlimited 2007d, p. 27).

Collecting is facilitated by the fact that the birds nest in large colonies. Large nesting sites are targeted for egg collection, as collectors can quickly gather a large number of eggs at these sites (Caziani *et al.* 2001, p. 111; Sáenz 2006, p. 89).

Egg collection has an immediate negative impact on the Andean flamingo's already poor breeding success (see Population Estimates-Breeding Success) (Arengo in litt. 2007, pp. 1–3; del Hoyo *et al.* 1992, p. 521). Because flamingos are long-lived with slow rates of reproduction (Bucher 1992, p. 183), stable populations can be maintained if the species' breeding success is good every 5–10 years (William Conway, Wildlife Conservation Society, Bronx, New York, as cited in Valqui *et al.* 2000, p. 112). However, the numbers of nesting birds being reported are lower in the past decade when compared to the 1980s (Parada 1992, Rodríguez and Contreras 1998—as cited in Caziani *et al.* 2007, p. 284). Chick production has been very low for the past 20 years, averaging 800 per year from 1987 to 1997 (Rodriguez Ramirez 2006, Amado *et al.* 2007, as cited in Arengo in litt. 2007, pp. 1–3), and 3,000 chicks per year from between 1997 to 2001 (Caziani *et al.* 2007, p. 283). As discussed in Factor E, disturbance caused by collection activities further compounds the adverse effects of egg collection (see Factor E).

Increasing demand for eggs and increased access to habitats further exacerbates the species' already poor breeding success. In 1975, Morrison (1975, p. 81) reported that flamingo eggs were in great demand and that traders visited nesting areas, including Lagos Poopó and Uru Uru, to buy eggs from local Indians, transporting eggs away ''by the truckload.'' As towns grow and mining operations expand, demand for eggs increases to satisfy the miners (del Hoyo *et al.* 1992, p. 521). Mining operations have infiltrated once isolated wetlands. In 1925, birds nesting at Laguna Cachi (part of Pastos Grandes, Bolivia) were considered secure from egg collecting due to the remote and inhospitable terrain (Walcott 1925, pp. 354–356). Today, Pastos Grandes, which is an important breeding ground in Bolivia, is the site of intense mineral prospecting (see Factor A).

Tourism and Ecotourism: As described in Factor A, ecotourism is prevalent at many wetlands inhabited by the Andean flamingo, including: Laguna Negra (Argentina), Laguna de Colorada (Bolivia), Salar de Atacama, and the TDPS wetland complex, which includes Lagos Poopó and Uru Uru (the latter three wetlands in Chile). According to the Corporación Nacional Forestal (1996c, pp. 10–11), uncontrolled tourism, especially the use of four wheeled all-terrain vehicles, has become a problem at Laguna Negra.

The Eduardo Avaroa National Reserve (Reserve) in Bolivia encompasses Laguna Colorada, Laguna Kalina, and Salar de Chalviri (Ducks Unlimited 2007b, p. 43). The Reserve began collecting tourism data in 1999 (González 2006, p. 1). Since 2000, tourism has increased annually by about 5 percent per year, from 26,066 visitors in 2000 to 51,271 visitors in 2005 (González 2006, p. 2). Over the 6-year period, a total of 142,968 tourists visited the Reserve, primarily in the Bolivian winter months of July (24,629 visitors) and August (32,230 visitors). During the Andean flamingo breeding season (November to February), an average of 18,000 people visited the Reserve each month (Gonzalez 2006, p. 2). In 2005, ticket sales indicated that 65 percent of the tourists came to see the flamingos (González 2006, p. 2). Within the Reserve, problems associated with tourism include increased car traffic and trash, especially disposable bottles and other non-biodegradable waste (Embassy of Bolivia 2008, pp. 7–8).

At Lago Titicaca (Peru), the large number of visitors and the noise of motorized vehicles has decreased the number of birds on the lake (INRENA 1996, p. 6). At Laguna Salinas (Peru), which provides habitat to all three South American flamingo species, excavation activities near the lake had a profound effect on the flamingos. Flamingos were driven away from areas where there was noise caused by excavating machinery, disrupting feeding and breeding activities. Flamingos fled nesting sites during disturbance activities (such as excavation), and some never returned, abandoning their nests (Ugarte-Nunez and Mosaurieta-Echegaray 2000, p. 137).

Summary of Factor B

Hunting for local consumption, egg collection, and tourism have a negative impact on Andean flamingo populations throughout their range. Hunting removes juveniles and adults from the population, which has already experienced a severe population decline within the past 30 years and is considered the rarest of all flamingo species in the world. Removal of adults from the population decreases the number of sexually mature specimens available for reproduction, may break pair bonds, and jeopardizes their already inconsistent breeding habits. Although egg-collecting has been carried out for years, and perhaps centuries, increased demand has intensified collection pressures. Egg collection is facilitated by the flamingo's colonial nesting practices and from increased access to once-remote wetlands from mining operations (Factor A). Disturbance from hunting, egg collection, and tourism exacerbates the species' poor breeding success (Factor E). Therefore, we find that hunting for local consumption, egg collection, and tourism are threats to the continued existence of the Andean flamingo throughout its range.

With regard to hunting for international trade, we believe that the small number of live specimens that were traded and the near lack of trade for commercial purposes, combined with the fact that there have been no shipments of live Andean flamingos since 1982, indicate that the level of international trade, controlled via valid CITES permits, is small. Therefore, we find that harvest of flamingos for international trade is not a threat to the continued existence of the Andean flamingo.

C. Disease or Predation

Disease: Flamingos are nomadic species with the potential to disperse pathogenic microorganisms and horizontally transmit disease agents due to their flocking behavior (Uhart *et al.* 2006, p. 32). Uhart *et al.* (2006, p. 32) found 13 antibodies for various infectious diseases (indicating exposure) in a study of all 3 altiplano flamingos. Changes in water availability and habitat quality may favor the emergence of pathogens, which could affect the health of flamingos (Uhart *et al.* 2006, p. 32). However, we are not aware of any pathogenic diseases that are currently affecting Andean flamingos in the wild.

A massive mortality of flamingos and other aquatic birds (on the order of several thousands) was recorded in January 1975 around the mouth of the Segundo River in Mar Chiquita (Argentina). Bucher (1992, p. 183) believed the observed mortality was caused by an outbreak of avian botulism. The affected birds showed typical field signs of the disease (Locke and Friend 1987, as cited in Bucher 1992, p. 183), including: Paralysis of voluntary muscles, inability to walk or fly, and a tendency to congregate along vegetated peninsulas and islands, where lines of carcasses were seen at the water's edge. Avian botulism outbreaks are associated with receding water conditions in areas of flooded vegetation during periods of high temperatures (Bucher 1992, p. 183). Thus, activities that decrease water levels at the lakes, as outlined in Factor A, could cause disease outbreaks and result in flamingo mortality.

In 2002, Fabry and Hilliard (2006, p. 49) began a flamingo monitoring program in the Atacama Desert to explore the declining flamingo populations in the region, test for linkages between human activity and declining flamingo populations, and evaluate flamingo health. The team has marked and released over 80 flamingos and has identified several pathogens, including Newcastle's disease, Avian influenza, and West Nile virus, as possible causes for increasing flamingo mortality. This research is ongoing.

Predation: Walcott (1925, p. 354) noted that fresh-water gulls (*Larus serranus*) at Laguna Colorada (Bolivia) were likely predating flamingo eggs. Other potential predators include the Andean wolf (*Dusicyon cuplaeus*), pampas fox (*Dusicyon griseus*), variable hawk (*Buteo poecilochrous*), and Andean caracara (*Phalcobaenus albogularis*). Johnson *et al.* (1958, p. 299) concluded predation by land-bound predators was not a significant threat to this species, given the difficulty of access to nesting sites. However, nesting sites are no longer as inaccessible as they were in the mid-20th century. Human activities (such as mining, urbanization, tourism, and concomitant infrastructure development) have infiltrated wetlands previously considered inaccessible (Factor A). This situation has been compounded by the ongoing drought conditions throughout a large portion of the Andean flamingo's range (Factor E). In January 1996, Caziani & Derlindati (2000, p. 124) reported that a colony of unidentified flamingo nests at Lagunas Vilama, where Andean and James' flamingo are known to breed, were found on dry land—probably due to an unexpected retraction of the lake—leaving 1,500 abandoned nests, some of which had eggs from that season. Because this species nests in the open, laying eggs directly on the ground, many nesting sites can be more easily accessed by humans and non-human predators. In the 2006–2007 breeding season, Childress *et al.* (2007, p. 7) noted that an entire colony of 600 unidentified flamingo nests at Laguna Brava (Argentina, where Andean flamingos are known to nest) had been decimated by foxes (species not identified). The Corporación Nacional Forestal (1996a, p. 12) reported that foxes ate flamingo eggs and chicks at Los Flamingos National Reserve (Chile) but did not document the extent of this predation.

Summary of Factor C

Several diseases have been identified in the flamingo population and are being monitored. Potential for disease outbreaks warrants continued monitoring and may become a more significant threat factor in the future, especially if habitat alteration combined with the ongoing drought continue to decrease water levels at the lakes (Factors A and E). Disease has been identified and has at least in one case likely caused mortality (botulism). Therefore, we find that disease in flamingos is a threat to the continued existence of the Andean flamingo.

Predation by foxes, gulls, and other predators results in direct removal of eggs, juveniles, and adults from the population. Predation can have devastating consequences for the species, especially given the colonial nature of the species and its tendency to nest in only a few wetlands each year. Predation removes potentially reproductive adults from the breeding pool, disrupts mating pairs, and exacerbates the species' already poor breeding success (these effects are discussed in detail under Factor B). Therefore, we find that predation is a threat to the continued existence of the Andean flamingo throughout its range.

D. Inadequacy of Existing Regulatory Mechanisms

Two regulatory issues can be discussed on a regional level: Protections under CITES, and Ramsar designations.

CITES: The Andean flamingo is listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is an international treaty among 173 nations, including all four Andean flamingo countries and the United States, that entered into force in 1975 (UNEP–WCMC 2008a, p. 1). In the United States, CITES is implemented through the U.S. Endangered Species Act (Act). The Act designates the Secretary of the Interior as the Scientific and Management Authorities to implement the treaty with all functions carried out by the Service. Under this treaty, countries work together to ensure that international trade in animal and plant species is not detrimental to the survival of wild populations, by regulating the import, export, re-export, and introduction from the sea of CITES-listed animal and plant species (USFWS 2008, p. 1). As discussed under Factor B, we do not consider international trade to be a threat impacting the Andean flamingo and consider that this international treaty has minimized the potential threat to the species from international trade.

Ramsar: The Ramsar Convention, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are presently 157 Contracting Parties to the Convention (including all of the countries where the Andean flamingo occurs), with 1,702 wetland sites, totaling 153 million hectares, designated for inclusion in the Ramsar List of Wetlands of International Importance. Many wetlands of importance to the Andean flamingo's life cycle are designated as wetlands of international importance under the Ramsar Convention. In Argentina, these include: Laguna de Mar Chiquita (Bárbaro 2002, pp. 1–12), Lagunas de Vilama (de la Zerda *et al.* 2000, pp. 1–6), Laguna Brava (de la Fuente 2002, pp. 1–10), and Laguna de Pozuelos (Administration de Parques Nacionales 1994, pp. 1–3). In Bolivia, Lagos Poopó and Uru Uru (Rocha 2002, pp. 1–13) and Laguna Colorada (Rocha and Eyzaguirre 1998, pp. 1–11) are Ramsar wetlands. Chilean Ramsar wetlands include Laguna del Negro Francisco and Laguna Santa Rosa (Corporación Nacional Forestal 1996c, pp. 1–12); Salar de Huasco (Corporación Nacional Forestal 1996b, pp. 1–5); and Salar de Surire (Soto 1996, pp. 1–9). In Peru, Lago Titicaca (INRENA 1996, pp. 1–14) and Laguna Salinas (Jefatura de la Reserva Nacional de Salinas y Aguada Blanca 2003, pp. 1–14) are Ramsar wetlands. Experts consider Ramsar to provide only nominal protection of wetlands, although they also note that such a designation may increase international awareness of its ecological value (Jellison *et al.* 2004, p. 19). However, as described below, activities that negatively impact the Andean flamingo are ongoing within Ramsar wetlands, including the curtailment and destruction of Andean flamingo habitat (Factor A), and hunting and overutilization of Andean flamingos (Factor B). As such, this designation has not mitigated the impact of threats on the Andean flamingo.

Due to the wide range of Andean flamingos in four countries along the Andes, the remaining analysis of existing regulatory mechanisms will be presented on a country-by-country basis, in alphabetical order.

Argentina: The Andean flamingo is considered vulnerable in Argentina (Goldfeder & Blanco 2007, p. 191). The Law of Provincial Game No. 3,014/73 (Law No. 3,014 1973, pp. 1–5) was established in Argentina in 1973. Article 7 of this law strictly prohibits hunting, possession, or transportation of wild animals, their parts, offspring, nests, or eggs, except as permitted by regulation (Law No. 3014, p. 7). Resolution No. 513/2007 (2007, pp. 1–7) and Resolution No. 1,089/98 (1998, pp. 1–4) prohibit hunting, trapping, interprovincial transport, or international trade in certain species of wildlife, including the Andean flamingo. Despite this law, hunting for local consumption of Andean flamingo individuals and eggs continues at wetlands of known importance in Argentina, including Laguna Pozuelos and Mar Chiquita (Barbarán 2004, p. 11; Bucher 1992, p. 183; Senz 2006, p. 103) (see Factor B). Therefore, these laws are inadequate to mitigate the threat of Andean flamingo hunting for local consumption.

Protected areas have been established by regulation at several sites occupied by the Andean flamingo in Argentina, including: (a) Laguna Brava and Laguna de Mulas Muertas, (b) Laguna de Mar Chiquita, (c) Laguna de Pozuelos, and (d) Lagunas de Vilama. As described below, the regulatory mechanisms behind these designations are inadequate to address or mitigate ongoing activities that are negatively impacting the Andean flamingo within these protected areas, including the curtailment and destruction of Andean flamingo habitat (Factor A), and hunting and overutilization of Andean flamingos (Factor B).

(a) Laguna Brava and Laguna de Mulas Muertas: Provincial Law No. 3944 declared the creation of the Reserva de Vicuñas y Protección del Ecosistema Laguna Brava, establishing Laguna Brava as a protected reserve in La Rioja Province (BLI 2008, p. 40). Laguna Mulas Muertas, where the Andean flamingo has overwintered, is also included within this reserve (BLI 2008, p. 40; Bucher *et al.* 2000, p. 120). This law also established the designated managing authorities and provided for the formulation of regulations for the operation of the Reserve, under the Provincial System of Protected Areas. There is an outpost for park rangers in the town of Alto Jague that is equipped with a 4x4 vehicle and a permanent staff of four park rangers assigned to the protected area. Despite this designation, the habitat within the reserve continues to be curtailed and disrupted by human activities. Recent road construction (de la Fuente 2002, p. 8) (see Factor A) and increased tourism, including the use of off-road vehicles (BLI 2008, p. 40) (see Factors A and B), are ongoing. Multinational mining companies have undertaken prospecting activities within the Reserve, indicating the potential that mineral extraction could occur there (de la Fuente 2002, p. 8) (see Factor A).

(b) Laguna de Mar Chiquita: Laguna de Mar Chiquita is an important wintering site for Andean flamingos and was included in the System of Protected Nature Areas of the Province of Córdoba in 1966 (BLI 2008, pp. 34–37). In 1994, the area was declared a multiple-use reserve (Reserva de Bañados del Río Dulce y Laguna de Mar Chiquita) (BLI 2008, p. 36; Ducks Unlimited 2007a, p. 22). In accordance with existing legislation, environmental protection is achieved through the regulated use of natural resources, respecting its characteristics, ecological status, wildlife and potential resources. In 2000, a group of provincial park wardens was formed to patrol the reserve. In 2001, there were four new park wardens, one expert and a technician to implement environmental legislation in the reserve (Bárbaro 2002, p. 10). Activities that cause habitat destruction are ongoing around Mar Chiquita, including pollution from agriculture, water contamination from agrochemicals (BLI 2008, pp. 36–37; Johnson and Arengo 2001, p. 38) (see Factor A), and disturbance from ecotourism activities (Ducks Unlimited 2007a, p. 22) (see Factor B).

(c) Laguna de Pozuelos: Located in Jujuy Province, Laguna de Pozuelos was designated a Natural Monument in 1981 and a UNESCO Biosphere Reserve in 1990 (BLI 2008, p. 31; Ducks Unlimited 2007a, p. 2). It is managed by the National Parks Administration of Argentina and is subject to the regulation of Law No. 22,351 (1980, pp. 1–11) concerning National Parks, Natural Monuments, and National Reserves (Administration de Parques Nacionales 1994, pp. 1–2). Under Law No. 22,351 (1980, p. 2), an area that has been declared a Natural Monument is conferred ''absolute'' protection, such that the land, things, and species of animals and plants thereon are inviolable. Despite this protection, mining and resultant water contamination continue (de la Fuente 2002, p. 8; Ducks Unlimited 2007a, p. 4; Goldfeder and Blanco 2007, p. 193) (see Factor A). According to the National Park Administration, a ''trained'' warden is posted at the site (Administration de Parques Nacionales 1994, pp. 1–2). Despite this, hunting continues to threaten the Andean flamingo at Laguna Pozuelos, where individuals and their eggs are hunted for subsistence and local commerce (Administration de Parques Nacionales 1994, p. 2; BLI 2008, p. 31) (see Factor B).

(d) Lagunas de Vilama: The lakes that form Lagunas de Vilama are located within the Reserva Altoandina de la Chinchilla, under the jurisdiction of the province of Jujuy in accordance with Provincial Decree No. 2,213E–92 (BLI 2008, pp. 52–53; de la Zerda *et al.* 2000, p. 5; Provincial Decree No. 2,213E 1992, pp. 1–5). This Reserve, along the Argentinean/Chilean border, was created in 1992 specifically to protect the chinchilla (*Eriomis brevicaudata*), the vicuña (*Vicugna vicugna*), and numerous birds (Provincial Decree No. 2,213 E 1992, p. 1). Despite this regulation, habitat destruction caused by prospecting for minerals and tourism (Factor A) and egg collection (Factor B) are factors that continue to threaten the Andean flamingo within the Lagunas de Vilama wetland system (BLI 2008, p. 553; Caziani *et al.* 2001, p. 106).

Bolivia: The 1975 Law on Wildlife, National Parks, Hunting and Fishing (Decree Law No. 12,301 1975, pp. 1–34) has the fundamental objective of protecting the country's natural resources. This law governs the protection, management utilization, transportation, and selling of wildlife and their products; the protection of endangered species; habitat conservation of fauna and flora; and the declaration of national parks, biological reserves, refuges, and wildlife sanctuaries, tending to the preservation, promotion, and rational use of these resources. However, hunting of flamingos continues to be a threat at Lake Poopó (Rocha 2002, p. 10; Sáenz 2006, pp. 88–89) (Factor B).

Wetlands frequented by the Andean flamingo in Bolivia that have some level of protected status include: (a) Lago Poopó and (b) Laguna Colorada, Laguna Kalina, and Salar de Chalviri. However, the regulations are ineffective at reducing the threat of habitat destruction (Factor A), hunting and egg collection (Factor B) and human disturbance (Factor E) within these protected areas.

(a) Lago Poopó: In 2000, Lago Poopó, an overwintering site for the Andean flamingo (see Current Range), was declared a natural heritage site and ecological reserve under Law No. 2,097 (2000, pp. 7–8) (Declaration of National Patrimony and Ecological Reserve of Oruru, for Lake Poopó in the Department of Oruru). Law No. 2,097 (2000, p. 7) allowed for international cooperation on the conservation and rehabilitation of the lake. However, as of 2002, Rocha (2002, p. 11) noted that little had been done to ensure the lake's conservation. In their review of the conservation and management challenges of saline lakes, Jellison *et al.* (2004, p. 14) concluded that because Lago Poopó is not part of the national system of protected areas there has been little attention to its conservation and ''wise use'' (Jellison *et al.* 2004, p. 14).

Lago Poopó is on the terminal end of the TDPS (Titicaca-Desaguadero-Poopó-Salar de Coipasa) hydrological system along the border with Peru (Jellison *et al.* 2004, p. 11, 120), with Lago Titicaca straddling the border between the two countries (Ronteltap *et al.* 2005, p. 1) (see Current Range: Bolivia). Water contamination from mining and metallurgical industries has contaminated the TDPS water system for many years (Adamek *et al.* 1998, Cardoza *et al.* 2004—as cited in Jellison *et al.* 2004, p. 12; Jellison *et al.* 2004, p. 11; Ricalde 2003, pp. 10, 91). Because Lago Poopó is located at the terminal end of the endoreic (closed) TDPS drainage system, pollutants are more likely to concentrate there (Jellison *et al.* 2004, p. 120) (Factor A). In addition to water contamination, Andean flamingos at Lago Poopó are exposed to threats from indiscriminant hunting (Rocha 2002, p. 10; Sáenz 2006, pp. 88–89) (Factor B).

(b) Laguna Colorada, Laguna Kalina, and Salar de Chalviri: Lagunas Colorada and Kalina are important breeding sites that belong to the same hydrological water basin (Ducks Unlimited 2007b, p. 13). Salar de Chalviri is a wetland complex that provides habitat for the Andean flamingo during the winter. Laguna Colorada was one of five wetlands, and the only wetland in Bolivia that, in 2005, harbored 50 percent of the breeding population (Caziani *et al.* 2006, p. 13). In the most recent simultaneous census, for 2006–2007, breeding in Bolivia occurred only at two wetlands, Laguna Colorada and Kalina (see Current Range). Therefore, the effects of habitat reduction (Factor A), hunting, and tourism (Factor B) at these wetlands greatly diminish the numbers of reproductive adults and juvenile offspring, and the overall breeding success of the species.

The Eduardo Avaroa National Reserve (La Reserva Nacional de Fauna Andina Eduardo Avaroa) (Reserve) was established in 1973 (Supreme Decree 11,231 1973, pp. 1–2), expressly to protect Laguna Colorada for its role in supporting a large diversity of wildlife, including rare species such as the Andean flamingo, and to counter a growing commerce in these species, which were being harvested from the area. The Decree established the boundaries of the Reserve, declared hunting within the park illegal, established a guard post within the park, and empowered the Minister of Agriculture and Cattle to conduct the necessary biological and ecological studies to manage the park. The area of the Reserve was defined as Laguna Colorada itself (which covers approximately 12,948 ac (5,240 ha)) (Ducks Unlimited 2007b, p. 13), plus a 6-mi (10-km) radial area surrounding the lake (Supreme Decree No. 11,239 1973, p. 1). Under Supreme Decree No. 18,431 (1981, pp. 1–2) the limits of the Reserve were extended to 1,764,515 acres (714,074 ha). With this expansion, Laguna Kalina and Salar de Chalviri were thus incorporated within the Reserve (Ducks Unlimited 2007b, pp. 13–16). In 1992, the Reserve was added to the Protected Area System (Sistema Nacional de Areas Protegidas (SNAP)) (FUNDESNAP 2008, p. 1; Rocha and Eyzaguirre 1998, pp. 8–9).

As of 1998, the Reserve had a management plan, but it was not being implemented. However, efforts were being made to manage tourism with the objective of wetland conservation and to patrol the area in order to avoid pilferage of flamingo eggs during the breeding season (Rocha and Eyzaguirre 1998, pp. 8–9). As of 2004, the following ongoing problems were identified within the Reserve: Uncontrolled and badly managed tourism; high concentrations of activities within the lagoons, including Laguna Colorada; lack of environmental controls for the mining industry; implementation of a geothermal project; uncertain financing to support activities to manage the protected area; unregulated use of archeological and natural resources; and weak management of the protected area (Flores 2004, p. 5). At Laguna Colorada, water contamination from tourism (RIDES 2005, p. 21; Rocha and Eyzaguirre 1998, p. 8) and livestock grazing are ongoing (Ducks Unlimited 2007b, p. 14; Flores 2004, pp. 35–36) (Factor A). Egg collecting has been reported at Laguna Colorada for many years (Hurlbert and Keith 1979, p. 332; Johnson *et al.* 1958, p. 292; Rocha and Eyzaguirre 1998, p. 1) and continues to be a problem within the Reserve (Ducks Unlimited 2007b, p. 17) (Factor B). Disturbance caused by collection activities further compounds the adverse effects of egg collection (see Factor E).

Supreme Decree No. 28,591 (2006, pp. 2–17) regulated the management of tourism within the protected areas that make up the National System of Protected Areas. It established a framework of regulatory provisions related to tourism so that each protected area could develop rules specific to the reserve, to ensure the conservation and protection of natural and cultural heritage. The Eduardo Avaroa National Reserve (Reserve) has been working toward a tourism management program for some time, including the collection and examination of tourism data for the Reserve in order to better understand how the Reserve is used and how to adjust their management of activities (González 2006, p. 1). However, tourism continues to increase within the Reserve (González 2006, p. 2), with concomitant stress on and contamination of the water resources (RIDES 2005, p. 21; Rocha and Eyzaguirre 1998, p. 8) (Factor A), along with the deleterious effect of human disturbance on the species (CONAF, Region II, as cited in INRENA 1996, p. 11) (Factor E).

Chile: Chile outlined the methods by which they classify various wild species as threatened or endangered species under Supreme Decree No. 75 (2006, pp. 1–6)—Reglamento para la Clasificación de Especies Silvestres—and has just initiated the process of classifying species with the publication of two proposed lists of species (Exenta No. 1,579 2006, pp. 1–4) (Da Inicio a Proceso de Clasificación de Especies e Indica Listado de Especies a Clasificar), but the Andean flamingo has not been listed nor has it been proposed for listing as threatened or endangered (see *http://www.conama.cl/clasificacionespecies/*). Therefore, there is no regulatory mechanism that specifically protects the Andean flamingo on a national level.

The Chilean National Commission on the Environment (Comisión Nacional del Medio Ambiente (CONAMA)) was established in 1990 and, in March 1994, the General Environmental Law (Ley de Bases Generales del Medio Ambiente) went into effect. The General Environmental Law restructured CONAMA and introduced new instruments of environmental management that had not previously existed: Environmental education and research; public participation; environmental quality standards to preserve nature and environmental heritage; emission standards; plans for management, prevention, and cleanup; responsibility for environmental damage; and the system of environmental impact assessment. Under the General Environmental Law, several new regulations have been established over more than twenty areas, including atmospheric, water, noise, and light pollution (Embassy of Chile 2007, pp. 1–2). However, water contamination from mineral extraction, agricultural pursuits, sewage and trash (Factor A) and disturbance from noise (Factor E) are ongoing at Chilean wetlands of importance to Andean flamingo life cycle, including: (a) Laguna Ascotán and (b) Salar de Atacama. Therefore, this regulatory mechanism is not being effectively implemented to reduce the threats to the Andean flamingo.

(a) Laguna Ascotán was once considered a breeding site for the species (Johnson *et al.* 1958, p. 296; Kahl 1975 p. 100). While the species continues to to feed at the site (Vilina and Martínez 1998, p. 28), there are no recent reports of nesting there. This may be attributed to mineral extraction (including borax) (Johnson 1958, p. 296) (Factor A) and concomitant disturbance activities (Factor E).

(b) Salar de Atacama has been a consistent and primary breeding ground (Bucher *et al.* 2000, p. 119; Childress *et al.* 2007a, p. 7; Ducks Unlimited 2007c, pp. 1–4; Johnson *et al.* 1958, p. 296). Mining activities and increased human presence and tourism has disturbed foraging and nesting birds there (Corporación Nacional Forestal 1996a, p. 9). Over 50,000 people visit Salar de Atacama (Chile) and surrounding areas each year (RIDES 2005, p. 21). These activities lead to water pollution, increased water usage, and disturbance of the flamingo life cycle. The breeding success of the species has been steadily decreasing at Salar de Atacama (Fabry and Hilliard 2006, p. 1). In Chile, breeding was attempted at four sites in Salar de Atacama. A total of 2,900 pairs of Andean flamingos laid eggs, but only 538 chicks survived (Childress *et al.* 2007a, p. 7).

Protected areas have been established by regulation at four sites occupied by the Andean flamingo in Chile: (a) Laguna del Negro Francisco, (b) Salar de Surire, and (c) Lagunas Atacama and Pujsa. These wetlands have figured as consistent breeding and overwintering habitats for many years (Bucher *et al.* 2000, p. 119; Childress *et al.* 2007a, p. 7; Ducks Unlimited 2007c, pp. 1–4; Fjeldså and Krabbe 1990, p. 86; Hellmayr 1932, p. 312; Johnson *et al.* 1958, p. 296; Kahl 1975 p. 100). However, as described below, the regulations are ineffective at reducing the threats of habitat destruction (Factor A), hunting and egg collection (Factor B), and human disturbance (Factor E) within these protected areas.

(a) Laguna del Negro: Salar de Negro Francisco provides year-round habitat for the Andean flamingo (Caziani *et al.* 2007, p. 279; Ducks Unlimited 2007c, p. 6; Valqui *et al.* 2000, p. 112). Laguna del Negro Francisco was included in the Parque Nacional Nevado Tres Cruces that forms part of the national system of protected wildlife areas (SNASPE) (Corporación Nacional Forestal 1996c, p. 11). Despite this designation, the Corporación Nacional Forestal (1996c, pp. 10–11) reported several persistent threats, including: (1) Concessions for water use held by the mining companies that work on the altiplano; (2) prospecting and digging for minerals and underground water, which involves road building that makes it possible for people to reach places that were formerly inaccessible; (3) intense illegal bird hunting (Bucher 1992, p. 183, Corporación Nacional Forestal 1996c, p. 11); and (4) uncontrolled tourism, especially the use of four-wheeled all-terrain vehicles (Corporación Nacional Forestal 1996c, pp. 10–11).

(b) Salar de Surire: Andean flamingos breed and overwinter at this wetland (Caziani *et al.* 2006, p. 13; Caziani *et al.* 2007, p. 279; McFarlane 1975, p. 88; Valqui *et al.* 2000, p. 112). In 2001, Salar de Surire, along with Salar de Atacama, was the most successful Andean flamingo breeding site in Chile (Caziani *et al.* 2007, p. 279). The Parque Nacional Lauca was created in 1970, incorporating approximately 1,285,000 acres (520,000 ha), including the Salar de Surire. In 1983, the limits of the national park were redefined, and three administrative units for protected nature areas were created: The present Parque Nacional Lauca, the National Nature Reserve Las Vicuñas, and the Salar de Surire Nature Reserve, including part of the salt marsh of 27,906 acres (11,298 ha) (Soto 1996, p. 8). Lauca Biosphere Reserve (including all three administrative units) was designated a UNESCO Biosphere reserve in 1983 (Rundel and Palma 2000, p. 262). Despite this designation, the threat of mining in the park continues (Rundel and Palma 2000, pp. 270–271). The number of people visiting remote Salar de Surire (Chile), a primary Andean flamingo breeding site, was under 1,000 as of 1995, but increasing (Soto 1996, p. 7). One travel Web site advertises the availability of a campsite, (*http://www.chilecontact.com/en/conozca/surire.php*), noting that no public transportation is available and recommending the use of four-wheel drive vehicles to access and tour the area. The impact of tourism is discussed under Factor B.

(c) Salars de Pujsa and Atacama: As mentioned above, Salar de Atacama provides year-round flamingo habitat and nesting sites. Salar de Pujsa was reported as a nesting site in 1997 (Valqui *et al.* 2000, p. 112), although no nesting was reported there in the 2004, 2005, or 2006 breeding seasons (Childress *et al.* 2005, p. 7; Childress *et al.* 2006, p. 7; Childress *et al.* 2007a, p. 7). These Salars are among the wetlands that were included in the Los Flamencos National Reserve (Reserve), designated in April 1990 by Decree No. 50 of the Ministry of Agriculture, although only part of Salar de Atacama is included. These wetlands form an important area for the biological stability of flamingo populations (Corporación Nacional Forestal 1996a, pp. 12–13).

In addition to the Reserve management plan, there is a proposed strategy for the sustainable management and regulation of activities in the salt marshes and for their conservation. The most recent reports available deem the management at this site insufficient, due to the limited number of staff and the large area of the reserve (Corporación Nacional Forestal 1996a, pp. 12–13). Locals at Salar de Atacama hunt the Andean flamingo for its feathers and for ritualistic use (Castro and Varela 1992, p. 22) (Factor B). Road building has increased access to nesting areas and facilitated hunting and egg collection (Corporación Nacional Forestal 1996a, pp. 11–12; Ducks Unlimited 2007c, p. 3) (Factor A). Water extraction in this endoreic (closed) basin, which is fed only by summer storms and winter snowmelts, is ongoing (Corporación Nacional Forestal 1996a, pp. 8–9). The rights to 13,137 ft^3/s (6.2 m^3/s) of water have been allocated; however, the water recharge in the basin is only about 10,594 ft^3/s (5 m^3/s) (RIDES 2005, p. 16) (Factor A).

Peru: The Andean flamingo is considered vulnerable by the Peruvian government under Supreme Decree No. 034–2004–AG (2004, p. 276855), which prohibits hunting, taking, transport, or trade of endangered species, except as permitted by regulation. At Laguna Salinas (an overwintering site in Peru), hunters have killed flamingos for target practice or just ''to get a close look at one.'' The extent of this persecution at Laguna Salinas is unclear, but may have abated since installation of a watch post in mid-1998 (Ugarte-Nunez and Mosaurieta-Echegaray 2000, p. 137). At Lago Titicaca (Peru), localized hunting and the collection of birds' eggs may be ongoing (Ducks Unlimited 2007d, p. 27). Excessive hunting is a problem at Lago Parinacochas (an overwintering site in Peru) (Ducks Unlimited 2007d, p. 23). Therefore, this regulatory mechanism is ineffective at protecting the Andean flamingo or mitigating the threat of hunting (Factor B).

Protected areas have been established through regulation at two sites occupied by the Andean flamingo in Peru: (a) Laguna Salinas and (b) Lago Titicaca. Lagunas Salinas has long provided overwintering habitat for the Andean flamingo (Caziani *et al.* 2007, p. 279; Hellmayr & Conover 1948, p. 277; Kahl 1975, pp. 99–100). Fourteen percent of the population overwintered there in 2003 (Ricalde 2003, p. 91). Lago Titicaca is part of the TDPS wetland system, to which Lagos Poopó and Uru Uru (Bolivia) belong. This wetlands complex provides an important variety of overwintering habitat for the Andean flamingo, where more than 50 percent of the known population of Andean flamingos overwintered in 2000 (Caziani *et al.* 2007, p. 279; Mascitti and Bonaventura 2002, p. 62). However, as described below, the regulations are ineffective at reducing the threat of habitat destruction (Factor A), hunting and egg collection (Factor B), predation (Factor C), and human disturbance (Factor E) within these protected areas.

(a) Laguna Salinas: Laguna Salinas is part of the Reserve National Salinas and Aguada Blanca (Reserve), established by Supreme Decree No. 070–79–AA in 1979 (1979, pp. 260–262). A master plan for the Reserve was adopted in 2001 (Jefatura de la Reserva Nacional de Salinas y Aguada Blanca 2003, pp. 6–7). However, at Laguna Salinas, which provides habitat for all three Andean flamingo species (Ducks Unlimited 2007d, p. 26), the habitat is being destroyed or modified by mining, fires, agriculture, and drainage for drinking water (Ricalde 2003, p. 91; Ugarte-Nunez and Mosaurieta-Echegaray 2000, p. 135) (Factor A). Flamingos are absent from polluted areas of the lake (Factor A); Andean flamingos are sensitive to reduced water levels (Factor A); and disturbance activities disrupt flamingo nesting and eating habits on the lake (Factor E) (Ugarte-Nunez and Mosaurieta-Echegaray 2000, pp. 135, 137, 139). In addition to reducing flamingo habitat availability, increased road construction to support mining and tourism (Factor A) facilitates hunting and predator access to nesting grounds (Corporación Nacional Forestal 1996a, pp. 12) (Factors B and C).

(b) Lago Titicaca: The Titicaca National Reserve (Reserva Nacional del Titicaca) (Reserve) (89,364 acres (36,180 ha)) encompasses approximately 8 percent of the Peruvian portion of Lago Titicaca (Supreme Decree No. 185–78–AA 1978, p. 257). The Reserve was created in 1978 (Chief Resolution No. 311–2001–INRENA 2001, pp. 413–415) to guarantee the conservation of its natural resources because of the existence of exceptional characteristics of wild fauna and flora, scenic beauty, and traditional use of natural resources in harmony with the environment. In addition, it was created to promote the socioeconomic development of the neighboring populations through the wise use of natural resources and the promotion of tourism. The Peruvian Navy controls navigation on all of the lakes in Peru, including boats that visit the reserve. It also patrols and monitors the border, and ensures compliance with regulations on hunting and the use of wildlife resources from the lake (INRENA 1996, pp. 9–10). The Institute of Natural Resources (Instituto Nacional de Recursos Naturales—INRENA), noted that the large number of visitors and noise disturbance from motorized vehicles negatively impacted the number of birds on the lake (Factor E) (INRENA 1996, p. 6). The waters of Lago Titicaca are polluted from boat traffic and domestic sewage, and localized hunting and egg collection may be occurring there (Ducks Unlimited 2007d, p. 27; Jellison *et al.* 2004, p. 11; Ricalde 2003, p. 91).

Summary of Factor D

The existing regulatory mechanisms or enforcement of these mechanisms throughout the species' range are inadequate to protect the Andean flamingo or mitigate the factors that are negatively impacting the species and its habitat, including habitat destruction (Factor A), hunting and tourism (Factor B), predation (Factor C), and disturbance (Factor E). Therefore, we find that the existing regulatory mechanisms are inadequate to mitigate the threats to the continued existence of the Andean flamingo throughout its range.

E. Other Natural or Manmade Factors Affecting the Continued Existence of the Species

Two additional factors are having a negative impact on the Andean flamingo population: human disturbance and ongoing drought.

Human disturbance: Walcott (1925, pp. 355–356) noted that the birds are shy and, when eggs are collected by humans, Andean flamingos do not return to lay a second egg. Jameison and Bingham (1912, pp. 12, 14) noted that extensive sheep and cattle pastures existed around Lago Parinacochas and that flamingos no longer nested there. Many human-induced disturbances exist throughout the Andean flamingos' range. Mining, population growth, tourism, and associated road construction and maintenance generally increase disturbance and noise and can make nesting and foraging areas unsuitable for the Andean flamingo. These disturbances have led to decreased numbers of birds foraging and nesting at several sites that are important for the Andean flamingo reproductive cycle, including: Salar de Atacama (Chile) (Corporación Nacional Forestal 1996a, p. 9), Laguna Colorada (Bolivia) (Rocha and Eyzaguirre 1998, p. 8), and the TDPS wetland system (INRENA 1996, p. 6). Flamingos that are disturbed during nesting season have been known to abandon their nests (Ugarte-Nunez and Mosaurieta-Echegaray 2000, p. 137). Road construction has increased access to wetlands, facilitating additional disturbances from foot traffic and motorized vehicles at lakes, such as Laguna Salinas (Peru) (Ugarte-Nunez and Mosaurieta-Echegaray 2000, p. 137), Lago Loriscota (Peru) (Valqui *et al.* 2000, p. 112), Laguna Brava (Argentina) (BLI 2008, p. 40; de la Fuente 2002, p. 8), and Lago Titicaca (Peru) (INRENA 1996, p. 6). Disturbance has increased with the increase in tourism and human encroachment into Andean flamingo wetlands, including: Laguna de Mar Chiquita (Argentina) (Ducks Unlimited 2007a, p. 22), Laguna Brava (Argentina) (BLI 2008, p. 40), Lagunas de Vilama (Argentina) (Caziani *et al.* 2001, p. 106), Laguna Negra (Argentina) (Corporación Nacional Forestal 1996c, pp. 10–11), Laguna de Colorada (Bolivia) (Embassy of Bolivia 2008, pp. 7–8), Salar de Atacama (Chile), and the TDPS wetland complex, which includes Lagos Poopó and Uru Uru (Chile) (INRENA 1996, p. 6).

Long-lived species with slow rates of reproduction, such as the Andean flamingo, can appear to have robust populations, but can quickly decline towards extinction if reproduction does not keep pace with mortality (BLI 2008, p. 2; Bucher 1992, p. 183; del Hoyo *et al.* 1992, p. 517). In the case of Andean flamingos, Conway (W. Conway, as cited in Valqui *et al.* 2000, p. 112) suggests that a stable population can be maintained if the species' breeding success is good every 5–10 years. Andean flamingos have temporally sporadic and spatially concentrated breeding patterns, and their breeding success and recruitment are low (Caziani *et al.* 2007; Childress *et al.* 2005, p. 7; Childress *et al.* 2006, p. 7; Childress *et al.* 2007a, p. 7). Productivity estimates from intensive studies of breeding sites in Chile indicate marked fluctuations over the past 20 years, with periods of very low breeding success (Arengo in litt. 2007, p. 2). Reproduction is spatially concentrated in just a few wetlands (Childress *et al.* 2005, p. 7; Childress *et al.* 2006, p. 7; Childress *et al.* 2007a, p. 7; Valqui *et al.* 2000, p. 112).

Ongoing Drought: The altiplano region has been undergoing a drought since the early 1990s. The water levels of the salars and lagunas occupied by the Andean flamingo normally expand and contract seasonally, depending in large part on summer rains to ''recharge'' or refill them (Bucher 1992, p. 182; Caziani and Derlindati 2000, pp. 124–125; Caziani *et al.* 2001, p. 110; Mascitti and Caziani 1997, p. 328).

Laguna de Mar Chiquita (Argentina) fluctuates by up to 20 in. (50 cm) in the dry season (Ducks Unlimited 2007a, p. 21). It is estimated that up to 95 percent of the total water input in the TDPS water system evaporates (Ronteltap *et al.* 2005, p. 2). In addition to the seasonal cycle of expansion and contraction, there are longer-term cycles in which lakes experience extended periods of expansion or contraction (Caziani and Derlindati 2000, p. 122). For instance, Laguna Pozuelos occasionally dries completely—on about a 100-year cycle. The last time it dried out completely was in 1958 (Mascitti & Caziani 1997, p. 321). According to researchers, wetlands have been drying out on a regional scale since the early 1990s due to extensive drought conditions (Caziani and Derlindati 2000, pp. 124–125; Caziani *et al.* 2001, p. 110; Mascitti and Caziani 1997, p. 328). The shallow wetlands preferred by Andean flamingos are subject to high rates of evapotranspiration, and drought conditions accelerate this process (Caziani and Derlindati 2000, p. 122).

Andean flamingos are sensitive to reduced water levels (Ugarte-Nunez and Mosaurieta-Echegaray 2000, pp. 135). The flamingo population at Laguna Pozuelos, which has shrunk to an estimated 66 percent of its usual size, has strongly diminished since the winter of 1993, which researchers consider a result of extensive lake desiccation (Mascitti and Caziani 1997, p. 328). Other wetlands are in the process of drying out or shrinking as a result of the drought, including Salar de Chalviri (Bolivia) (Ducks Unlimited 2007b, pp. 17–20); Lago Poopó (Bolivia) (Ducks Unlimited 2007b, p. 5); Lagunas Vilama (Argentina) (Caziani and Derlindati 2000, p. 122); and the TDPS wetland system (Bolivia, Chile, and Peru) (Jellison *et al.* 2004, p. 11). Lago Uru Uru (Bolivia) nearly dried out in 1983 but ''recharged'' in 1984 after flooding (Ducks Unlimited 2007b, p. 5). Laguna Salinas (Peru) nearly dried out in 1982–1983, but refilled during heavy rains in 1984. Currently, the water fluctuates widely each year, nearly drying out from September through January (Ducks Unlimited 2007d, p. 25).

Andean flamingos are equally sensitive to increasing water levels. Recall that Andean flamingos generally occupy wetlands that are less than 3 ft (1 m) deep (Fjeldså and Krabbe 1990, p. 86; Mascitti and Casteñera 2006, p. 331). In 1998, breeding was reported for the first time at Laguna Brava. The same year, more than 7,000 non-breeding birds were reported 4 mi (7 km) away at Laguna de Mulas Muertas, which was not a normal feeding habitat. Bucher *et al.* (2000, p. 120) believe this shift in habitat use was prompted by El Niño, which caused increased water levels at their usual nesting and feeding sites across the border in Chile. Laguna de Mar Chiquita (Argentina) experienced a period of ''exceptional flooding'' beginning in 1977, such that nesting sites were inundated and the salinity of the water decreased (Ducks Unlimited 2007a, p. 21). Long known only as an overwintering site, breeding was recently reported at Mar Chiquita (Childress *et al.* 2005, p. 6).

When winter brings increased aridity and lower temperatures, higher-altitude wetlands may dry out or freeze over. Under these conditions, Andean flamingos may move to lower altitudes (Blake 1977, p. 207; Boyle *et al.* 2004, pp. 570–571; Bucher 1992, p. 182; Caziani *et al.* 2006. p. 17; Caziani *et al.* 2007, pp. 279, 281; del Hoyo 1992, p. 519; Fjeldså and Krabbe 1990, p. 85; Hurlbert and Keith 1979, pp. 330; Mascitti and Bonaventura 2002, p. 360; Mascitti and Castañera 2006, p. 328). Research has recently shown that Andean flamingos use their habitat on a landscape level—beyond the Salar or Laguna in which they feed or breed—using wetland systems that provide a variety of habitat options from which to select optimal nesting and feeding sites (Caziani and Derlindati 2000, p. 122; Caziani *et al.* 2001, pp. 104, 110; Derlandati 2008, p. 10). Flamingo productivity is affected by climatic variability and its influence on water availability during the breeding season (Caziani *et al.* 2007, p. 284). Although the Andean flamingo can move between wetlands in response to annual climatic variability (Bucher *et al.* 2000, pp. 119–120; Mascitti 2001, p. 20; Mascitti and Bonaventura 2002, pp. 362–364), drastic water level changes can significantly alter the seasonal altitudinal movements of the Andean flamingo (Mascitti and Caziani 1997, pp. 324–326).

Summary of Factor E

The extent to which human disturbance has infiltrated Andean flamingo habitat and the ongoing activities that contribute to this disturbance could have long-lasting consequences on the population size and age structure, especially considering the species' unique life-history, breeding patterns, and recent years of low productivity (see Population Estimates: Breeding Success). Therefore, we find that human disturbance activities are threats to the continued existence of the Andean flamingo throughout its range.

Andean flamingo habitat throughout the Andes is in the midst of an ongoing drought. The species' reliance upon shallow wetlands during their entire lifecycle makes them particularly vulnerable to threats that influence the amount and distribution of precipitation, runoff, or evapotranspiration. The drought is causing the shallow wetlands upon which they depend for their entire life cycle to dry out or to fluctuate widely from year to year, which disrupt the species' breeding and feeding cycles, and can strand entire nesting colonies when waters retract unexpectedly. These drought conditions are being exacerbated by water extraction and pollution occurring throughout the species' habitat (Factor A). Reduced water levels can increase access to nesting sites, facilitating predation and hunting (Factors B and C). Therefore, we find the ongoing drought to be a threat to the continued existence of the Andean flamingo throughout its range.

Status Determination for the Andean Flamingo

The Andean flamingo is colonial, feeding and breeding in flocks, and is the rarest of all six flamingo species worldwide. Experts consider that the more dispersed nature of the species at smaller nesting sites has inhibited reproduction in the species. The Andean flamingo underwent a severe population decline in the last few decades, from a conservative estimate of 50,000 to 100,000 in the early 1980s to a current estimate of 34,000. This population decline coincides with increased habitat alteration (Factor A), overutilization (Factor B), disease and predation (Factor C), as well as increased human disturbance and an ongoing drought (Factor E). The Andean flamingo's entire life cycle relies on the availability of networks of shallow saline wetlands (salars and lagunas) at low, medium, and high altitudes that are characteristic throughout its range in Argentina, Bolivia, Chile, and Peru. Several man-made and natural factors are having a negative impact on the flamingo's persistence in the wild. These factors include mining activities and resultant pollution, increasing human population and water usage, hunting and egg collection, tourism, predation, human disturbance, and drought conditions. Mining occurs at many of the wetlands that the Andean flamingo depends upon for habitat. The threats from mining include direct habitat destruction, water pollution, water extraction, and disturbance (Factors A and E). Hunting and egg collecting reduce the number of individuals in the population and exacerbate the species' poor breeding success, and low recruitment rate (Factor B). In combination with these habitat threats, the altiplano region is undergoing a long-term drought, which is impacting the availability and quality of wetlands for feeding, breeding, and overwintering (Factor E). Increased tourism at the wetlands is taxing limited water supplies, causing further water contamination from trash and sewage, and increasing habitat disturbance from human presence (Factors A and B). Infrastructure to support mining and tourism destroys and increases access to Andean flamingo habitats, facilitating hunting, egg collecting, and human influx, along with increased pollution, water use, and disturbance (Factors A, B, and E). Predation removes potentially reproductive adults from the breeding pool, disrupts mating pairs, and exacerbates the species' already poor breeding success and is facilitated by increased access to wetlands and the ongoing drought (Factors A, B, and E). Many wetlands within protected areas continue to undergo activities that destroy habitat or remove individuals from the population (including hunting and egg collecting), such that the regulatory mechanisms are inadequate to mitigate the threats to the species and its habitat (Factor D). The magnitude of the threats is exacerbated by the species' recent and drastic reduction in numbers, poor breeding success and recruitment, and the species' reliance on only a few wetlands for the majority of its reproductive output.

Section 3 of the Act defines an ''endangered species'' as ''any species which is in danger of extinction throughout all or a significant portion of its range'' and a ''threatened species'' as ''any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' Based on the immediate and ongoing significant threats to the Andean flamingo throughout its entire range, as described above, we determine that the Andean flamingo is in danger of extinction throughout all of its range. Therefore, on the basis of the best available scientific and commercial information, we are proposing to list the Andean flamingo as an endangered species throughout all of its range.

II. Chilean woodstar (*Eulidia yarrellii*)

Species Description

The Chilean woodstar, endemic to Chile and Peru, is a small hummingbird in the Trochilidae family (BLI 2008). No larger than the size of a moth (Johnson 1967, p. 121), the Chilean woodstar is approximately 3 inches (in) (8 centimeters (cm)) in length and has a short black bill (BLI 2008; del Hoyo *et al.* 1999, p. 674). Males have iridescent olive-green upperparts, white underparts, and a bright violet-red throat (del Hoyo *et al.* 1999, p. 674; Fjeldså and Krabbe 1990, p. 296). Females also have iridescent olive-green upperparts; however, their underparts are buff (pale yellow-brown) and they do not have a brightly colored throat (Fjeldså and Krabbe 1990, p. 296). The male Chilean woodstar has a strongly forked tail, which is green in the center and blackish-brown on the ends, while the female's tail is unforked and has broad white tips (BLI 2008). It is also known as Yarrell's woodstar (del Hoyo *et al.* 1999, p. 647) and Picaflor Chico de Arica (Johnson 1967, p. 121). The species is locally known as ''*Picaflor*'' or ''*Colibrí*'' (Johnson 1967, p. 121).

Taxonomy

The species was first taxonomically described by Bourcier in 1847 and placed in Trochilidae as *Eulidia yarrellii* (BLI 2008). According to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) species database, the Chilean woodstar is also known by the synonyms *Myrtis yarrellii* and *Trochilus yarrellii* (UNEP–WCMC 2008b). Both CITES and BirdLife International recognize the species as *Eulidia yarrellii* (BLI 2008). Therefore, we accept the species as *Eulidia yarrellii*, which follows the Integrated Taxonomic Information System (ITIS 2008).

Habitat and Life History

Hummingbird habitat requirements are poorly understood (del Hoyo *et al.* 1999, p. 490). Many species are highly adaptable, adjusting to human-induced changes or expanding their ranges if food conditions are favorable. Others rapidly decline or are in danger of extinction due to environmental disturbances (del Hoyo *et al.* 1999, p. 490). The Chilean woodstar has generally been described as inhabiting riparian thickets, secondary growth, desert river valleys, arid scrub, agricultural lands, and gardens (Stattersfield *et al.* 1998, p. 233). Estades *et al.* (2007, p. 169) looked at a variety of habitat variables in relation to Chilean woodstar numbers and found that tree cover in September was the only variable that significantly affected their abundance. In areas with higher tree cover, more Chilean woodstars were observed (Estades *et al.* 2007, p. 169). During the rainy season, when woodstars have more resources to exploit at higher elevations, the population is more dispersed and vegetation variables do not appear to limit the abundance of the species (Estades *et al.* 2007, p. 170).

As with all hummingbird species, the Chilean woodstar relies on nectar-producing flowers for food but also relies on insects as a source of protein (del Hoyo *et al.* 1999, p. 482; Estades *et al.* 2007, p. 169). The Chilean woodstar drinks nectar from the flowers of a variety of native trees such as *Geoffroea decorticans* (chañar) and *Schinus molle* (pimento), and ornamental plants such as *Lantana camara*, *Pelargonium* spp., and *Bougainvillea* sp. (Estades *et al.* 2007, p. 169). In addition, the species has been seen feeding from the flowers of several crops, including alfalfa, garlic, onion, and tomato (Estades *et al.* 2007, p. 169). Its small beak and body size enable it to exploit flowers with very small corollas (collective term for the petals of a flower) (Estades *et al.* 2007, p. 172).

Breeding activity likely takes place between August and September (del Hoyo *et al.* 1999, p. 674), although occasionally active nests have been found at other times of the year, suggesting that there may be some temporal variability (Estades *et al.* 2007, p. 169). Most nests have been located in olive trees (*Olea europaea*) at an average height of 7.5 $\pm$1.3 ft (2.3 $\pm$0.4 m), but a few nests were found in native shrubs and ornamental trees (Estades *et al.* 2007, p. 169).

A 2006 study by Estades and Aguirre (2006, p. 6) found Chilean woodstars nesting in only one location, a site in the Chaca area of the Vitor Valley that is less than 2.5 ac (1 ha) in size. The breeding site is an old olive grove that is lightly managed and is not sprayed with pesticides (Estades and Aguirre 2006, p. 6). The grove is surrounded by *Geoffroea decorticans* (chañares; Chilean Palo Verde) and citrus trees, which both flower in September (Estades and Aguirre 2006, p. 6). The location of the observed nests suggest to Estades and Aguirre (2006, p. 6) that the Chilean woodstar does not place its nest at the minimum distance from the food source, as would be expected according to the optimal foraging theory. Instead, it appears that Chilean woodstars build their nest at an intermediate distance of 164 ft (50 m) from nectar sources (flowers) (Estades and Aguirre 2006, p. 6). Estades and Aguirre (2006, p. 6) indicate that this may be a strategy the Chilean woodstar employs to avoid the presence of other hummingbirds around their nest. In addition, Estades and Aguirre (2006, p. 6) report that it appears the quality of this particular olive grove is enhanced by the nearby presence of sheep, whose wool is used by the Chilean woodstar to build its nest. As a result of this study, Estades and Aguirre (2006, p. 6) state that the reproductive habitat of the Chilean woodstar requires an adequate combination of nesting sites (olive and mango trees) and food sources (small flowers).

Historical Range and Distribution

Historical evidence suggests that although the Chilean woodstar has a limited distribution, it was locally abundant (Estades and Aguirre 2006, p. 2). However, beginning in the 1970s, the frequency of observations of this species appears to have declined, recently to levels considered alarming by some ornithologists (Estades and Aguirre 2006, p. 2).

Current Range and Distribution

The Chilean woodstar is endemic to a few river valleys near the Pacific coast from Tacna, Peru, to northern Antofagasta, Chile (Collar *et al.* 1992, p. 530; del Hoyo *et al.* 1999, p. 674; Johnson 1967, p. 121). This area lies at the northern edge of the Atacama Desert, one of the driest places on Earth (Collar *et al.* 1992, p. 530). Current populations are only known to occur in the Vitor and Azapa valleys, in the Arica Department in extreme northern Chile (Estades *et al.* 2007, p. 168). There have been a few observations of this species in the town of Tacna, Peru (near the border of Chile), but these observations have been infrequent (Collar *et al.* 1992, p. 530) and there have been no records of the species there in the last 20 years (Jaramillo 2003, as cited in Estades *et al.* 2007, p. 164). At least some individuals appear to move seasonally to higher elevations to exploit seasonal food resources (Fjeldså and Krabbe 1990, p. 296). Estades *et al.* (2007, p. 170) hypothesize that these higher elevation valleys may provide some connectivity between the lower elevation valleys, otherwise isolated by the unvegetated expanses of the Atacama Desert.

In 1967, Johnson (1967, p. 121) described the Chilean woodstar as a ''species of extremely limited range and very small total population.'' However, Johnson (1967, p. 121) also stated that it was the most abundant hummingbird in the Azapa Valley, where he and others counted ''over a hundred hovering like a swarm of bees.'' In September 2003, using fixed-radius point counts and sampling an area larger than the presumed range, Estades *et al.* (2007, pp. 168–169) found the Chilean woodstar to be restricted to the Azapa and Vitor valleys of northern Chile, and to be the rarest hummingbird in the Azapa Valley (Estades *et al.* 2007, p. 170). Despite repeated searches, it was not found in the Lluta Valley (Estades *et al.* 2007, p. 168), where it was previously reported to breed (Fjeldså and Krabbe 1990, p. 296). A further study in the Azapa and Vitor valleys in 2006 found Chilean woodstars nesting in only one location, a site in the Chaca area of the Vitor Valley that is less than 2.5 ac (1 ha) in size (Estades and Aguirre 2006, p. 6).

Population Estimates

In September 2003, the Chilean woodstar population was estimated to be 1,539 individuals (929–2,287; 90 percent confidence interval (CI)) with over 70 percent of the population found in the Azapa Valley (Estades *et al.* 2007, p. 168). In April 2004, the population was estimated to be 758 individuals (399–1,173; 90 percent CI), again with over 70 percent of the population found in the Azapa Valley (Estades *et al.* 2007, p. 168). Estades *et al.* (2007, p. 170) warn against interpreting their results as a population crash from 2003 to 2004, because the 2004 surveys were conducted in April, when food resources and populations were more dispersed (Estades *et al.* 2007, p. 170).

Further population estimates were conducted by Estades (2007, in litt.) in 2006 and 2007. In 2007, the population of Chilean woodstars was estimated to be 1,256 individuals (694 in the Azapa Valley and 562 in the Vitor Valley) (Estades 2007, in litt.). Estades (2007, in litt.) reports that, overall, the species declined between 2003 and 2007, even though the Chilean woodstar population did increase between 2006 and 2007. Estades (2007, in litt.) attributes the increase in the population of the species between 2006 and 2007 to an increase in the number of individuals in the Vitor Valley, while the number of Chilean woodstars in the Azapa Valley declined.

Conservation Status

The Chilean woodstar is listed as an ''endangered and rare'' species in Chile under Decree No. 151—Classification of Wild Species According to Their Conservation Status (ECOLEX 2007). The species is considered to be ''Endangered'' by IUCN, due to its very small range, with all viable populations apparently confined to remnant habitat patches in two desert river valleys (BLI 2008). These valleys are heavily cultivated, and the extent, area, and quality of suitable habitat are likely declining (BLI 2008).

Summary of Factors Affecting the Chilean Woodstar

A. The Present or Threatened Destruction, Modification, or Curtailment of the Species' Habitat or Range

The historical range of the Chilean woodstar has been severely altered with extensive planting of olive and citrus groves in the valleys of northern Chile and southern Peru (del Hoyo *et al.* 1999, p. 674). The native food plants of the species may have been drastically reduced when habitat for the species was converted to agriculture; now the species depends largely on introduced garden flowers as nectar sources (del Hoyo *et al.* 1999, p. 674). Although the Chilean woodstar is able to incorporate introduced plant species into its diet, the loss of some native species likely continues to be a limiting factor for the species (Estades *et al.* 2007, p. 172). As an example, Estades *et al.* (2007, p. 172) report that one of the most likely reasons for the disappearance of the Chilean woodstar from the Lluta Valley is the cutting of almost all the chañares (*Geoffroea decorticans*), which is considered one of the most important food sources for the species. Chañares are cleared by farmers who consider it an undesirable plant and an attractant to mice (Estades *et al.* 2007, p. 172).

In a study to estimate the population of the Chilean woodstar, Estades (2007, in litt.) found a decrease in the population of the Chilean woodstar in the Azapa Valley between 2006 and 2007. Estades (2007, in litt.) associates this decline with the substantial increase in agricultural development, related to the cultivation of tomatoes in the Azapa Valley in recent years.

Chilean woodstars appear to rely primarily on introduced olive trees for nesting (Estades *et al.* 2007, p. 172). The species has most likely been forced to use orchards as nesting sites due to the paucity of native trees (Estades *et al.* 2007, p. 172). Although olive trees are not exposed to as many pesticides as other fruit trees in the region, the use of high-pressure spraying (of water) to control mold threatens the viability of nests and their contents (Estades *et al.* 2007, p. 172). Because of the small size of the remaining population (see Factor E), the loss of even a few nests annually is a threat to the continued existence of the species.

Summary of Factor A

As a result of extensive agriculture in the river valleys where the Chilean woodstar occurs, most of its natural habitat is disappearing, requiring the species to rely mainly on artificial sources for feeding and nesting. Although the species is able to use introduced plants, the loss of important native food plants, such as chañares, is most likely a limiting factor for the Chilean woodstar. Due to the scarcity of native trees, the species seems to rely heavily on introduced olive trees for nesting. However, management practices currently used in olive groves adversely impact the species and its nests. Therefore, we find that habitat destruction is a threat to the continued existence of the Chilean woodstar throughout its range.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

In 1987, the Chilean woodstar was listed in CITES Appendix II, which includes species that are not necessarily threatened with extinction, but may become so unless trade is subject to strict regulation to avoid utilization incompatible with the species' survival. International trade in specimens of Appendix II species is authorized through permits or certificates under certain circumstances, including verification that trade will not be detrimental to the survival of the species in the wild and that the material was legally acquired (UNEP–WCMC 2008a).

Since its listing in 1987, there have been no CITES-permitted international transactions in the Chilean woodstar (Caldwell 2008, in litt.). Therefore, we believe that international trade is not a factor influencing the species' status in the wild. In addition, we are unaware of any other information currently available that indicates that hunting or overutilization of the Chilean woodstar for commercial, recreation, scientific, or education purposes has ever occurred. As such, we do not consider this factor to be a threat to the species.

C. Disease or Predation

We are not aware of any scientific or commercial information that indicate disease or predation poses a threat to this species. As a result, we are not considering disease or predation to be a contributing factor to the continued existence of the Chilean woodstar.

D. Inadequacy of Existing Regulatory Mechanisms

The Chilean woodstar is listed as an ''endangered and rare'' species in Chile under Decree No. 151—Classification of Wild Species According to Their Conservation Status (ECOLEX 2007). In 2006, it was also designated as a national monument under Decree No. 2—Declaring National Monuments of the Wild Fauna Huemul, Long-tailed Chinchilla, Short-tailed Chinchilla, Andean Condor, Chilean Woodstar, and Juan Fernandez Firecrown, which prohibits all hunting and capture of these species (ECOLEX 2006). However, this regulation is not necessary to reduce an existing threat to the Chilean woodstar because we do not consider hunting or collection (Factor B) to be a threat to the species.

The Chilean woodstar is listed in Appendix II of CITES (UNEP–WCMC 2008b). CITES is an international treaty among 173 nations, including Chile, Peru, and the United States, that entered into force in 1975 (UNEP–WCMC 2008a). In the United States, CITES is implemented through the U.S. Endangered Species Act (Act). The Act designates the Secretary of the Interior as the Scientific and Management Authorities to implement the treaty with all functions carried out by the Service. Under this treaty, countries work together to ensure that international trade in animal and plant species is not detrimental to the survival of wild populations by regulating the import, export, re-export, and introduction from the sea of CITES-listed animal and plant species (USFWS 2008). As discussed under Factor B, we do not consider international trade to be a threat to the Chilean woodstar. Therefore, this international treaty does not reduce any current threats to the species. Any international trade that occurs in the future would be effectively regulated under CITES.

We are not aware of any regulatory mechanisms that effectively limit or restrict habitat destruction, or high-pressure spraying of olive trees with water to reduce mold, two of the threats to the Chilean woodstar (see Factor A).

As discussed under Factor E, pesticides are also a threat to the Chilean woodstar, and there are some regulations that limit or ban certain pesticides. For example, current regulations in Chile prohibit the importation, production, and application of DDT, Aldrin, Dieldrin, Chlordane and Heptachlor (Altieri and Rojas 1999, p. 64). Despite such regulations, large-scale use of pesticides such as Parathion, Paraquat, Lindane, and pentachlorophenol—all severely restricted or even banned in Europe, Japan, and the United States—continues in Chile (Rozas 1995, as cited in Altieri and Rojas 1999, p. 64). Furthermore, international standards and quarantine requirements, imposed by countries importing Chilean fruits to limit quarantined insects, have acted to increase pesticide use in Chile (see Factor E) (Altieri and Rojas 1999, p. 63).

Summary of Factor D

We are not aware of any regulatory mechanisms that effectively limit or restrict habitat destruction, or high-pressure spraying of olive trees with water to reduce mold, two of the threats to the Chilean woodstar. Although there are some regulations in Chile that limit or ban certain pesticides, other kinds of pesticides are still widely used in Chile, especially by fruit growers. Therefore, we find that the existing regulatory mechanisms are inadequate to mitigate the current threats to the Chilean woodstar throughout its range.

E. Other Natural or Manmade Factors Affecting the Continued Existence of the Species

Pesticides: The use of Malathion, Dimethoate, and other chemicals to control the Mediterranean fruit fly (*Ceratitis capitata*) in the 1960s and early 1970s correlates with declines in Chilean woodstar abundance (Estades *et al.* 2007, pp. 171–172). Although Malathion is only slightly to moderately toxic to wild birds (Pascual 1994 and George *et al.* 1995, as cited in Estades *et al.* 2007, p. 171), the systemic insecticide Dimethoate is very toxic and is known to contaminate the nectar of flowers (Baker *et al.* 1980, as cited in Estades *et al.* 2007, p. 171). The Chilean government program to eradicate the Mediterranean fruit fly in the Arica-Azapa area has been reduced since the 1970s (Olalquiaga and Lobos 1993, as cited in Estades *et al.* 2007, p. 171), which likely has reduced this threat to Chilean woodstar (Estades *et al.* 2007, p. 171). Although the governmental pesticide applications for the eradication of the Mediterranean fruit fly may be declining, private farmers still rely on a heavy use of highly toxic chemicals to keep their crops pest-free (Salazar and Araya 2001, as cited in Estades *et al.* 2007, p. 171), and their use shows no signs of decline (Estades *et al.* 2007, p. 172).

As a result of international standards and quarantine requirements imposed by countries importing Chilean fruits, there is an overwhelming incentive for farmers to continue to extensively use chemical pest control (Altieri and Rojas 1999, p. 63). If the inspection of a shipment of Chilean fruits detects just one specimen of a quarantined insect pest, the result is the automatic rejection of the entire shipment of fruit (Altieri and Rojas 1999, p. 63). Therefore, Chilean fruit growers intensively spray their crops to completely eliminate all pests in order to avoid the risk of shipment rejection and its associated economic losses (Altieri and Rojas 1999, p. 63).

Estades *et al.* (2007, p. 170) found that significant amounts of pesticides are still being used, particularly in the Azapa Valley, and there is at least one recent case where the application of insecticides at a plant nursery resulted in the death of a female Chilean woodstar. Furthermore, in a study to estimate the population of the Chilean woodstar, Estades (2007, in litt.) found a decrease in the population of the species in the Azapa Valley between 2006 and 2007. Estades (2007, in litt.) associates this decline with the substantial increase in agricultural development, related to the cultivation of tomatoes, in the Azapa Valley in recent years. The cultivation of tomatoes in this area of Chile requires a high demand of pesticides, and thus represents a growing threat to the Chilean woodstar (Estades 2007, in litt.).

Competition from the Peruvian sheartail: Estades *et al.* (2007, p. 172) hypothesized that the Peruvian sheartail (*Thaumastura cora*), which has experienced rapid population increases within the range of the Chilean woodstar, is a strong competitor for food or space because: (1) These species have morphological similarities which, in hummingbirds, indicates they may require similar food resources; (2) there appears to be spatial segregation between the species; and (3) antagonistic interactions have been documented (Estades *et al.* 2007, p. 169). Because the sheartail is more aggressive than the Chilean woodstar, it is believed to displace the woodstar within its range (Estades *et al.* 2007, pp. 169, 172). In Azapa, Peruvian sheartails have occupied the lower parts of the valley where there is a large supply of flowers in residential areas year-round (Estades *et al.* 2007, p. 172). Chilean woodstars, on the other hand, are primarily located in the middle part of the valley where the dominant land use is agriculture (Estades *et al.* 2007, p. 172). As a result, the Chilean woodstar has a much higher risk of exposure to pesticides (Estades *et al.* 2007, p. 172). Because certain pesticides used within the range of the Chilean woodstar are known to cause mortality, increased exposure to these pesticides increases the species' risk of population decline and extinction.

In a study to estimate the population of the Chilean woodstar, Estades (2007, in litt.) found an increase in the population of the species in the Vitor Valley (Chaca-Codpa area) between 2006 and 2007. Estades (2007, in litt.) suggests that one of the reasons for the population increase in the Vitor Valley during this time period was due to the fact that no Peruvian sheartails were observed in Chaca. This observation supports the theory that Peruvian sheartails are a competitor of the Chilean woodstar (Estades *et al.* 2007, pp. 163, 172). In addition, the abundance of Chilean woodstar nests observed in the species' only breeding site (in the Chaca area of the Vitor Valley) appears to be related to the absence of Peruvian sheartails in this location (Estades and Aguirre 2006, p. 6). Furthermore, the high abundance of Peruvian sheartails at Azapa could explain the absence of nesting by the Chilean woodstar at otherwise appropriate sites, such as the Azapa Valley (Estades and Aguirre 2006, p. 6).

Reproduction: Another study in the Azapa and Vitor valleys in 2006 found Chilean woodstars nesting in only one location, a site in the Chaca area of the Vitor Valley that is less than 2.5 ac (1 ha) in size (Estades and Aguirre 2006, p. 6). Of the 19 nests that were monitored, 12 failed; the cause of these nest failures is unknown (Estades and Aguirre 2006, p. 8). The daily nest failure rate was 3.21 percent, which is higher than has been observed in other hummingbird species (Estades and Aguirre 2006, p. 8). The probability of nest success was 23.8 percent, which is also higher than has been observed for other hummingbird species (Estades and Aguirre 2006, p. 8). Estades and Aguirre (2006, p. 8) note that the method used to calculate both of these values for other hummingbirds (by Baltosser 1986, as cited in Estades and Aguirre 2006, p. 8) is not exactly the same as the method used in this study. Although the values of reproductive success are within normal range, the high percentage of nest failures is troubling for a species that has such a small population size (Estades and Aguirre 2006, p. 8).

The loss of hatchlings, probably due to a lack of space in the nest itself, also indicates that recruitment of the Chilean woodstar is low (Estades and Aguirre 2006, pp. 8, 10). If you take into account that the flowering period for chañares and citrus is relatively short (a maximum of two months), the possibility of Chilean woodstars producing a second clutch in the spring is almost zero (Estades and Aguirre 2006, p. 10). Without a second nesting period, the Chilean woodstar is not able to compensate for a loss of its first, and most likely only, clutch (Estades and Aguirre 2006, p. 10). All data suggest that the recruitment capability of the Chilean woodstar is low and that, currently, the majority of reproduction is taking place only in the Vitor Valley (Estades and Aguirre 2006, p. 10).

Small Population Size and Restricted Range: The Chilean woodstar has experienced a population decline since the 1960s and now consists of less than 2,000 individuals distributed within two valleys (Estades *et al.* 2007, p. 170). Species tend to have a higher risk of extinction if they occupy a small geographic range, occur at low density, occupy a high trophic level and exhibit low reproductive rates (Purvis *et al.* 2000, p. 1949). Small populations are more affected by demographic stochasticity, local catastrophes, and inbreeding (Pimm *et al.* 1988, pp. 757, 773–775). The small, declining population makes the species vulnerable to loss of genetic variation due to inbreeding depression and genetic drift. This, in turn, compromises a species' ability to adapt genetically to changing environments (Frankham 1996, p. 1507) and reduces fitness, and increases extinction risk (Reed and Frankham 2003, pp. 233–234).

Summary of Factor E

Other natural or manmade factors affecting the continued existence of the Chilean woodstar include extensive use of pesticides by farmers and competition from the Peruvian sheartail. These threats have been associated with the decline in the population of the species and the lack of nest sites in the Azapa Valley. Because the Chilean woodstar is currently breeding in only one site (in the Chaca area of the Vitor Valley) and has a low recruitment rate, restricted range, and a small population size, any threats to the species are further magnified. Therefore, we find that other natural or manmade factors are a threat to the continued existence of the Chilean woodstar throughout its range.

Status Determination for the Chilean Woodstar

We have carefully assessed the best available scientific and commercial information regarding the past, present, and potential future threats faced by the Chilean woodstar. The species is currently at risk throughout all of its range due to a number of immediate and ongoing threats. The Chilean woodstar is restricted to two river valleys, where there has been extensive modification of its primary habitat. It is threatened by agricultural practices, in particular the use of pesticides and high-pressure spraying of olive trees to remove mold, as well as competition from the more aggressive Peruvian sheartail. The magnitude of these threats is exacerbated by the species' restricted range, only one breeding site, low recruitment rate, and extremely small population size. An insect outbreak causing increased use of toxic pesticides in agricultural fields, a series of catastrophic events, or other detrimental interactions between environmental and demographic factors could result in the rapid extinction of the Chilean woodstar.

Section 3 of the Act defines an ''endangered species'' as ''any species which is in danger of extinction throughout all or a significant portion of its range'' and a ''threatened species'' as ''any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' Based on the immediate and ongoing significant threats to the Chilean woodstar throughout its entire range, as described above, we determine that the Chilean woodstar is in danger of extinction throughout all of its range. Therefore, on the basis of the best available scientific and commercial information, we are proposing to list the Chilean woodstar as an endangered species throughout all of its range.

III. St. Lucia Forest Thrush (*Cichlhermina lherminieri sanctaeluciae*)

Species Description

The St. Lucia forest thrush (*Cichlhermina lherminieri sanctaeluciae*) (hereafter referred to as ''thrush'') is a subspecies of the forest thrush (*C. lherminieri*) in the family Turdidae. It is a medium-sized bird, approximately 10 inches (in) (25 to 27 centimeters (cm)) in length (BLI 2000). This subspecies has all dark upperparts, is brownish below with white spots on the breast, flanks and upper belly, and white lower belly. It has yellow legs and bill, and bare skin around the eye (BLI 2000).

Taxonomy

This subspecies was first taxonomically described by P. L. Sclater in 1880 (del Hoyo *et al.* 2005, p. 681).

Habitat and Life History

The St. Lucia forest thrush occupies mid- and high-altitude primary and secondary moist forest habitat (Keith 1997, p. 105). The thrush feeds on insects and berries from ground level to the forest canopy (del Hoyo *et al.* 2005, p. 681; Raffaelle 1998, p. 381). It previously gathered in large numbers in autumn to feed on berries (del Hoyo *et al.* 2005, p. 681). The thrush breeds in April and May and builds a cup-shaped nest placed not far above the ground in a bush or tree (del Hoyo *et al.* 2005, p. 681; Raffaelle 1998, p. 381). Clutch size ranges from two to three eggs, and the eggs are blue-green in color (del Hoyo *et al.* 2005, p. 681).

Historical Range and Distribution

Although we are unaware of any specific information on the historical range and distribution of the St. Lucia forest thrush, we assume that this subspecies has always been found only on the island of St. Lucia.

Current Range and Distribution

The entire species of forest thrush is known from Montserrat, Guadeloupe, Dominica, and St. Lucia. The St. Lucia forest thrush is endemic to the island of St. Lucia in the West Indies (del Hoyo *et al.* 2005, p. 681). St. Lucia is an island in the Caribbean, between the Caribbean Sea and the North Atlantic Ocean, and is 238 square miles (m^2) (616 square kilometers (km^2)) in area (CIA World Factbook 2008).

Population Estimates

This subspecies was considered numerous in the late 1800s (Semper 1872, as cited in Keith 1997, p. 105). We could find no historical accounts of population size of this subspecies. The current population status of the thrush is unknown, but recent sightings of this subspecies are rare, with only six confirmed sightings on the island over the last few years (Dornelly 2007, in litt.). These sightings consist of one bird in the St. Lucia Nature Reserve, one near the town of De Chassin in the north part of the island, and four individuals along the De Cartiers Trail in the Quilesse Forest Reserve on the south part of the island (Dornelly 2007, in litt.). A survey was conducted in 2007 to try to estimate the populations of various rare birds on the island of St. Lucia including the thrush (Dornelly 2007, in litt.). However, no thrushes were observed during the study period (Dornelly 2007, in litt.).

Conservation Status

The entire species of forest thrush (*Cichlhermina lherminieri*) is classified as ''Vulnerable'' by IUCN, due to human-induced deforestation and introduced predators (BLI 2008b).

Summary of Factors Affecting the St. Lucia Forest Thrush

A. The Present or Threatened Destruction, Modification, or Curtailment of the Species' Habitat or Range

The habitat of the St. Lucia forest thrush consists of mid- and high-altitude primary and secondary moist forests (Keith 1997, p. 105). Consistent with previous accounts, the most recent sightings of the thrush were within this mid- to high-elevation moist forest habitat, where in June and August of 2007, respectively, St. Lucia Forestry Department staff sighted four birds in one location along the Des Cartiers Trail in the south of the island, and one bird in De Chassin in the north of the island (Dornelly 2007, in litt.).

As of 2004, natural forest occupied approximately 29,870 ac (12,088 ha) on the island of St. Lucia, 56 percent of which (16,727 ac (6,769 ha)) was within forest reserves and 43 percent (12,845 ac (5,198 ha)) was on private lands (Joint Annual Report (JAR) 2004, p. 42). The St. Lucia Department of Forestry considers habitat quality within the Forest Reserves to be high, but considers the habitat quality on private lands to be ''less,'' since the Department has little control over management of these private lands (Dornelly 2007, in litt.). In 2004, 633 ac (256 ha) of plantation forest existed within the forest reserves consisting of three main timber tree species, and an additional 615 ac (249 ha) of plantation forest existed on private lands (JAR 2004, p. 42), but there is no information to suggest that the thrush utilizes plantation forest habitat.

Historically, St. Lucia's policy that allowed open access to ''Common Property resources,'' combined with the country's high demand for agricultural land, led to large-scale deforestation (GOSL 1993, as cited in John 2000, p. 3), which reduced the thrush's habitat, resulting in a rapid population decline of this subspecies (IUCN 2008). The widespread deforestation that continues to this day suggests that population numbers continue to decline as a result of this impact. A potential impact of habitat destruction is exemplified by the Grand Cayman thrush (*Turdus ravidus*), a species closely related to the St. Lucia forest thrush, which went extinct as its habitat on the island was progressively cleared (Johnston 1969, as cited in BLI 2008a).

In the 1980's, deforestation on St. Lucia was estimated at 1.9 percent per year due to banana cultivation. Although the banana industry has faltered since that time, (GOSL 1993, as cited in John 2000, p. 3), according to the World Bank (2005, p. 1), farmers in St. Lucia have continued to clear forests for cultivation, moving to higher and steeper land. The government has encouraged this deforestation by constructing roads into these remote areas, which further reduces forest lands. Degradation of the hillside environment puts the more productive lowlands at risk, and hurricanes and tropical storms accelerate the degradation process (World Bank 2005, p. 1).

As of 2004, 28.5 percent of the land on St. Lucia was used for ''intensive farming,'' and 26.3 percent was for ''mixed'' use purposes (JAR 2004, p. 41). According to St. Lucia's 2007 Economic and Social Review (p. 3), although the banana industry was negatively impacted by the passage of Hurricane Dean in August, the overall outturn in agriculture more than compensated for the banana decline, with a 7.6 percent increase in ''non-traditional crops.'' This is a strong indication that increasing agriculture continues to put pressure on St. Lucia's forest resources. Aside from agriculture, in the 21st century, construction activities and development of the access road network has been a leading cause of deforestation on St. Lucia (John 2000, pp. 3, 4).

Even within St. Lucia's Forest Reserves, the land is not protected to such an extent that it is preserved in its natural condition. According to St. Lucia's ''Forest, Soil, and Water Conservation Ordinance 1946/1983,'' with permission of the Forestry Department, one may ''injure, cut, fell, convert, remove, or harvest any tree or parts thereof.'' Although it is illegal to occupy Forest Reserves for the purposes of cultivation, squatting, or pasturing livestock (St. Lucia Forestry Department n.d.), enforcement of these activities is questionable, given that as of the year 2000, squatters occupied 247 ac (100 ha) of area within forest reserves (John 2000, p. 3). As of the year 2000, 4.5 miles (7.2 km) of roads existed within the forest reserves, providing access to forest resources within the reserves. Typical uses of forest resources include fuelwood collection for heating and cooking purposes, as well as traditional use of non-wood forest products. Certain species of forest trees are used for production of brooms, canoes, and incense, while the bark of other tree species are used to produce fermented drinks, and liannes are used in the craft industry (John 2000, pp. 6, 7). Removal of these forest products either reduces the quality or the availability of nesting, feeding, and breeding habitat of the thrush, thereby potentially reducing population numbers and the reproductive success of breeding birds.

Summary of Factor A

Both historical and current information suggests that this species is restricted to natural forests on the island, which, based on recent data, have been reduced to approximately 29,870 ac (12,088 ha) on the island. A large percentage of the remaining natural forest that occurs on private lands in St. Lucia (43 percent) is subject to ongoing loss from timber harvest, conversion of forest lands to agriculture, construction activities, and road development. These ongoing activities result in destruction of the limited habitat available for the thrush, which has historically been attributed to a rapid decline in this subspecies' population numbers. Although to a lesser extent than on private lands, the forests within St. Lucia's forest reserves (56 percent of the remaining forest) are also subject to destruction and modification from activities such as timber removal, fuelwood gathering, and removal of non-wood forest products for traditional use, activities which destroy and degrade the thrush's habitat. Therefore, we find that the ongoing destruction and modification of the thrush's habitat is a threat to the continued existence of the St. Lucia forest thrush throughout its range.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

We are not aware of any scientific or commercial information that indicates overutilization of the St. Lucia forest thrush for commercial, recreational, scientific, or educational purposes currently poses a threat to this subspecies. As a result, we are not considering overutilization to be a contributing factor to the continued existence of the St. Lucia forest thrush.

C. Disease or Predation

Disease: We are not aware of any scientific or commercial information that indicates that disease poses a threat to this subspecies. As a result, we are not considering disease to be a contributing factor to the continued existence of the St. Lucia forest thrush.

Predation: The St. Lucia forest thrush is suspected to be impacted by predation from an introduced mongoose (Raffaelle *et al.* 1998, p. 381). The Asian mongoose (*Herpestes javanicus*) was introduced to the island of St. Lucia in the early 1900s (Hoagland *et al.* 1989, p. 624) and is considered an invasive species. Mongoose have been introduced to many island chains for the purpose of controlling small rodents, however their diet is not restricted to rodents; mongoose are known to eat birds as well. Morley and Winder (2007, p. 1) found that in the Fiji islands, some bird species were primarily associated with those islands that were free of mongoose. Any effects of mongoose introduction detected, however, were 'historical,' as mongoose had been on these islands for at least 20 years prior to their study. Bird assemblages on islands where mongoose had been introduced were (1) dominated by introduced bird species that are relatively unaffected by predation, or (2) native arboreal species that avoid predation, as mongoose rarely venture up into the forest canopy. Some researchers have suggested that ground-nesting bird populations have established a predator-prey equilibrium with mongooses in the Caribbean (Westermann 1953, as cited in Hays and Conant 2006, p. 7). Although the thrush is not known as a ground-nesting bird, it is reported to nest in shrubs and trees near the forest floor. On St. Lucia, the mongoose and other introduced predators, such as birds and cats, have contributed to the decline of another native bird species, the White-breasted thrasher (*Ramphocinclus brachurus*), adding to the pressures of habitat destruction (Collar *et al.* 1992, p. 824). The degree to which mongoose are responsible for the decline of bird species is often hard to assess, because of exacerbating factors such as the introduction of other species, such as rats and cats, which often have impacts to bird populations as well. Therefore, we do not have enough information to assess whether predation by an introduced mongoose is a significant threat to the St. Lucia forest thrush. In addition, we are not aware of any information on the potential impacts of predation from other predators (native or nonnative) on this subspecies.

Summary of Factor C

We are not aware of any scientific or commercial information that indicate that disease or predation currently poses a threat to this subspecies. Although the St. Lucia forest thrush is thought to be impacted by predation from an introduced mongoose, we do not have any data to show that mongoose predation is a current threat to the thrush. As a result, we are not considering disease or predation to be a contributing factor to the continued existence of the St. Lucia forest thrush.

D. Inadequacy of Existing Regulatory Mechanisms

The St. Lucia forest thrush is a ''protected wildlife'' species under Schedule 1 of the Wildlife Protection Act (WPA) of 1980, which has prohibited hunting of this subspecies since 1980 (ECOLEX n.d.(b)). In addition, the WPA prohibits taking, damaging or destroying of eggs or young, or the damage of a nest of ''protected wildlife'' species (ECOLEX n.d.(b)). Where habitat for this species occurs within Forest Reserves or

Protected Forests, it is protected from harvest without approval by the Forestry Department under the Forest, Soil and Water Conservation Ordinance Act of 1946, amended in 1983 (ECOLEX n.d.(a)). However, we do not consider overutilization (Factor B) to be a current threat to the St. Lucia forest thrush, so these laws do not address any of the threats to this subspecies.

The Forest, Soil and Water Conservation Ordinance Act of 1946, amended in 1983, authorizes the St. Lucia Minister of Agriculture to establish Forest Reserves on government land and Protected Forests on private lands (John 2000, p. 7). Habitat in Forest Reserves and Protected Forests is conserved primarily for the purpose of protecting watershed processes and preventing soil erosion. No legal commercial timber harvest occurs on these lands. However, fuelwood collecting, removal of non-wood forest products for traditional use, and timber removal (with permission of the Forestry Department) still occur in some Forest Reserves. Where suitable habitat for the thrush exists in Forest Reserves, it is assumed to be of high quality (Dornelly 2007, in litt.). However, small illegal homesteads occur on approximately 247 ac (100 ha) of the Forest Reserves, and residents of these homesteads utilize the timber and other forest resources, such as fuelwood, in the surrounding areas (John 2000, p. 3).

Timber harvest on private lands other than Protected Forests is not regulated in St. Lucia. As discussed above under Factor A, deforestation on private lands as a result of timber harvest, conversion of forest lands to agriculture, construction activities, and road development is ongoing. It is not known how much of the private natural forest habitat on the island is occupied by the St. Lucia forest thrush. However, based on the localities of the few recent confirmed sightings of this subspecies, and the proportion (43 percent) of natural forest that occurs on private lands, the St. Lucia forest thrush likely inhabits at least some of the private lands on the island.

Summary of Factor D

St. Lucia has developed numerous laws and regulations to manage wildlife and forest resources on the island. However, these laws do not adequately protect the habitat of the St. Lucia forest thrush from destruction or modification. Suitable thrush habitat within Forest Reserves is provided some level of protection from existing laws designed to protect watershed processes and prevent soil erosion. However, these laws do not adequately protect the habitat of this subspecies because they allow non-commercial uses of forest resources (including nest trees) to continue. Natural forest habitat on private lands is unregulated, and although the rate of habitat destruction and modification has likely decreased since the 1980s, conversion of forest land to agriculture and timber harvest still continues. As a result of the lack of regulatory protection of the natural forest habitats on private lands and the limited protection of Forest Reserves, we find that the existing regulatory mechanisms are inadequate to mitigate the current threats to the St. Lucia forest thrush throughout its range.

E. Other Natural or Manmade Factors Affecting the Continued Existence of the Species

Bare-Eyed Robin: Competition with the bare-eyed robin (*Turdus nudigenis*), which colonized the island in the 1950s, has been identified as a factor impacting this subspecies (Raffaelle *et al.* 1998, p. 381). However, we do not have enough information to assess whether competition with the bare-eyed robin is a significant threat to the St. Lucia forest thrush.

Shiny Cowbird: Brood parasitism by the shiny cowbird (*Molothrus bonarientsis*) which colonized the island in 1931, is also suspected as a factor impacting this subspecies (Raffaelle *et al.* 1998, p. 381). The shiny cowbird is a known ''brood parasite'' (i.e., they lay their eggs in the nests of other birds and do not provide any parental care for their own offspring). When the eggs of the brood parasite hatch, these chicks often push out the eggs or chicks of the host birds and are raised by the host species. Parental care that the host birds provide to the young parasites is care denied to their own young. This often has a detrimental effect on the reproductive success of the hosts, reducing population growth. The shiny cowbird is an extreme host generalist; its eggs have been found in the nests of over 200 species of birds (Friedmann and Kiff 1985 and Mason 1986, as cited in Cruz *et al.* 1989, p. 524). Shiny cowbirds are known to parasitize other bird species nests on St. Lucia (Cruz *et al.* 1989, p. 527). Many of the documented host species have not evolved effective defense or counter-defense mechanisms during the 70+ years the cowbird has occupied the island (Post *et al.* 1990, p. 461). Although brood parasitism by the shiny cowbird has the potential to impact the thrush, we could find no documented cases of brood parasitism on the St. Lucia forest thrush.

Small Population Size: The presumed small size of the St. Lucia forest thrush population, based on only six confirmed sightings of the subspecies in the last few years (Dornelly 2007, in litt.), makes this subspecies vulnerable to any of several risks, including inbreeding depression, loss of genetic variation, and accumulation of new mutations. Inbreeding can have individual or population-level consequences either by increasing the phenotypic expression (the outward appearance or observable structure, function or behavior of a living organism) of recessive, deleterious alleles or by reducing the overall fitness of individuals in the population (Charlesworth and Charlesworth 1987, p. 231; Shaffer 1981, p. 131). Small, isolated populations of wildlife species are also susceptible to demographic problems (Shaffer 1981, p. 131), which may include reduced reproductive success of individuals and chance disequilibrium of sex ratios. Once a population is reduced below a certain number of individuals, it tends to rapidly decline towards extinction (Franklin 1980, pp. 147–148; Gilpin and Soulé 1986, p. 25; Holsinger 2000, pp. 64–65; Soulé 1987, p. 181).

A general approximation of minimum viable population size is the 50/500 rule (Shaffer 1981, p. 133; Soulé 1980, pp. 160–162). This rule states that an effective population (N_e) of 50 individuals is the minimum size required to avoid imminent risks from inbreeding. N_e represents the number of animals in a population that actually contribute to reproduction, and is often much smaller than the census, or total number of individuals in the population (N). Furthermore, the rule states that the long-term fitness of a population requires an N_e of at least 500 individuals, so that it will not lose its genetic diversity over time and will maintain an enhanced capacity to adapt to changing conditions. Therefore, an analysis of the fitness of this population would be a good indicator of the subspecies' overall survivability.

Although the current population status of the St. Lucia forest thrush is unknown, we presume the population of the thrush is small, since recent sightings of this subspecies are rare, with only six confirmed sightings on the island over the last few years (Dornelly 2007, in litt.). Even though a survey was conducted in 2007 to try to estimate the populations of various rare birds on the island of St. Lucia including the thrush, no thrushes were observed during the study period (Dornelly 2007, in litt.). As a result, we presume the size of the St. Lucia forest thrush population falls below the minimum effective population size required to avoid risks from inbreeding (N_e = 50 individuals). We also presume the population size of this subspecies falls below the upper threshold (N_e = 500 individuals) required for long-term fitness of a population that will not lose its genetic diversity over time and will maintain an enhanced capacity to adapt to changing conditions. As such, we currently consider the St. Lucia forest thrush to be at risk due to lack of near- and long-term viability.

Stochastic Events: The St. Lucia forest thrush's small population size makes this subspecies particularly vulnerable to the threat of adverse random, naturally occurring events (*e.g.*, volcanic activity, tropical storms and hurricanes) that could destroy individuals and their habitat. St. Lucia is a geologically active area, resulting in a significant risk of catastrophic natural events. It is subject to volcanic activity and hurricanes (CIA World Factbook 2008).

St. Lucia is a volcanic island (University of the West Indies Seismic Research Centre n.d.(a)). Historically, there have been no magmatic eruptions on St. Lucia (i.e., eruptions involving the explosive ejection of magma) (University of the West Indies Seismic Research Centre n.d.(b)). However, there have been several minor phreatic (steam) explosions in the Sulphur Springs area of St. Lucia (University of the West Indies Seismic Research Centre n.d.(b)), ''which spread a thin layer of cinders (ash) far and wide'' (Lefort de Latour 1787, as cited in University of the West Indies Seismic Research Centre n.d.(b)). The occurrence of occasional swarms (a sequence of many earthquakes striking in a relatively short period of time and may last for days, weeks, or even months) of shallow earthquakes together with the vigorous hot spring activity in southern St. Lucia indicate that this area is still potentially active and the island can therefore expect volcanic eruptions in the future (University of the West Indies Seismic Research Centre n.d.(b)). On Montserrat, where another subspecies of the forest thrush (*Cichlherminia lherminieri lawrencii*) is found, volcanic activity caused a reduction in the range of the subspecies by two-thirds (in 1995–1997) (G. Hilton in litt., as cited in BLI 2008b), and in 2001, heavy ash falls resulted in loss of habitat (Continga 2002, as cited in BLI 2008b). Because of the similarity in ecology, taxonomy, and habitat requirements between the subspecies on Monserrat and the St. Lucia forest thrush, volcanic activity on St. Lucia could have similar effects on the St. Lucia forest thrush population.

Tropical storms and hurricanes occur in the Caribbean, and can have severe impacts on terrestrial ecosystems on small islands. A primary impact of forest habitats is the damage caused to trees by high winds. Trees are often blown over or sustain damage to trunks and limbs. These types of impacts can result in a major habitat loss to the St. Lucia forest thrush. In addition, there is often damage to soil productivity due to landslides and excess soil erosion (John 2000, p. 19). St. Lucia has experienced an increase in the number of hurricanes and severe tropical storms over the last 30 years. After hurricane Allen in 1980, at least 55 percent of all dominant tree species on the island had broken branches and many had lost large portions of their crowns (Whitman 1980, as cited in John 2000, p. 18). The indirect effects occur in the aftermath of the storm when species experience loss of food supplies and foraging substrates, loss of nests, loss of nest sites (trees) and roost sites (John 2000, p. 20). Moreover, these indirect effects are likely to increase their vulnerability to predation. With hurricanes and tropical storms, species are also exposed to the strong winds which can displace individuals off of the island into the surrounding open ocean environment (John 2000, p. 20). Some of these displaced birds are likely blown far out to sea, and may not be able to make it back to land in their weakened state. In general, the most vulnerable terrestrial wildlife populations have a diet of nectar, fruit, or seeds; nest, roost or forage on large old trees; require a closed canopy forest; have special microclimate requirements; or live in habitat where the vegetation has a slow recovery rate (John 2000, p. 20). Small populations with these traits are at a greater risk to hurricane induced extinction, particularly if they exist in small isolated habitat fragments (John 2000, p. 20).

Summary of Factor E

We presume the population of the St. Lucia forest thrush is small since there have only been six confirmed sightings of the subspecies in the last few years. The thrush's small population size makes this subspecies particularly vulnerable to the threat of adverse random, naturally occurring events (e.g., volcanic activity, tropical storms, and hurricanes) that could destroy individuals and their habitat. The occurrence of occasional swarms of shallow earthquakes, along with vigorous hot spring activity, indicates that St. Lucia could still be volcanically active, and future volcanic eruptions are expected. Tropical storms and hurricanes are naturally occurring events in the Caribbean; however, the frequency of these events has increased over the last 30 years. These high-intensity events damage forest habitats, which are currently very restricted (approximately 29,870 ac (12,088 ha)) on the island due to timber harvest and agricultural conversions. It can take many years for forested areas to fully recover from the damage caused by tropical storms and hurricanes. Therefore, we find that the subspecies' presumed small population size and restricted range due to deforestation, and the increase in naturally occurring events that damage the thrush's habitat, are a threat to the continued existence of the St. Lucia forest thrush throughout its range.

Status Determination for the St. Lucia Forest Thrush

We have carefully assessed the best available scientific and commercial information regarding the past, present and potential future threats faced by the St. Lucia forest thrush. The subspecies is currently at risk throughout all of its range due to ongoing threats of habitat destruction and modification (Factor A), lack of near- and long-term viability associated with the thrush's presumed small population size (Factor E), and random, naturally occurring events such as volcanic activity, tropical storms, and hurricanes (Factor E).

The St. Lucia forest thrush is presumed to be rare based on the limited availability of suitable habitat and the fact that there have been only a few confirmed sightings of this subspecies over the last several years. The primary factor impacting the continued existence of the thrush is habitat loss and degradation, as a result of deforestation from timber harvest and agricultural conversions. Although 56 percent of the natural forests remaining on St. Lucia (as of 2004) is partially protected through establishment of a network of Forest Reserves, these forests are still subject to destruction and modification from activities such as timber removal, fuelwood collecting, and removal of non-wood forest products for traditional use. Approximately 43 percent of the natural forest habitats on which this subspecies depends occur on private lands. Deforestation on private lands is an ongoing threat to the St. Lucia forest thrush, due to the lack of regulatory protection of natural forests on private lands and the continued loss of these forests through timber harvest, conversions to agriculture, construction activities, and road development.

The island of St. Lucia is a geologically active area, resulting in a significant risk of catastrophic natural events. The thrush's presumed small population size makes this subspecies particularly vulnerable to the threat of adverse random, naturally occurring events such as volcanic activity, tropical storms, and hurricanes that could destroy individuals and their habitat.

Section 3 of the Act defines an ''endangered species'' as ''any species which is in danger of extinction throughout all or a significant portion of its range'' and a ''threatened species'' as ''any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' Based on the immediate and ongoing significant threats to the St. Lucia forest thrush throughout its entire range, as described above, we determine that the St. Lucia forest thrush is in danger of extinction throughout all of its range. Therefore, on the basis of the best available scientific and commercial information, we are proposing to list St. Lucia forest thrush as an endangered species throughout all of its range.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness, and encourages and results in conservation actions by Federal governments, private agencies and groups, and individuals.

Section 7(a) of the Act, as amended, and as implemented by regulations at 50 CFR part 402, requires Federal agencies to evaluate their actions within the United States or on the high seas with respect to any species that is proposed or listed as endangered or threatened, and with respect to its critical habitat, if any is being designated. However, given that the Andean flamingo, Chilean woodstar, and St. Lucia forest thrush are not native to the United States, no critical habitat is being proposed for designation in this rule.

Section 8(a) of the Act authorizes limited financial assistance for the development and management of programs that the Secretary of the Interior determines to be necessary or useful for the conservation of endangered and threatened species in foreign countries. Sections 8(b) and 8(c) of the Act authorize the Secretary to encourage conservation programs for foreign endangered species and to provide assistance for such programs in the form of personnel and the training of personnel.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to all endangered and threatened wildlife. As such, these prohibitions would be applicable to the Andean flamingo, Chilean woodstar, and St. Lucia forest thrush. These prohibitions, under 50 CFR 17.21, make it illegal for any person subject to the jurisdiction of the United States to ''take'' (take includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt any of these) within the United States or upon the high seas, import or export, deliver, receive, carry, transport, or ship in interstate or foreign commerce in the course of a commercial activity or to sell or offer for sale in interstate or foreign commerce, any endangered wildlife species. It also is illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken in violation of the Act. Certain exceptions apply to agents of the Service and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22 for endangered species, and at 17.32 for threatened species. With regard to endangered wildlife, a permit must be issued for the following purposes: For scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities.

Peer Review

In accordance with our joint policy with National Marine Fisheries Service, ''Notice of Interagency Cooperative Policy for Peer Review in Endangered Species Act Activities,'' published in the **Federal Register** on July 1, 1994 (59 FR 34270), we will seek the expert opinions of at least three appropriate independent specialists regarding this proposed rule. The purpose of peer review is to ensure that our final determination is based on scientifically sound data, assumptions, and analyses. We will send copies of this proposed rule to the peer reviewers immediately following publication in the **Federal Register**. We will invite these peer reviewers to comment during the public comment period on our specific assumptions and conclusions regarding the proposal to list the Andean flamingo, the Chilean woodstar, and the St. Lucia forest thrush as endangered.

We will consider all comments and information we receive during the comment period on this proposed rule during our preparation of a final determination. Accordingly, our final decision may differ from this proposal.

Public Hearings

The Act provides for one or more public hearings on this proposal, if we receive any requests for hearings. We must receive your request for a public hearing within 45 days after the date of this **Federal Register** publication (see **DATES**). Such requests must be made in writing and be addressed to the Chief of the Division of Scientific Authority at the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings, as well as how to obtain reasonable accommodations, in the **Federal Register** at least 15 days before the first hearing.

Required Determinations

National Environmental Policy Act (NEPA)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*), need not be prepared in connection with regulations adopted under section 4(a) of the Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

Clarity of the Rule

We are required by Executive Orders 12866 and 12988, and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in the **ADDRESSES** section. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

References Cited

A complete list of all references cited in this proposed rule is available on the Internet at *http://www.regulations.gov* or upon request from the Division of Scientific Authority, U.S. Fish and Wildlife Service (see **FOR FURTHER INFORMATION CONTACT**).

Author

The primary author(s) of this proposed rule is staff of the Division of Scientific Authority, U.S. Fish and Wildlife Service (see **FOR FURTHER INFORMATION CONTACT**).

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 16 U.S.C. 1531–1544; 16 U.S.C. 4201–4245; Pub. L. 99–625, 100 Stat. 3500; unless otherwise noted.

2. Amend § 17.11(h) by adding a new entry for ''Flamingo, Andean,'' ''Thrush, St. Lucia forest,'' and ''Woodstar, Chilean'' in alphabetical order under ''BIRDS'' to the List of Endangered and Threatened Wildlife to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
*	*	*	*	*	*	*	
BIRDS							
*	*	*	*	*	*	*	
Flamingo, Andean	*Phoenicoparrus andinus*.	Argentina, Bolivia, Chile, and Peru.	Entire	E	....	NA	NA
*	*	*	*	*	*	*	
Thrush, St. Lucia forest.	*Cichlherminia lherminieri sanctaeluciae*.	West Indies—St. Lucia.	Entire	E	....	NA	NA
*	*	*	*	*	*	*	
Woodstar, Chilean	*Eulidia yarrellii*	Chile and Peru	Entire	E	....	NA	NA
*	*	*	*	*	*	*	

* * * * *

Dated: December 16, 2008.

Kenneth Stansell,

Acting Director, U.S. Fish and Wildlife Service.

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