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Garrett, Kimball L., "Population Trends And Ecological Attributes Of Introduced Parrots, Doves And Finches In California" (1998).
Proceedings of the Eighteenth Vertebrate Pest Conference (1998). 49.

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POPULATION TRENDS AND ECOLOGICAL ATTRIBUTES OF INTRODUCED PARROTS, DOVES AND FINCHES IN CALIFORNIA

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ABSTRACT: At least 10 species of parrots (Family Psittacidae), along with the Eurasian Collared-Dove (Columbidae: *Streptopelia decaocto*), Orange [Northern Red] Bishop (Ploceidae: *Euplectes franciscanus*), and Nutmeg Mannikin ["Spice Finch" or "Spotted Munia"] (Estrildidae: *Lonchura punctulata*), have recently established significant viable and generally increasing populations in California. Populations of all of these taxa are concentrated in highly modified urban and suburban habitats (parrots, doves) or in flood control basins and river channels with abundant rank annual growth (bishop, mannikin). With various collaborators, the author has monitored these taxa in southern California through the 1990s. Because of the potential for deleterious ecological interactions with native bird species and for damage to certain commercial crops, monitoring of these species and other potentially established exotic bird species must be ongoing. Here the author reports his present knowledge of population sizes and trends, geographical distribution, habitat relationships, and foraging and breeding ecology of these introduced species and suggest schemes for continued monitoring.

KEY WORDS: birds, bishop, California, conure, dove, mannikin, munia, parakeet, parrot, vertebrate pests

Proc. 18th Vertebr. Pest Conf. (R.O. Baker & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. 1998.

INTRODUCTION

In discussing exotic bird species in southern California, Hardy (1964) summarized the Los Angeles region as "... little more than a gigantic aviary wherein agriculture is heavily practiced and where individuals of any tropical or temperate bird species might escape to persist for a time and carry out its breeding cycle." This statement has proven prophetic, for, in the nearly three decades since Hardy's comment, species diversity and population sizes of "exotic" bird species have grown considerably. Birds have long been introduced into California for hunting, aesthetics, or by accident (Grinnell and Miller 1944; Long 1981; Johnson and Garrett 1994); some bird species have reached California by spreading from introductions elsewhere into North America. Concerns about the ecological impacts of non-native bird species are not new, but are increasing (Temple 1992). Additional concerns center around the economic impact of non-native birds on agriculture.

This review excludes introduced game species (most recently reviewed by Small 1994). Similarly, ornamental waterfowl and pheasants are not considered here, although the Mute Swan (*Cygnus olor*), Egyptian Goose (*Alopochen aegyptiacus*), and Common Peafowl (*Pavo cristatus*), among other species, should be closely monitored in California. The status, distribution and natural history of four "standard," long-established non-game species in California, Rock Dove (*Columba livia*), Spotted Dove (*Streptopelia chinensis*), European Starling (*Sturnus vulgaris*), and House Sparrow (*Passer domesticus*) are relatively well-known (Johnston 1992; Lowther and Cink 1992; Cabe 1993; Johnston and Garrett 1994; Garrett and Walker, in prep.) and need not be discussed further here, although potential interactions between the Spotted Dove and the naturalizing Eurasian Collared-Dove (*Streptopelia decaocto*) are of considerable interest.

Additionally, the author does not treat several localized introductions. Some of these have been intentional (e.g., Northern Cardinal, *Cardinalis cardinalis*). Other, accidental, introductions and have caused concern to agricultural agencies but have now largely been "controlled;" these include the Oriental (Japanese) White-eye (*Zosterops palpebrosa*) and Red-whiskered Bulbul (*Pycnonotus jocosus*).

In this paper the author concentrates on a group of species which have recently thrived in extensively modified habitats of urban and suburban areas and, in some cases, near important agricultural regions. All of these species are of potential concern as agricultural pests, and could negatively impact native bird species, either directly or through diffuse (community) impacts. The main goal is to summarize the current status and ecological attributes of these species in hopes that this information will be of value to those charged with managing California's native biodiversity and agriculture.

METHODS

Information was obtained through literature review, ongoing field work, and a citizen science project to monitor parrots; the last was recently summarized by Garrett (1997). Some information was supplied by W. S. Smithson from his ongoing research on bishops and mannikins. The field identification of many of these taxa is not covered in standard North American field guides; useful identification papers included Craig (1992) for *Euplectes*, Restall (1997) for *Lonchura*, and Smith (1987) for *Streptopelia*.

RESULTS

The species treated in the following accounts appear to be naturalized within California. In most cases their populations have reached levels in the hundreds or thousands, they have spread beyond a single confined

geographical area, they have maintained stable or increasing populations, and reproduction in the wild appears to be the main source of population recruitment. The inclusion of some species may be marginal, but even these species are of potential concern.

Rose-ringed Parakeet (*Psittacula krameri*) - "Ring-necked Parakeet"

Native Range and Habitat: Central Africa (Senegal east to Uganda); Indian Sub-continent to Burma; naturalized in Britain (Morgan 1993) and elsewhere. Lightly wooded areas, cultivated areas, plantations, savannas, deciduous woods, semidesert scrub (Forshaw 1989).

Distribution in California: Mainly Los Angeles County, especially coast from Malibu to Westchester and Temple City area of San Gabriel Valley (Garrett 1997); at least formerly in Highland Park, Los Angeles County, and San Bernardino vicinity (Hardy 1964, 1973). California birds of unknown subspecies, but almost certainly from the Indian subcontinent and likely *manillensis*.

Habitat in California: Urban and suburban areas, especially in lower portions of coastal canyons dominated by sycamores, *Platanus racemosa* (Garrett 1997).

Elevation Range: 0 to 2000 m in Old World range (Forshaw 1989); 0 to 200 m in southern California (Garrett 1997).

Primary Diet: Seeds, berries, fruits, blossoms, nectar (Forshaw 1989); in southern California 14 diet items noted by Garrett et al. (1997), including sycamore and plane tree (*Platanus*) seeds and seed at feeders. Considered "serious pests" in orchards, coffee plantations, and croplands in native range (Forshaw 1989). Pest potential in California examined by Shelgren et al. (1975).

Foraging Substrate and Techniques: Trees, shrubs, occasionally ground; picks, chews with bill.

Breeding Season: Few data for California; peak appears to be in April (Mabb 1997b).

Nest Site and Materials: Cavity in tree (natural or woodpecker-drilled; niches under roofs, holes in walls, even earth mounds (Forshaw 1989). Nests in California have been in palms (Garrett, pers. obs.) and silver maples (Mabb 1997b); known nest heights about 10 m.

Mating System: Monogamous pairs.

Clutch Size: 3 to 5 (Forshaw 1989); 8 eggs in one nest in California (Hardy 1964).

Broods/Year: No data for California; probably one.

Incubation Period: 22 days (Forshaw 1989).

Fledging Period: 7 weeks (Forshaw 1989).

Age at First Breeding: Usually 3 years (Forshaw 1989).

California Population Size and Trends: About 64 estimated in greater Los Angeles area as of 1997 (Garrett 1997). Stable or possibly decreasing. Present and presumably nesting in Eagle Rock, Los Angeles County, 1956 to 1963 (Hardy 1964), but largely gone from there by the early 1970s. Population in Zuma Canyon, Malibu, Los Angeles County, appears to have decreased since late 1970s and early 1980s (Garrett 1997, pers. obs.).

Blue-crowned Parakeet (*Aratinga acuticaudata*)

Native Range and Habitat: South America; nominate subspecies, which appears to be the one established in California, occurs in Brazil, E. Bolivia, Paraguay, and N. Argentina (Forshaw 1989); Found in dry woodlands,

shrublands, gallery (riparian) woodland (Forshaw 1989). **Distribution in California:** San Fernando Valley (especially Northridge), coastal Los Angeles County (vicinity of Redondo Beach), and San Diego. Sightings also for Simi Valley, Ventura County.

Habitat in California: Residential areas with exotic plantings.

Elevation Range: In South America, found from lowlands up to 1800 m, and regularly to 2600 m (Stotz et al. 1996); in California, 0 to 250 m (Garrett 1997).

Primary Diet: Seeds, fruits, berries, nuts; known to damage sorghum crops in Paraguay (Forshaw 1989). In southern California, pepper (*Schinus*) and five other food items from exotic plants (plus seed at feeders) listed by Garrett et al. (1997).

Foraging Substrate and Techniques: Bushes, trees, sometimes ground (Forshaw 1989); uses bill to obtain food.

Breeding Season: No data for California; eggs recorded in Argentina in December (Forshaw 1989).

Nest Site and Materials: Tree cavity; no data for California.

Mating System: Presumably monogamous pairs.

Clutch Size: 2 to 3 (Forshaw 1989).

Broods/Year: No data.

Incubation Period: 23 days in captivity (Forshaw 1989).

Fledging Period: 50 days in captivity (Forshaw 1989).

Age at First Breeding: No data.

California Population Size and Trends: In greater Los Angeles area probably only about 50 individuals, but apparently increasing (Garrett 1997). Population establishment recent; species not noted by Hardy (1973).

Mitred Parakeet (*Aratinga mitrata*) - "Mitred Conure"

Native Range and Habitat: Central and southern Peru (east of Andes) to eastern Bolivia, northwestern Argentina; California birds appear to be from the nominate subspecies. Woodlands, small forest patches, arid montane slopes and valleys (Forshaw 1989); steep hills and rock faces, legume-dominated deciduous and cloud forest (Fjeldså and Krabbe (1990).

Distribution in California: Naturalized in coastal areas from Malibu to Long Beach and coastal northwestern Orange County, and also in the Los Angeles basin and San Gabriel Valley; small numbers (naturalized?) from San Francisco to south San Francisco Bay region, and sightings also in San Diego and Sacramento areas (Garrett 1997).

Habitat in California: Urban parks, suburban residential areas (Garrett 1997).

Elevation Range: In South America, 1000 to 2500 m (Stotz et al. 1996); in California generally 0 to 300 m (Garrett 1997).

Primary Diet: Seeds, fruits, flowers (Forshaw 1989); in southern California 32 items recorded by Garrett et al. (1997) and Collins and Kares (1997), especially sycamores (*Platanus* spp.), *Eucalyptus sideroxylon*, *Ficus* spp., *Magnolia grandiflora*, *Myoporum laetum*.

Foraging Substrate and Techniques: Trees, shrubs, occasionally seed feeders; uses bill to obtain food, bill and feet to manipulate food.

Breeding Season: In southern California copulation noted in March, and presumed fledged young in July and

August (Collins and Kares 1997); in native range eggs noted in December (Fjelds  and Krabbe 1990).

Nest Site and Materials: In South America, nests in cliffs or tree hollows (Fjelds  and Krabbe); one nest noted in tree cavity at 10 m (Forshaw 1989). Few data for California, but appears to use building niches and drainpipe holes as well as tree cavities (Garrett, pers. obs.).

Mating System: Presumably monogamous pairs.

Clutch Size: 2 eggs (Forshaw 1989).

Broods/Year, Incubation Period, Fledging Period, Age at First Breeding: No data.

California Population Size and Trends: Greater Los Angeles area population estimated at 680 by Garrett (1997); small numbers at scattered localities elsewhere in the state. Unknown prior to late 1970s or early 1980s (Garrett 1997); not mentioned in review by Hardy (1973). Substantial increases since the 1980s, with numbers apparently continuing to build.

Red-masked Parakeet (*Aratinga erythrogenys*) - "Cherry-headed Conure"

Native Range and Habitat: Western Ecuador and northwestern Peru; arid coastal lowlands, deciduous forest, dry scrub, open desert and towns (Forshaw 1989).

Distribution in California: San Gabriel Valley and Redondo Beach areas of Los Angeles County; San Francisco and possibly San Diego areas (Garrett 1997); scattered observations elsewhere.

Habitat in California: Residential urban and suburban areas; usually in the same areas as Mitred Parakeets (Garrett 1997).

Elevation Range: In Tumbesian South America found from lowlands to 800 m (Stotz et al. 1996); in California mainly 0 to 300 m.

Primary Diet: Seeds, fruits, nectar; in southern California Garrett et al. (1997) noted six food items, including *Eucalyptus* flowers, *Myoporum laetum* berries, sycamore seeds.

Foraging Substrate and Techniques: As in Mitred Parakeet.

Breeding Season: No data.

Nest Site and Materials: No data; presumably in tree cavities.

Mating System: Presumably monogamous pairs.

Clutch Size: Clutch of 3 reported by Forshaw (1989).

Broods/Year: No data.

Incubation Period: 23 days (Forshaw 1989).

Fledging Period: 50 days (Forshaw 1989).

Age at First Breeding: No data.

California Population Size and Trends: Greater Los Angeles area population estimated at about 70 by Garrett (1997); up to several dozen may occur in the San Francisco Bay area (M. Bittner, pers. comm.). Populations apparently increasing; not reported by Hardy (1973) and apparently first established in the 1980s or early 1990s.

Black-hooded Parakeet (*Nandayus nenday*) - "Nanday Conure"

Native Range and Habitat: Southeastern Bolivia, southwestern Brazil, Paraguay, northern Argentina

(Forshaw 1989); open country, pantanal (seasonally flooded grasslands), savannas, croplands, palm groves (Forshaw 1989).

Distribution in California: Coastal Los Angeles and Orange counties, especially from Brentwood and Pacific Palisades to Malibu; a few in the San Gabriel Valley (Garrett 1997). Also noted in Sacramento (Garrett 1997) and formerly in Loma Linda area of San Bernardino County (Hardy 1973; Fisk and Crabtree 1974).

Habitat in California: Suburban residential areas, often in or near coastal canyon mouths (Garrett 1997).

Elevation Range: Lowlands to 800+ m in South America; in California, mainly coastal, 0 to 100 m.

Primary Diet: Seeds, fruits, nuts, berries (Forshaw 1989); in southern California, noted feeding on chinaberries (*Melia azederach*; Fisk and Crabtree 1974) and seven other items including sycamore fruits and sunflowers (Garrett et al. 1997).

Foraging Substrate and Techniques: Trees, shrubs, ground.

Breeding Season: The few data in California suggest most breeding is in spring, summer (Fisk and Crabtree 1974, KLG pers. obs.). Nesting recorded in late November in Brazil (Forshaw 1989).

Nest Site and Materials: Hollows in tops of fenceposts and presumably also trees (Forshaw 1989); in California nests in hollows in sycamores (*Platanus racemosa*) and other trees (Garrett 1997). No nest lining employed (Forshaw 1989).

Mating System: Presumably monogamous; an observation reported in Forshaw (1989) suggests that more than two adults may be present at nest site.

Clutch Size: 3 to 4 (Forshaw 1989).

Broods/Year: No data.

Incubation Period: 21 to 23 days in captivity (Forshaw 1989).

Fledging Period: About 56 days (Forshaw 1989).

Age at First Breeding: No data.

California Population Size and Trends: Garrett (1997) estimated at least 180 birds in the greater Los Angeles area. Small populations noted by Fisk and Crabtree (1974) may not be extant, but numbers in coastal Los Angeles and Orange counties may be increasing.

White-winged Parakeet (*B. versicolurus*) - "Canary-winged Parakeet" in part, "Bee-bee Parakeet"

Native Range and Habitat: Northern Amazonia from southeastern Colombia and northeastern Peru east to the Amazon River mouth (Forshaw 1989). Humid lowland forest and edge, second growth (Brightsmith in press). Naturalized in Florida (Smith and Smith 1993; Brightsmith in press).

Distribution in California: Limited numbers in San Francisco (Arrowood 1981) and south coastal Los Angeles County (Redondo Beach and Palos Verdes Peninsula; Garrett 1997).

Habitat in California: Coastal residential and suburban area with exotic flora, especially palms (Garrett 1997).

Elevation Range: In South America, 0 to 1,000 m (Stotz et al. 1996). In California, mainly around sea level (to 50 m).

Primary Diet: Seeds, fruit, blossoms (Brightsmith in press). In San Francisco area Arrowood (1981) lists 11

food items, including palm fruits (dates), leaf buds, flowers, figs, apples.

Foraging Substrate and Techniques: Arboreal; usually high in trees (Forshaw 1989; Brightsmith in press).

Breeding Season: In Florida fledglings noted February to July (Brightsmith in press); in San Francisco nesting mainly March to July (Arrowood 1981). Nestlings have been collected in Los Angeles County, California in June (Garrett 1997).

Nest Site and Materials: Tree cavities, or among palm fronds (Brightsmith in press); nest heights in Florida 2 to 12+ m (Brightsmith in press). Especially apt to nest in date palms (*Phoenix*) in California (Arrowood 1981).

Mating System: Monogamous, with long-term pair bonds (Brightsmith in press).

Clutch Size: 5 or more eggs (Forshaw 1989; Brightsmith in press).

Broods/Year: 1 (Brightsmith in press).

Incubation Period: 25 to 26 days (Brightsmith in press).

Fledging Period: 5 to 6 weeks (Forshaw 1989).

Age at First Breeding: 2 to 3 years in captive birds (Forshaw 1989).

California Population Size and Trends: Greater Los Angeles area populations only about 20 birds (Garrett 1997); probably similar numbers in San Francisco area. Has apparently decreased since 1960s and 1970s in Los Angeles area, perhaps because of interactions with Yellow-chevroned Parakeets (Garrett 1997).

Yellow-chevroned Parakeet (*Brotogeris chiriri*) - "Canary-winged Parakeet" in part, "Bee-bee Parakeet"

Native Range and Habitat: Mainly south of the Amazon region, from Bolivia and eastern and southern Brazil to Paraguay and northern Argentina (Forshaw 1989). Open woodlands, savannas, subtropical forests, towns (Brightsmith in press). Naturalized in southern Florida (Smith and Smith 1973).

Distribution in California: Los Angeles basin south to Palos Verdes Peninsula and east to southwestern San Gabriel Valley (Garrett 1997); possibly established (along with White-winged Parakeets) in San Francisco.

Habitat in California: Urban and suburban areas with exotic flora, especially silk-floss trees (*Chorisia speciosa*), palms, and eucalyptus (Garrett 1997).

Elevation Range: In South America from near sea level to 1,200 m and sometimes 1,560 m (Stotz et al. 1996; Forshaw 1989); in California from sea level to about 300 m (Garrett 1997).

Primary Diet: Seeds, fruit, blossoms (Brightsmith in press). In southern California (Garrett et al. 1997) noted taking 11 different items (including commercial bird seed at feeders), but concentrating on seeds of silk-floss tree and blossoms of red ironbark (*Eucalyptus sideroxylon*).

Foraging Substrate and Techniques: Canopy and subcanopy (Brightsmith in press).

Breeding Season: In Florida similar to White-winged (Brightsmith in press).

Nest Site and Materials: Cavities in tree trunks (especially palms) or limbs; holes excavated in arboreal termite nests (Forshaw 1989); nests in California have mainly been in palms.

Mating System: Monogamous (Forshaw 1989).

Clutch Size: 5 to 6 (Forshaw 1989).

Broods/Year: No data.

Incubation Period: About 26 days in captivity (Forshaw 1989).

Fledging Period: About 56 days in captivity (Forshaw 1989).

Age at First Breeding: No data.

California Population Size and Trends: Greater Los Angeles area population estimated at at least 380 birds (Garrett 1997). Not established in California until after the early 1970s, with great increases since then taking place mainly in the late 1980s and 1990s (Garrett 1997).

Red-crowned Parrot (*Amazona viridigenalis*) - "Green-cheeked Amazon"

Native Range and Habitat: Eastern Mexico (Tamaulipas and Nuevo Leon to northern Veracruz); semi-deciduous tropical forests, scrub, older cities (Enkerlin-Hoeflich 1997). Naturalized in southernmost Texas and Florida.

Distribution in California: Urban coastal slope of southern California, from Los Angeles County (especially San Gabriel Valley) to Orange County; also locally in San Diego area (Garrett 1997); small numbers have been noted on the Monterey Peninsula (Roberson and Tenney 1992).

Habitat in California: Older urban and suburban areas, especially with a combination of exotic trees and shrubs, small orchards, and native live oaks (*Quercus agrifolia*) (Froke 1981; Hall 1988; Garrett 1997).

Elevation Range: In Mexico from sea level to 1,200 m (Stotz et al. 1996); in California mainly 0 to 400 m (Garrett 1997).

Primary Diet: Seeds, fruit, buds, flowers (Enkerlin-Hoeflich 1997); in southern California Garrett et al. (1997) noted 24 diet items, including sycamore fruits, *Ficus*, sweetgum (*Liquidambar*) fruits, acorns from *Quercus* spp., pecans, walnuts, and *Eucalyptus* blossoms. Froke (1981) listed additional food items.

Foraging Substrate and Techniques: Tree crowns, shrubs. Manipulates food with bill and feet.

Breeding Season: In San Gabriel Valley of southern California dependent, fledged young mainly noted from July to October, with extremes from April to December (Mabb 1997b).

Nest Site and Materials: Existing cavities (from woodpeckers or natural decay) in trees (Enkerlin-Hoeflich 1997). In San Gabriel Valley silver maples (*Acer saccharinum*) especially important, but also uses utility poles (Mabb 1997b); may be somewhat colonial in nest site choice. Froke (1981) reported nests in blue gums (*Eucalyptus*) in the San Gabriel Valley at heights of 14 m and 18 m.

Mating System: Probably monogamous pairs (Enkerlin-Hoeflich 1997).

Clutch Size: Mean in northeastern Mexico 3.4 (n=53; Enkerlin-Hoeflich 1997). No data for California.

Broods/Year: 1 in native range (Enkerlin-Hoeflich 1997); no data for California.

Incubation Period: 27 days (n=36; Enkerlin-Hoeflich 1997).

Fledging Period: 53 days (n=17; Enkerlin-Hoeflich 1997).

Age at First Breeding: Unknown in native range (Enkerlin-Hoeflich 1997), but perhaps 3 years (Forshaw 1989).

California Population Size and Trends: Greater Los Angeles area population conservatively estimated at 1,080 by Garrett (1997); strong increases since the 1960s and 1970s, when reported as "very rare" by Hardy (1973) and only about 50 birds estimated for the San Gabriel Valley by Froke (1981). Large numbers of juveniles noted annually in recent years (Mabb 1997b) indicating high nesting success. Size of roosting flocks in the San Gabriel Valley continues to increase (Mabb 1997a and pers. comm.).

Lilac-crowned Parrot (*Amazona finschi*)

Native Range and Habitat: Western Mexico from Sonora and Chihuahua south to Oaxaca (Howell and Webb 1995); wooded foothills, coastal hills and mountains; deciduous forest, thorn scrub, oaks (Forshaw 1989; Howell and Webb 1995).

Distribution in California: Similar to Red-crowned Parrot but considerably less numerous; mainly in the San Gabriel Valley, Los Angeles County.

Habitat in California: Residential and suburban areas; sometimes in native oaks, and has nested (at least once) in native coniferous forest in the San Gabriel Mountains (Garrett 1997).

Elevation Range: In Mexico from sea level to 2,200 m; in southern California mainly 0 to 400 m, but one probable nesting pair was noted at 1,600 m (Garrett 1997).

Primary Diet: Fruits (especially figs), nuts, berries, buds, blossoms (Forshaw 1989). In southern California noted taking 21 items, including sycamore and sweetgum (*Liquidambar*) fruits, figs, pecans, apricots, and *Eucalyptus* blossoms (Garrett et al. 1997); Froke (1981) lists some additional food items.

Foraging Substrate and Techniques: Usually high in trees, tall shrubs (Forshaw 1989).

Breeding Season: In Mexico at least from February to July (Forshaw 1989). In southern California nestlings noted in May and June (Froke 1981; Mabb 1997b); dependent fledged young peak from July to September (Mabb 1997b).

Nest Site and Materials: Cavities (natural or drilled by woodpeckers) in trees (Forshaw 1989); nests in southern California noted in utility pole at about 8 m (Mabb 1997b) and in cavity in blue gum at 20 m (Froke 1981).

Mating System: Monogamous pairs (Forshaw 1989).

Clutch Size: 2 (Forshaw 1989).

Broods/Year: No data; probably only one.

Incubation Period: 28 to 29 days in captivity (Forshaw 1989).

Fledging Period: About 60 days in captivity (Forshaw 1989).

Age at First Breeding: Probably 3 years in most *Amazona* (Forshaw 1989).

California Population Size and Trends: Greater Los Angeles area population conservatively estimated at about 100 birds (Garrett 1997); an unknown additional number in the San Diego area. Numbers may be considerably higher; difficulty of distinguishing Red-crowned and Lilac-crowned parrots in the field (as well as the

confounding factor of potential hybrid young) makes confident population estimates difficult. Hardy (1973) did not record this species in the late 1960s, and Froke (19981) estimated about 22 for the San Gabriel Valley in the late 1970s. Populations have clearly increased since those studies.

Yellow-headed Parrot (*Amazona oratrix*) - "Yellow-headed Amazon"

Native Range and Habitat: Mexico, from Colima in west and Nuevo Leon and Tamaulipas in east, south to Oaxaca and Yucatan; closely related species occur south into South America (Forshaw 1989); riverine woodland, wooded areas with fields, deciduous forest and thorn forest (Forshaw 1989).

Distribution in California: Mainly Los Angeles basin, San Gabriel Valley, and urban Orange County (Garrett 1997).

Habitat in California: Residential, suburban areas.

Elevation Range: In Mexico from 0 to 900 m (Howell and Webb 1995; Stotz et al. 1996); in southern California mainly 0 to 300 m (Garrett 1997).

Primary Diet: Fruits, seeds, nuts, berries, blossoms, leaf buds (Forshaw 1989); in southern California noted feeding on walnuts, sweetgum, olives, camphor, *Eucalyptus* blossoms, junipers, sycamores (Froke 1981; Garrett et al. 1997).

Foraging Substrate and Techniques: Trees, shrubs.

Breeding Season: No data.

Nest Site and Materials: Hollows (which may be self-excavated) in live trees (Forshaw 1989); in California, also among palm fronds (Froke 1981).

Mating System: Monogamous pairs (Forshaw 1989).

Clutch Size: 2 to 4, usually 3 (Forshaw 1989).

Broods/Year: No data, but probably only 1.

Incubation Period: About 29 days in captivity (Forshaw 1989).

Fledging Period: About 60 days in captivity (Forshaw 1989).

Age at First Breeding: Probably about 3 to 4 years, as in other large parrots (Forshaw 1989).

California Population Size and Trends: Garrett (1997) estimated about 60 birds in the greater Los Angeles area. Has declined since the 1960s to 1970s, when considered "fairly common" by Hardy (1973); now largely absent from the West Los Angeles area, where not uncommon in the 1970s (Garrett 1997).

Eurasian Collared-Dove (*Streptopelia decaocto*)

Native Range and Habitat: India, western Asia, China west to Balkan region; has rapidly spread through Europe during the 20th century (Cramp 1985). Introduced in eastern Asia and the Bahamas, and has spread from the Bahamas to Florida and much of the southeastern United States; establishment in the Americas detailed by Smith (1987). Semi-open, cultivated areas, dry deciduous regions, suburbs, farmyards, orchards; generally avoids open areas, urban centers (Cramp 1985); a human commensal in much of its range.

Distribution in California: A small population of unknown origin was established in Ventura, Ventura County, by 1992 (Small 1994), and has since spread (though not contiguously) to coastal Santa Barbara and San Luis

Obispo counties. Recent sighting (March 1998) for the Antelope Valley near Lancaster, Los Angeles County (Garrett, pers. obs.).

Habitat in California: Coastal towns, suburban areas.

Elevation Range: Primarily lowlands; in California, mainly 0 to 100 m (although the recent Antelope Valley sighting is for 750 m).

Primary Diet: Cereal grains; also seeds, fruits of herbs and grasses, rarely insects (Cramp 1985); often feeds on spilled grain (Goodwin 1983).

Foraging Substrate and Techniques: Ground; rarely in bushes, trees (Cramp 1985).

Breeding Season: Prolonged; in northwestern Europe mainly from March to October (Goodwin 1983; Cramp 1985); no data for California.

Nest Site and Materials: Tree, bush, tall hedge, or building ledge; mean height of 6.77 m (Cramp 1985); nest is a flimsy platform of stems, twigs (Cramp 1985). No data for California.

Mating System: Monogamous; pairs are persistent, year-round (Cramp 1985).

Clutch Size: 2 (97% of all clutches; Cramp 1985).

Broods/Year: 3 to 6 per year (Cramp 1985).

Incubation Period: 14 to 16 days (Cramp 1985).

Fledging Period: 15 to 19 days (Cramp 1985).

Age at First Breeding: 1 year or less (Cramp 1985).

Longevity: Oldest known in wild was 13 years, 8 months (Cramp 1985).

California Population Size and Trends: Established in the Ventura Marina area, Ventura County by the early 1990s. Now numbers from several dozen to the low hundreds in that area (Garrett, pers. obs.). Small local populations became established in Santa Barbara [where not previously present (Lehman 1994)], Morro Bay, Cambria, and perhaps elsewhere by 1998. The explosive population growth and range expansion of this species in Europe (Cramp 1985; van den Bosch et al. 1992) and southeastern United States (Smith 1987; Stevenson and Anderson 1994) suggests that California populations will also rapidly expand.

Nutmeg Mannikin (*Lonchura punctulata*) - "Spice Finch," "Scaly-breasted Munia," "Spotted Munia," "Ricebird"

Native Range and Habitat: India, southeast Asia, Philippine Islands, Indonesia (Restall 1997). Open and semi-open country with bushes, trees, scrub; secondary forest, grassy clearings, cultivated areas, parkland, gardens, urban areas (Restall 1997). Widely introduced in eastern Asia, Australia, Hawaiian Islands, Indian Ocean islands, West Indies, etc. (Long 1981; Restall 1997).

Distribution in California: Lowland river systems and surrounding parks and residential areas from San Fernando and San Gabriel Valleys, Los Angeles County, south to coastal Orange County; small scattered populations from Ventura to San Diego, and perhaps in the south San Francisco Bay area. (Garrett, pers. obs.; Smithson 1997).

Habitat in California: Urban parks with low, weedy growth, flood control basins, river bottoms, gardens, residential areas with seed feeders (Garrett, pers. obs.; Smithson 1997).

Elevation Range: Sea level to 3,000 m in native range (Restall 1997); in California noted mainly from sea level

to 800 m (Garrett, pers. obs.; Smithson 1997).

Primary Diet: Grass and weed seeds, waste grain, crumbs, and cultivated rice (Restall 1997), and cultivated sorghum (Goodwin 1982). In California, feeds on seeds of grasses such as *Echinochloa*, *Paspalum*, *Bromus*, *Avena*, and *Cortaderia* (Smithson 1997); also on commercial bird seed provided at feeders.

Foraging Substrate and Techniques: Grass and weed stalks, ground, feeders.

Breeding Season: Nests year round in native range (Restall 1997), especially during and after the rainy (monsoon) season (Goodwin 1982). Nesting in California has been noted from February to November (Smithson 1997).

Nest Site and Materials: The nest is placed in a tree, tall bush, building niche, or thatched roof (Restall 1997). In California most nests have been in exotic pines, but also in other exotics, willows (Smithson 1997); mean height of 26 nests in southern California was 5.6 m (Smithson 1997). The nest is made of grasses and straw, and may be up to "watermelon" size (Restall 1997); it is globular, not woven, and has an entrance hole at one side.

Mating System: Probably monogamous; may be somewhat colonial (Restall 1997).

Clutch Size: 4 to 6 (Goodwin 1982; Restall 1997); mean clutch size at 6 California nests was 5.5 (Smithson 1997).

Broods/Year: 2, sometimes 3 to 4 (Restall 1997); double broods have been recorded in California (Smithson 1997).

Incubation Period: 14 days (Restall 1997).

Fledging Period: 18 to 19 days (Restall 1997).

Age at First Breeding: At least occasionally breeds at less than 1 year (Smithson, pers. comm.).

California Population Size and Trends: Los Angeles and Orange County population conservatively estimated at 450 (Smithson 1997). Not mentioned by Hardy (1973); possible establishment in early 1990s first noted by Johnson and Garrett (1994). Pest potential and occasional appearance in California pet shops noted by 1987 (J. Hitchcock, pers. comm.). Numbers appear to be rapidly expanding in lowland southern California.

Orange Bishop (*Euplectes franciscanus*) - "Northern Red Bishop"

Native Range and Habitat: Sub-Saharan Africa, from Senegal east to Ethiopia and south to the equator (Macworth-Praed and Grant 1960; a related species (Red Bishop, *Euplectes orix*) occurs farther south in Africa. Tall grassland, cultivated areas, especially near water and marshes (Zimmerman et al. 1996).

Distribution in California: Riverbottom areas of coastal lowlands, mainly in Los Angeles and Orange counties (Johnson and Garrett 1994; Smithson 1997), but also locally from Santa Barbara County to San Diego County, and in the San Francisco Bay area. Most numerous in the Los Angeles and San Gabriel River systems.

Habitat in California: Weedy areas, flood control basins, river channels, especially where dominated by *Echinochloa* grass (Smithson 1997).

Elevation Range: From lowlands to at least 1,000 m in Africa (Zimmerman et al. 1996); in California mainly found from sea level to 800 m.

Primary Diet: Grass seeds, especially *Echinochloa*, *Cortaderia*, and *Paspalum dilatatum* (Smithson 1997);

also noted feeding on emergent aquatic vegetation (*Polygonum*) and on cocklebur (*Xanthium*) (Garrett, pers. obs.). Visits seed feeders, mainly in late winter and spring (Smithson 1997; Garrett, pers. obs.).

Foraging Substrate and Techniques: Grass and weed stems, ground, seed feeders.

Breeding Season: Breeding in southern California is mainly August to November, and appears to be tied to the seeding of *Echinochloa* grass and other important food items (Smithson 1997).

Nest Site and Materials: Nest is placed in clumps of *Echinochloa* grass or, more rarely, pampas grass (*Cortaderia*) or giant reed (*Arundo donax*) (Smithson 1997). Probably also placed in other weedy or marshy vegetation in flood control basins, river channels. Mean nest height in southern California was 1.1 m (n=5; Smithson 1997). The ball-shaped nest is woven from grass blades and stems. Males build multiple nests; females line those that are ultimately used for nesting (Craig 1980, 1982).

Mating System: Polygynous; males may hold harems of up to 6 females (Craig 1982).

Clutch Size: 2 to 3 in southern California (Smithson 1997). Mean clutch size of related *E. orix* in South Africa is 2.7 (n=1,060; Maclean 1985).

Broods/Year: Possibly only 1 in California (Smithson 1997).

Incubation Period: 12 to 13 days in closely related *E. orix* in South Africa (Maclean 1985).

Fledging Period: 12 to 16 days in related *E. orix* in South Africa (Maclean 1985).

Age at First Breeding: Probably 2 years (Craig 1982).

California Population Size and Trends: Current population in Los Angeles and San Gabriel River drainages (Los Angeles and Orange counties) conservatively estimated at 400 (Smithson 1997). Occasional sightings date back at least to the 1970s (Garrett, pers. obs.), but most rapid increases have been in the 1990s. Sizes and trends of small populations elsewhere in California unknown.

DISCUSSION

The future of the populations outlined above is hard to predict; many factors (physical stress, disease, or ecological interactions) could impact populations. On the other hand, some of these populations could continue to expand into available habitat, and suitable habitats themselves could expand with increasing urbanization. In the case of the Eurasian Collared-Dove, the long-established (but also introduced) Spotted Dove might provide an ecological barrier or might itself decline with a growing Collared-Dove population. Additionally, we do not know at present how closely-related species now in "artificial" sympatry will coexist, and whether interbreeding might occur; examples of such species pairs are Red-crowned and Lilac-crowned parrots, White-winged and Yellow-chevroned parakeets, and Mitred and Red-masked Parakeets.

Current knowledge of the ecological and economic impacts of these species is limited; some (such as the Nutmeg Mannikin and Black-hooded Parakeets) are known to depredate crops in parts of the native or introduced range. Currently the California populations

discussed above appear to have little, if any, impact on economically important crops, but may have very local impact on gardens and small orchards. Their restriction to urban and suburban habitats minimizes agricultural impacts, as well as deleterious interactions with native birds such as cavity nesters, frugivores, and granivores.

Standard bird censuses (BBS, CBC) do not adequately monitor many introduced bird species (Johnson and Garrett 1994). Birders, consultants, and agency biologists need to become familiar with the field identification of non-native (as well as native) species. Ongoing Breeding Bird Atlas work is filling in some distributional gaps. The primary need, however, is for focused monitoring. Little is known of the natural history of these species in their introduced range, and information from their native ranges (if even available) may not always be applicable to the area. Monitoring schemes should not only detail geographical distribution and population sizes, but should seek to examine breeding phenology and requirements, reproductive success, movements, diet, and interactions with native (and other non-native) species.

ACKNOWLEDGMENTS

The author thanks W. Scott Smithson, S. Warter and C. Collins for allowing the use of preliminary data collected by Smithson on mannikins and bishops; the California Department of Agriculture has helped fund Smithson's important work. Donald Brightsmith kindly shared information on White-winged and Yellow-chevroned parakeets prior to publication. James C. Hitchcock provided information on early detections of Nutmeg Mannikins in California. Kathy C. Molina helped with literature research.

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