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EFFORT IN CALIFORNIA

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ABSTRACT: Upon discovery in 1980 in the San Diego area of a feral population of Indian White-eyes (Zosterops palpebroso palpebroso), a prohibited species in California, an eradication program was begun by the California Department of Food and Agriculture (CDFA). Mist-netting and shooting proved to be the most successful of the capture methods explored. After three and one-half seasons of retrieval effort and 330 birds taken, fewer than a dozen birds now have been detected in the wild. Within the remainder of the fiscal year, CDFA is conducting intense survey and retrieval. Whether eradication is feasible and applicable to other incipient infestations of exotic birds potentially detrimental to agriculture within the State is yet to be determined.

INTRODUCTION

In September 1980, sightings of Zosterops sp. by local ornithologists within Balboa Park, adjacent to and on San Diego Zoo grounds, were confirmed by members of the CDFA Detection Unit. Zoo records of acquisition reported Zosterops on inventory in the early '60s and mid-'70s, and indicate a possible escape of two pair in 1973 or 1974.

Subsequent delimitation surveys by state and county agricultural personnel revealed an established population of 100-200 birds within three principal areas: Balboa Park, Presidio Park, and Pt. Loma, a residential area approximately six miles away. It is speculated that the Pt. Loma infestation may have resulted from a separate introduction.

BACKGROUND

In 1974, the California Fish and Game Commission approved addition of the genus Zosterops to Title 14, Section 671 (a) (12) of the California Administrative Code, thereby prohibiting importation, transportation, and possession of members of this genus in California. Part of this action was based on recommendation from California Department of Food and Agriculture (CDFA), which proposes vertebrate species that could threaten agriculture be restricted. The considerations given Zosterops at that time were based on available literature on the biology and history of white-eyes in the tropical, sub-tropical and temperate regions of the Old World.

Within the passerine order, the avian family Zosteropidae comprises 85 species, 67 of which fall within the genus Zosterops. This group, commonly referred to as "white-eyes" or "silvereyes", contains birds marked by a characteristic ring of feathers around the eye, although in a few species the eye ring is absent or of another color.

Members of the genus are abundant in areas where they are known to occur, and have been gregarious in colonizing where introduced. The introduction of Zosterops japonica to Hawaii in 1928 by aviculturists has resulted in a species now thriving over the entire archipelago.

Neither migratory nor a strong flier, Zosterops has shown an ability to survive trade-wind storms and to colonize new areas successfully. Since the 1850s, gray-backed white-eyes from Tasmania, for instance, have established as far as New Zealand, 1,200 miles away, with viable populations even on the sub-Antarctic Macquarie Islands. The pattern of this migration is comparable to the movement of the European starling (Sturnus vulgaris) throughout the continental U.S. since 1900.

The establishment of free-flying white-eyes in California could have serious detrimental effects on surrounding avian species, through competition for food as well as displacement during population expansion. Generally, Zosterops are omnivorous feeders, consuming a variety of insects, nectar and fruit. This habit has been confirmed from analysis of stomach contents of Indian white-eyes captured on the project. Western Australian Agriculture currently recommends the use of Mesurool (methiocarb) in mitigating damage to commercial grapes caused by Zosterops lateralis, an indigenous species. White-eyes' nectar-consuming habit could cause competition with native birds, and possibly reduce the population number of species more confined to a limited geographic area. As yet, no exotic avian species introduced to California has caused damage to commercial agriculture or threatened wildlife, but the pattern of emigration and domination of both the English house sparrow and the European starling in the United States gives cause for all inadvertent introductions to be scrutinized carefully and considered for eradication, if warranted and feasible.

The Indian white-eye (Zosterops palpebroso palpebroso) is a wide-ranging arboreal species found throughout much of India, extending into neighboring Southeast Asian countries. Typically, it breeds in the foothills (up to elevations of 7,500 feet), wooded portions of the plains, and the coast. It may produce up to three clutches a year, three to six per brood. It is not surprising that this species would be able to establish within California, an area of similar climate, geography, and habitat. In fact, Southern California lies within the same three degrees latitude (32°-35°) that occur within its northern range in India. Some plant groups coincide with those of its native range, and because of the establishment of horticultural importations along the coast, many plants are identical.

RETRIEVAL

Our objectives, at the beginning of this program were to capture birds, to explore capture methodology incorporating the most acceptable techniques into the retrieval program, and, thirdly, to assess whether eradication was economically justifiable.

Techniques for the capture of white-eyes have been under continuous refinement. Mist-netting and shooting have been the most productive methods. Initially, mist-netting was the only capture method used and has produced the highest yield of birds, especially of juveniles, although it has been somewhat labor-intensive. Net modifications, such as conversion from 10' bamboo poles to 5' conduit sections, have improved maneuverability and capability. A system of pulleys and rings to facilitate raising and lowering of nets enabled the nets to be worked effectively by one person. Experimentation with different types of mist nets have shown the best results from 1-1/4" black nylon single mesh. The most practical array proved to be two 18' nets strung vertically tandem.

Use of tape-recorded bird calls early in the retrieval effort revealed that white-eyes are highly sociable and respond well to recordings of their vocalizations. These were used in attracting birds towards the nets. Two distinctive calls are the most common: one a territorial cry and the other a twittering chatter.

Live decoys, who evoked live responses, seemed to help even more. In 1982 and 1983, decoys were kept on zoo grounds under permit to the San Diego County Agricultural Commissioner and used when possible to increase capture rate. These have produced excellent results when used in conjunction with the tape recorded calls.

Trapping has been explored as much as time has allowed. In 1982, a Modified Australian Crow trap was set up on the Jungle Trail in the Zoo. Combinations of decoys, plants, fruits, and sugar water bottles were placed within. No advantage could be attributed to any attractant. Six captures were reported by zoo keepers early in the spring, but no captures occurred after May. At the end of 1982, use of this trap was discontinued. We would like to explore other trap systems in the hope of realizing benefit from a passive capture method. Any suggestions for designs are welcome.

Platform bait stations with foods that birds in captivity were known to prefer, e.g., sliced oranges and papayas, were set out in three areas. "Informal" bait stations, such as a piece of fruit simply hung on the twig of a tree, were also placed. Exposed fruit was allowed to collect insects in the event that they might serve as an added attractant. No birds were ever seen, nor was any fruit eaten from these stations. Birds have been noted feeding intensively on small figs of a Ficus religiosa, as well as a horticultural variety of Prunus in Balboa Park; these have been natural bait stations where birds were observed and around which survey efforts tend to be concentrated. Other principal plant associations are:

<u>Ficus</u> spp. especially <u>F. religiosa</u> and <u>F. macrophylla</u>	<u>Nycoa sylvatica</u>
<u>Hibiscus syriacus</u>	<u>Populus nigra</u>
<u>Pittosporum</u> spp.	<u>Liriodendron tulipifera</u>
<u>Eucalyptus</u> spp.	<u>Persimmon japonica</u>
<u>Eugenia</u> spp.	<u>Pistacia chinensis</u>
<u>Liquidambar styracifolia</u>	<u>Punica granatum</u>
<u>Acacia melanoxylon</u>	<u>Sapicium sebiferum</u>
<u>Calodendrum capense</u>	<u>Tibouchina semidecandra</u>
<u>Lagerstroemia indica</u> and other spp.	<u>Acokanthera</u> sp.
<u>Magnolia macrophylla</u>	<u>Carissa grandiflora</u>
<u>Erythrina caffra</u>	<u>Cercis occidentalis</u>
<u>Malus</u> (crabapple)	<u>Photinia serralata</u>

The San Diego Botanic Garden, an integral part of the Zoological Gardens, is renowned for its comprehensive assemblage of exotic and subtropical plants. The preponderance of plants and fruits of ornamental subtropicals in Balboa Park and in the San Diego area appear to provide such diversity of food meeting the needs of feral white-eyes that bait stations are not practical as lures.

Shooting was first attempted in late 1982 when netting success diminished. It appeared that some birds consistently would not draw near to the nets, although often times they responded to recorded decoy calls. As numbers detected declined, attempts were made to take the few remaining more wary birds by shooting. Twenty-four birds were taken in the fall of 1982, nine in 1983. Bird shot (.22 calibre) and pellets (1.77 and .22) were tried, and it was found that a .177 pellet in a spring loaded airgun provided the most satisfactory results with the least noise.

Speculation that a core of more elusive birds remained in the wild at the close of 1982 when cold weather set in, was borne out in May of 1983, when birds were first seen and heard (but not during January-April) in large numbers. The program was reinitiated full time in June, but by then many young birds were out. Mist-netting accomplished 49 captures within the next two months. Later in the season, as these captures diminished, shooting again was tried.

ANALYSIS

In 1982, when the first large number of bird captures occurred, birds were sacrificed and analyzed for sex and age. With assistance from Dr. Gerald Cosgrove of the Zoo Pathology Department, and Mr. Fred Schaffner, an ornithologist working seasonally on the project who performed the necropsies, sex ratio as well as age were determined on nearly 76 birds.

Age determination was made by reference to the pneumatization technique developed by Yuneck for hermit thrush and American robin. There is no record of age determination on *Zosterops* available in the literature. Of 72 crania examined, only 12 appeared complete (adult). Gonadal development was checked to corroborate age determinations. It was realized that the bulk of white-eyes captured July - November 1982, were juveniles, birds just produced that season.

The sex ratio was determined from dissected birds to be nearly equal; of the 76 birds inspected, 34 were males, 36 females, and 6 were undetermined, primarily due to lack of gonadal development. At this time, close examinations were made to find out any external characteristics of the bird which could be used to separate the sexes. *Zosterops palpebrosa* is described as sexually indistinguishable and, to our scrutiny, this was indeed true. Use of decoy birds' gender in manipulating wild birds into nets, etc., could have proved valuable. Different number combinations of decoys were tried, and optimum results appeared to result from decoys grouped in two's. In 1983, the sex and age determinations based on reproductive organs were performed by Ms. Lauren Hall-Cather, now seasonally with CDFA on the project.

Ms. Hall-Cather also initiated an analysis of stomach contents on birds captured in midsummer, which confirmed their omnivorous habits. Twenty-one gizzards from white-eyes captured June through August 1983, were saved and frozen until analyzed August 1983. This analysis consisted of a simple visual percentage estimate of different materials found in the gizzard. Four gizzards contained nothing (although birds had been euthanized immediately after capture) and were discarded. Of the 17 remaining, 10 were examined individually, and 7 were opened, contents were mixed together, combined in a general wash and then studied under a dissecting microscope at high power. Vegetable matter, seeds, flowers, and fruit pulp rested on the bottom of the dissecting dish while insect parts floated to the top, becoming discernible from the rest of the contents. Insect parts included egg capsules, soft-bodied grubs, parts of exoskeletons, and whole insects, such as thrips. Flower parts included petals and anthers. Seeds were of a great variety, ranging from grain-like to round oily fruit seeds. Gizzards from five birds have been submitted to CDFA Lab Services for insect identification.

Active correspondence with countries where *Zosterops* is known to occur and is reputed to cause damage has produced some background information; but outside of Western Australia, where serious damage from *Z. lateralis* is well documented, no significantly descriptive information has been made available. There is a need to compare in depth the biology of the species within the genus *Zosterops*. Bird handbooks suggest very broad differences, and the damage potential of *Z. lateralis* vs. *Z. palpebrosa* may be analogous to that of *Carpodacus mexicanus* vs. *C. purpureus*, the house finch and purple finch.

Ms. Hall-Cather is currently working on a model describing reproductive potential of white-eyes from field observations made in the San Diego area. A number of variables, e.g., human predation rate, disease, natural mortality rate, etc., are still being checked against the data from the white-eyes captures. This model may show whether the last few birds can be successfully extirpated and, perhaps, when retrieval efforts would be most productive. A total of 330 birds have been taken on this project so far: in 1982, 125 birds were retrieved; in 1983, 69 birds. The major portion of captures has been juveniles, or birds produced that season. As of this writing, the cost to date incurred by the contributing agencies--the California Departments of Food and Agriculture and of Fish and Game, the San Diego County Department of Agriculture and the San Diego Zoological Society--has amounted to just over \$70,000.

A review of pest potential of Indian white-eyes to wildlife as well as to agriculture will be considered later this season. Meanwhile, in conjunction with the aggressive retrieval effort, intensive surveys are scheduled to count and capture remaining birds. With the help of Hall-Cather's model, it may be possible to determine whether population reduction is actually being realized, and whether eradication is feasible.

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