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Use of an Anticoagulant to Control Mongooses in Nene Breeding Habitat

by Charles P. Stone,[1] Marsha Dusek,[2] and Mark Aeder[3]

Small Indian mongooses *(Herpestes auropunctatus)* were brought to Hawaii in 1883 to control rats in sugar cane fields. This early experiment in biological control did not succeed for at least four reasons: 1) mongooses are diurnal predators while rats are active mainly at night; 2) rat vulnerability to predation varies with species and habitat; 3) mongooses are versatile predators, able to survive on a variety of food resources; and 4) reproductive potential of rats is higher than that of mongooses. Mongooses now occur on all main islands except Lana'i, Kaua'i and Ni'ihau, ranging from sea level to 10,000 ft elevation.

Mongooses in Hawaii have adapted to a wide variety of foods, including marine invertebrates; garbage; abundant insects such as cockroaches and dung beetles; other arthropods; the ubiquitous house mouse *(Mus domesticus)*; seabirds, songbirds, doves, poultry, and their eggs; and fruiting trees and shrubs (LaRivers 1948; Baldwin et al. 1952; Kami 1964; Kramer 1971; Tomich 1986). They probably are also effective predators on introduced skinks and geckos in some areas, taking these and the above items roughly in proportion to availability. Predation on ground-nesting gamebirds such as the Common Pheasant *(Phasianus colchicus)*, California Quail *(Callipepla californica)*, and Wild Turkey *(Meleagris gallopavo)* has been noted (Smith and Woodworth 1951; Baldwin et al. 1952; Woodworth and Woodside 1953; Kramer 1971).

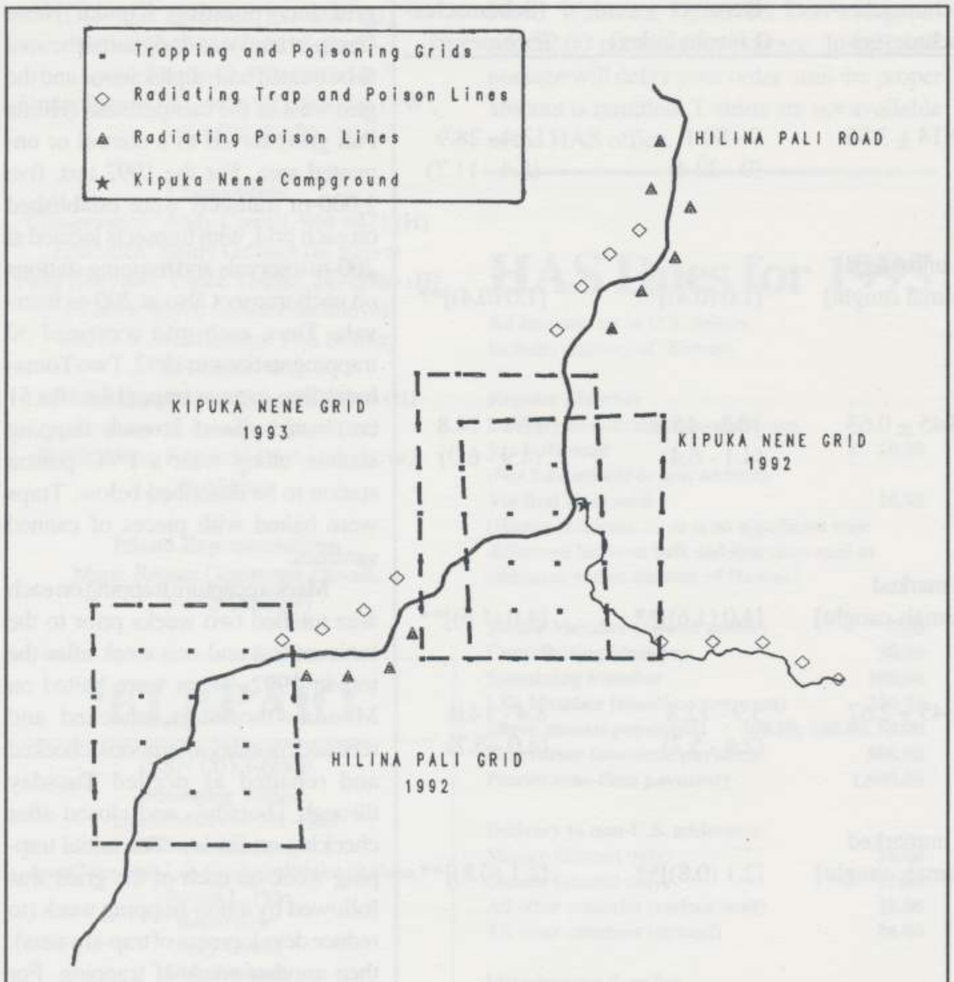

Fig. 1. Location of traps and poison stations near Kipuka Nene Campground as determined by Geographic Positioning System (GPS) and plotted on a Geographic Information System (Arcinfo).

These adaptable predators are also known to take eggs, young, and, sometimes, adults of eight species of Hawaiian birds Federally listed as Endangered Species in the U.S. These include: Nene or Hawaiian Goose *(Branta sandvicensis)*, 'Alala or Hawaiian Crow *(Corvus hawaiiensis)*, Hawaiian Duck *(Anas wyvilliana)*, Hawaiian Coot or 'Alae Ke'oke'o *(Fulica americana alai)*, Hawaiian Stilt *(Himantopus mexicanus knudseni)*, Hawaiian Gallinule or 'Alae 'Ula *(Gallinula chloropus sandvicensis)*, Hawaiian Dark-rumped Petrel *(Pterodroma phaeopygia sandwichensis)*, and Newell's Shearwater *(Puffinis newelli)*.

From 1984 to 1986, research was conducted in Hawaii by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS) to gather information necessary to register the anticoagulant toxicant diphacinone (Bell Laboratories, Inc., Madison, Wisconsin 53704) for control of mongoose populations to protect endangered birds. Mongooses are extremely sensitive to diphacinone, which allows the chemical to be used in low concentrations that minimize risk to other animals. In 1988, an experimental use permit was issued by the Environmental Protection Agency to conduct tests of 0.00025% (2.5 ppm) lean hamburger-diphacinone bait on 25- and 100-ha grids in Hawai'i Volcanoes National Park on Hawai'i Island and on the James Campbell National Wildlife Refuge on O'ahu. Mongoose invasion rates after poisoning for 22 to 24 days were determined by measuring consumption of untreated hamburger at the grid stations. Based on the results of these tests, which included monitoring the fates of mongooses radio-collared before using the toxicant, diphacinone received a Special Local Need registration under Section 24-C of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) in 1991.

In 1992, we began tests in Hawai'i Volcanoes National Park to determine the practicality of using diphacinone to reduce mongoose numbers near Kipuka Nene, an important nesting and brooding area for Nene in the park. Several pairs of birds were known to frequent the area, but successful reproduction had not been observed there for several years. The purposes of this study were to determine the size of the area that should be treated with the chemical, the time interval that would be required to afford protection to Nene eggs and young, the costs to management, and the actual effects on Nene reproduction and survival.

Study Area

Kipuka Nene (Fig. 1) is located at about 3,000 ft elevation in the mid-elevation woodland zone (seasonal submontane zone) of the park (2,000-4,000 ft), between the lowland and the upland forest and woodland zones. The climate of the area is typically dry and warm in the summer, with average annual rainfall of about 20 in. Strong, desiccating winds are not infrequent, and contribute to dry conditions. The most important management problem in the zone is fire, aggravated by the flammable and fire-adapted alien grasses that now thrive there.

Scattered native shrubs in the area include 'ohelo *(Vaccinium reticulatum)*, pukiawe *(Styphelia tameiameiae)*, and 'a'ali'i *(Dodonaea viscosa)*, with ground cover dominated by the alien grasses bush beardgrass *(Schizachyrium condensatum)* and molasses grass *(Melinis minutiflora)*. The alien common guava *(Psidium guajava)* is also abundant. Where moisture permits, open 'ohi'a *(Metrosideros polymorpha)* woodland with an understory of mixed native trees and shrubs and alien grasses can be found. Much of the study area consists of pahoehoe lava flows with little to no vegetative cover.

Methods and Materials

Live trapping for population, density, and survival estimates

1992—Two trapping grids were established at two locations along Hilina Pali Road near Kipuka Nene in August 1992 (Fig. 1) to determine population estimates and mark animals prior to the toxicant test. Trapping was also conducted on each grid after the toxicant test to determine population estimates and survival of marked mongooses. The grid incorporating Kipuka Nene Campground was designated the area to be treated with diphacinone and the grid west of the campground (Hilina Pali grid) served as a control or untreated area. For the 1992 test, five 1,000-m transects were established on each grid, with transects located at 200-m intervals and trapping stations on each transect also at 200-m intervals. Thus, each grid contained 30 trapping stations in 1992. Two Tomahawk live-capture traps (18 x 18 x 51 cm) were placed at each trapping station, along with a PVC poison station to be described below. Traps were baited with pieces of canned sardines.

Mark-recapture trapping on each area totalled two weeks prior to the toxicant test and one week after the test in 1992. Traps were baited on Monday mornings, checked and rebaited Monday afternoons, checked and rebaited as needed Tuesday through Thursday, and closed after checking on Friday. The initial trapping week on each of the grids was followed by a non-trapping week (to reduce development of trap-shyness), then another week of trapping. For the Kipuka Nene area, trapping was conducted 14-18 September and 29 September-2 October prior to poi-

Table 1. Estimated populations and densities of mongooses on Kipuka Nene and Hilina Pali grids, 1992 and 1993-94.

Locations and Years	Population Estimate (Lincoln Index)	Population Estimate (Schumacher-Eschmeyer)	Population Density* (Lincoln Index)	Population Density* (Schumacher-Eschmeyer)
Kipuka Nene Before 1992 Toxicant Test	36 ± 22.05 (15 animals caught)	21.14 ± 3.86	0 - 80.1 (0 - 32.4)	13.4 - 28.9 (5.4 - 11.7)
Kipuka Nene After 1992 Toxicant Test	[1 unmarked animal caught]	[1 unmarked animal caught]	[1.0 (0.4)]**	[1.0 (0.4)]**
Hilina Pali Control Before 1992 Toxicant Test	13 ± 1.44 (13 animals caught)	13.45 ± 0.68	10.1 - 15.9 (4.1 - 6.4)	12.1 - 14.8 (4.9 - 6.0)
Hilina Pali Control After 1992 Toxicant Test	[4 marked animals caught]	[4 marked animals caught]	[4.0 (1.6)]**	[4.0 (1.6)]**
Kipuka Nene Before 1993-94 Toxicant Test	17.88 ± 3.30 (16 animals caught)	21.45 ± 2.67	5.9 - 12.8 (2.4 - 5.2)	8.4 - 14.0 (4.0 - 5.7)
Kipuka Nene After 1993-94 Toxicant Test	[4 unmarked animals caught]	[4 unmarked animals caught]	[2.1 (0.8)]**	[2.1 (0.8)]**

*Animals/100 ha (animals/100 a)
**Minimum estimates based on actual captures

soning, and 26-30 October after poisoning. For the non-treated Hilina Pali area, trapping was conducted 21-25 September and 5-9 October, and 2-6 November after poisoning had been completed in the Kipuka Nene area. Mongooses were marked with numbered metal ear tags in each ear upon initial capture in both areas. Animals were handled through use of fish bags and welders gloves; no anaesthetics were used.

1993-94—For the 1993-94 test, five 1,200-m transects in the Kipuka Nene area were used, but the Hilina Pali grid was not used because of time constraints. The Kipuka Nene grid was expanded to include seven stations on each of the five transects, and the grid was shifted to the west by removing the easternmost transect and adding a transect to the west. In addition, three new traplines were established that radiated out from the grid to the north, east, and west (Fig. 1). These modifications were made to better protect the core Nene nesting and brooding area from mongoose predation.

Trapping stations on the 1993-94 grid numbered 35, and those on the radiating traplines 13, for a total of 48 stations. As in the 1992 test, two Tomahawk traps per station were used. In addition, a cat trap was placed near each of the radiating trapline stations (i.e., 13 cat traps). Cat traps were baited with scent lures and dried fish chow. Trapping was conducted and mongooses were ear-tagged for a four-week period (24 August-17 September, 1993) prior to the toxicant test. Mongooses were trapped for a two-week period (4-14 January, 1994) subsequent to the toxicant test to obtain population and survival estimates.

Boundaries of grids, radiating trap and poison lines, and local landmarks were recorded on a Trimble Geographic Positioning System (GPS), differentially corrected with data collected at a base station at Kaloko-Honokohau National Historical Park, and mapped on PC-Arcinfo, a Geographic Information System (GIS).

Population and Density Estimates

Mongoose population estimates were computed with Lincoln Index and Schumacher-Eschmeyer formulae for capture-recapture data (Davis and Winstead 1980). The boundary of the area used by each population was considered to be half the distance between grid lines (100 m) projected outside the actual grid lines on each of the four sides of the grid. The area used by mongooses caught in the traps on the radiating traplines in 1993-94 was considered to be the distance between stations (200 m). Thus, in 1992, 100 ha (247 a) was the total area used to calculate density estimates for both grids; in 1993-94, 192 ha (475 a) was considered the total area used by mongooses vulnerable to the traps. These areas are conservative, so it is likely that resident mongoose population density estimates are somewhat inflated in the figures presented here.

Economics

Cost of the toxicant program in 1993-94 was calculated and compared with the estimated cost of running a trapping program to control mongooses for an area of the same size. The initial cost of traps is included in the cost of controlling animals with trapping, but, since population estimation is not a necessary part of the operational toxicant program, trap purchases and operation costs are not included for control with toxicant.

Toxicant test

A mix of diphacinone and lean (10% fat) hamburger was placed in 30 PVC poison stations on the Kipuka Nene grid in 1992 and in 58 stations in 1993-94. In 1992, the toxicant was available for 20 days, 5-25 October. In 1993-94, diphacinone was used for 105 days, 20 September-3 January. Bait stations were constructed of 4-in diameter PVC pipe in the shape of a T, with openings for mongoose entrance in the arms of the T and bait placed in the supporting tube. Paper or plastic cold drink or luau cups were used to hold 400-500 g of diphacinone-treated lean hamburger mix, and each station was anchored to the ground with an iron stake. Baits were weighed upon placement and removal each week, and bait was changed each Monday. Animals captured during the first two weeks after the toxicant test in 1993 were sacrificed and

Table 2. Shortest distances moved by mongooses between recapture sites for mongooses recaptured more than once, Kipuka Nene and Hilina Pali study sites, Hawaii Volcanoes National Park, 1992 and 1993-94.

Area and Year	Males Tag No.	Males Dist.(m)	Males No. Recap.	Females Tag No.	Females Dist.(m)	Females No. Recap.
Hilina Pali (1992)	101	633	7	107	282	3
				103	447	4
				105	447	4
				130	447	5
				126	825	3
Kipuka Nene (1992)				028	316	2
Kipuka Nene (1993)	326	447	3	303	849	3
	332	565	2			
	301	1,400+	2			
Mean		761			516	

* Hilina Pali was trapped over 7-week period; Kipuka Nene was trapped over a 3-week period in 1992, 4 weeks in 1993-94.

Table 3. Toxic bait consumption frequencies at 58 diphacinone stations on Kipuka nene grid and adjacent areas, Hawai'i Volcanoes National Park, 1993.

Weeks with High Bait Consumption*	No. Stations Having Frequency in Column 1	Rats Captured: Before Toxicant Available	Rats Captured: After Toxicant Available
0	9		
1	14		
2	10		
3	6	2	
4	3	1	
5	2		
6	4		
7	3		
8	1		
9	0		
10	0		
11	1		1
12	2		1
13	2		1
14	1		
Total	58		

*Bait consumption >150 grams per week. Toxicant was available for 14 weeks total.

autopsied for evidence of anticoagulant poisoning.

Results and Discussion
Population, Density, and Survival Estimates

Results of population estimates from Lincoln Index and Schumacher- Eschmeyer formulae and densities calculated from these are presented in Table 1; however, the numbers of animals captured after the toxicant tests in both 1992 and 1993-94 at Kipuka Nene were too low to allow population estimates. None of the animals taken after poisoning were marked, suggesting immigration into the Kipuka Nene grid in both years after poisoning, rather than survival of resident animals through poisoning. In contrast, although numbers of animals captured on the Hilina Pali grid in 1992 were also too low to allow estimates, all recaptured animals had previously been marked, suggesting survival of resident animals and also substantiating the fact that mongooses are readily retrapped.

The Lincoln Index estimate for the Kipuka Nene area before the toxicant test in 1992 was relatively high (36), and the standard error was very large (22.05). The Schumacher-Eschmeyer estimate for the same time and area was the most variable of these indices (Table 1). Probably the low recapture rate was responsible, as only two of the eight animals taken in the recapture period had previously been ear-tagged. The Kipuka Nene grid is centered on a campground and a hiking trail runs through it, so harborage is higher than in the Hilina Pali area. As a result, transient animals may be more common there. This, coupled with the short (1 week) recapture period in 1992 may have provided a less reliable estimate than desirable for the area that year.

Population estimates obtained by the two methods (Lincoln Index and Schumacher-Eschmeyer) are generally similar, with the exception of the Kipuka Nene area in 1992. Comparison of 1992 and 1993-94 Schumacher- Eschmeyer mean estimates for Kipuka Nene suggests that 1992 poisoning had little effect on the 1993-94 population level. Rapid ingress of animals after poisoning is presumably the reason for this. In 1993-94, 4 animals (2 males and 2 females) were trapped in the poisoned area within two weeks of poisoning, and 11 more (7 males, 2 females, and 2 unknown) were taken within the next 2.5 months. The four mongooses captured during the two weeks following poisoning did not show evidence of anticoagulant poisoning. Although most mongooses captured after poisoning were taken on the periphery of the previously poisoned area, several animals were taken near the campground in the center of the grid. None of the 15 mongooses captured in the 2.5 months following toxicant use was ear-tagged, suggesting that these animals came into the area after the 15-week poisoning period.

Mongoose density estimates were generally in the range of 6 to 16 animals per 100 ha, with the exception of the 1992 Kipuka Nene estimate (0-80/100 ha). Other researchers estimated populations of 100 animals per 100 ha in rain forest near human habitation and 200 to 300 mongooses per 100 ha in moist forest, based on limited data and Lincoln Index formulae (J.K. Baker and C. Russell, formerly National Park Service, pers. comm.). Keith reported densities of 4 to 50 animals per 100 ha in habitat ranging from lowland wetlands to mid-elevation woodlands (J.O. Keith, formerly U.S. Dept. Agriculture, pers. comm.). Mongoose densities on islands in the Caribbean are reportedly much higher than those found in Hawaii, ranging from 100 to 1,000 animals per 100 ha.

Table 4. Bait consumption event frequencies during 15 weeks of diphacinone poisoning, Kipuka Nene, Hawai'i Volcanoes National Park, 1993.

Date of Bait Pickup	Number of Stations with High Bait Consumption*
September 20	24
September 27	18
October 4	16
October 11	12
October 18	14
October 25	8
November 1	13
November 9	13
November 15	11
November 23	8
November 29	16
December 6	13
December 13	3
December 20	14
December 27	9

*Bait consumption > 150 grams per week. Total of 58 stations were available.

Table 5. Costs of controlling mongooses on a 192 ha (475 a) area with diphacinone for 15 weeks compared with estimated cost for control with live trapping for same area and time period, Kipuka Nene, Hawai'i Volcanoes National Park, 1993.

	Costs
Diphacinone Control	
Materials	
Lean hamburger (58 lb/wk at $2.19/lb)	$1,905*
Warning signs (2/station at $4 ea)	464
PVC poison stations	1,292
Miscellaneous materials (diphacinone concentrate, cups, oil, wax paper)	300
Subtotal	$3,961
Labor	
Bait mixing (45 person hours at $12.20/hr)	549*
Bait placement and changing(120 person hours at ($12.20/hr)	1,464*
Poison station construction and placement	625
Subtotal	$2,638
Total Cost for 15 Weeks of Diphacinone Control	$6,599 ($3,918)*
Live Trapping Control	
Materials	
Mongoose traps (58 traps at $21.74/trap)	$1,261
Sardines, scent lures, etc.	100*
Subtotal	$1,361
Labor	
Trap setting and checking (360 person days (24/wk) at $12.20/hr)	4,392*
Trap placement and removal (16 person hours at $12.20/hr)	195*
Subtotal	$4,587
Total Cost for 15 Weeks of Live Trapping Control	$5,948 ($4,687)*

*Recurring yearly cost.

Movements

The mean male movement between traps (761 m) was larger than that of females (516 m), consistent with most previous research, although sample size for males was small (Table 2). Keith (1987) found a mean home range radius for male mongooses in Hawai'i in the spring of 725 m and a mean for females of 400 m. In the fall, comparable figures were 375 m for males and 400 m for females. Mongooses have reproductive peaks from February to March and May to July in Hawaii (Baldwin et al. 1952), probably influencing male movements. Availability of seasonal foods may also influence movements in some areas. Mongooses are known to have overlapping home ranges rather than defended areas (Nellis 1989), a possible adaptation to availability of inconsistent but locally abundant food. Movements of radio-telemetered animals of over a mile to newly available garbage or other foods have been noted (J.O. Keith, pers. comm.).

Diphacinone Bait Consumption

Toxic bait was consumed by black rats *(Rattus rattus)* and a variety of invertebrates (e.g., various fly larvae, western yellowjackets *[Vespula pensylvanica]*, ants *[Hymenoptera]*, rove beetles *[Staphylinidae]*, and earwigs *[Dermaptera]*). In addition, bait weight changes resulting from dehydration or hydration made it impossible to present accurate information related directly to mongoose bait consumption. However, it was evident that at some poison stations, significant toxic bait use continued throughout the 15 weeks of poisoning in 1993-94 (Table 3). A few stations showed large amounts (>150 g) of toxic bait consumed in 10-14 of the 15 weeks, but most stations showed 0-2 periods in which large amounts of toxic bait were eaten. It is likely that some of the large quantity consumption was by rats, which are considerably more resistant to diphacinone than mongooses. This seems especially likely at stations where use was nearly continual throughout the 15 weeks. Rats were captured after poisoning ceased at three of the six stations showing 10-14 weeks of high bait use (Table 3). However, high toxic bait consumption also occurred even after many weeks of poisoning at stations with little previous use (Table 4), suggesting that mongooses (especially males with larger home ranges than females or more sedentary rats) were likely to move into the area at any time.

Economics

Because lean hamburger is expensive and a continuing cost of control, the price of controlling mongooses with diphacinone is relatively high (Table 5). However, this expense is offset by relatively low cost of labor, since there are no animals to handle and toxic bait can be changed once per week. Mongoose control by trapping is initially expensive because of the cost of traps, but these may be reused for several years. Labor to effect control with trapping is high, because traps must be checked three times per week for humane treatment of animals and replacement of bait. Use of long-lasting lures (fish oil scent in paraffin) has reduced the need to change baits in traps. Unlike PVC poison stations, traps should be removed from the field each year and set out during the next Nene breeding season to increase trap life and efficiency of use.

Conclusions

For the first time in several years, two Nene goslings were raised to adult size by their parents in the Kipuka Nene area in 1993-94. Another young bird reached 10 days of age at Kipuka Nene campground, at which time cold and wet weather may have caused an early death. While Nene production cannot be directly tied to the predator control test, there had been no sustained predator control in the area until 1993-94 (the 1992 toxicant test lasted only 20 days, a small portion of Nene breeding season [September-April]).

Mongoose control should be conducted over as large an area as practical because of the mobility of mongooses and the potential damage that can be done by even one animal. Control should also be in effect for the critical period during which birds are vulnerable, often an extended interval for endangered birds. The amount of labor that can be devoted to a large area for a long time seems a key consideration in management of mongooses to protect dispersed and rare species of birds.

Whether a manager uses diphacinone or trapping as a control method seems largely a matter of labor available at low cost. Mongoose control with diphacinone may result in animals surviving in an area for 5 to 8 days longer (the time to death from anticoagulant poisoning) than they would if they immediately entered a trap and were dispatched. However, use of one trap per station may also preclude entry by other animals for at least two days, once the trap is occupied. We captured animals in each of the two traps per station on several occasions in our capture-recapture tests.

Diphacinone bait is unpleasant to work with when it is infested with maggots and yellowjackets. The use of insecticides at toxicant stations could reduce the insect life attracted to aging hamburger. Killing mongooses directly is less attractive to many managers than poisoning. Disposal of carcasses at landfills or through burial is legal, but it is another essential step in the process if trapping is used for control. Finding a cheaper bait than lean hamburger, now required on the diphacinone label, and reducing the signing and other label requirements that cost money and take time, could also tip the balance toward use of the toxicant in operational control by the land manager.

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Paradise Pursuits Update

by Wendy Johnson

As of press time, over 20 high schools across the state had applied to participate in the 1994-'95 Paradise Pursuits program. Dedicated teachers have been assembling student teams and gearing up to coordinate the study of resource materials supplied by the Hawaii Audubon Society and other generous contributors. Eager to learn more about our unique island ecosystems and willing to test their knowledge in congenial competition, Hawaii's students have what it takes to make the program a worthwhile and rewarding one.

Each and every one of Kaua'i's public high schools will be represented in Paradise Pursuits for the first time this year, a great goal for all the islands to shoot for in the future. DOE students from Moloka'i will also be participating this season, another first for the program. We have been very pleased to hear from new coaches who are excited about the program and also from the returning coaches who state that their biggest problem has been narrowing down the field of interested students to three team members and who will "man" the buzzers at quiz time.

A noteworthy addition to the list of Paradise Pursuits Primary Resources supplied to each school for 1994-'95 is provided by a generous contribution from Bess Press. Thirty hardcover copies of Susan Scott's *Plants and Animals of Hawaii* are being distributed to participating schools this fall. This book has proven in past seasons to be both interesting and informative for the students, as well as an excellent source of question material for the Paradise Pursuits staff. A warm mahalo to Buddy Bess of Bess Press for his sincere commitment to publishing and distributing educational material on Hawaii and for Hawaii.

Research Grants

The Hawaii Audubon Society makes grants for research in Hawaiian or Pacific natural history. Awards generally do not exceed $500 and are oriented toward small-scale projects within Hawaii. Special consideration will be given to those applicants studying dryland forests and aeolian systems on Hawai'i.

The deadlines for receipt of grant applications are 1 April and 1 October. For an application form send a self-addressed stamped envelope to Grants, Hawaii Audubon Society, 1088 Bishop Street, Suite 808, Honolulu, HI 96813. For more information, call Phil Bruner, (808) 293-3820 (W).

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T-shirts for Sale

The Hawaii Audubon Society has a stock of T-shirts designed to spread the Audubon message. Not only are they attractive personal apparel, but they make excellent presents as well.

T-shirts bearing the Society's 'Elepaio logo are available in blue spruce and mountain rose with a black design. We also have a few in ash (gray). In addition, the "hot" Kolea (Pacific Golden Plover) T-shirts are also available. This T-shirt is white with a three-color design of the Kolea and native hibiscus. Proceeds from the Kolea T-shirt go to help HAS fund research on shorebirds in Hawai'i and elsewhere in the Pacific region.

T-shirts are $12 each, plus $2.00 per shirt for postage. They are available in medium, large, and extra large adult sizes only. When ordering T-shirts, be sure to list size and first, second, and third choice of color. To order T-shirts send your check, payable to the Hawaii Audubon Society, to Yvonne Izu, 1957 Alai Place, Wahiawa, HI 96786. Don't forget to add $2.00 per shirt for postage. Insufficient postage will delay your order until the proper amount is remitted. T-shirts are not available at the HAS office.

HAS Dues for 1995

All amounts are in U.S. dollars.
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(Includes delivery of *'Elepaio* and *Audubon Magazine* as bulk or 2nd class mail to U.S. zip codes. Renewal, $30 annually.)	

Christmas Counts Need Your Help

Participants are needed to make the annual statewide Christmas counts a success. This is a sincere plea for help. You do not need to be an expert birdwatcher or ornithologist to participate. The general meeting on 5 December (see Calendar on page 80) will discuss the history and importance of the Christmas bird counts.

Information collected during the counts will be compiled and submitted for publication in *Audubon Field Notes*, a magazine which includes the Christmas count volume and four other seasonal issues reporting bird observations throughout North America and Hawaii. Participants' fees ($5 per person) go entirely to help offset the cost of publishing the Christmas count issue.

Christmas bird counts in Hawaii have been a longstanding tradition and one of the Hawaii Audubon Society's favorite annual field and social events. Bird counting will be done in towns, suburbs, wetlands, sea cliffs, beaches, grasslands, mountains, and forest.

Following are a list of the counts and the person to contact for more information and to sign up. As of press time, some dates had not been finalized.

Hawai'i Island

North Kona. Saturday, 17 December. Contact: Reginald David, 329-9141 (W).

Volcano. Contact: Larry Katahira, 967-8226. Participants wishing to go with the party to Kulani Correctional Facility must get their social security number and birthdate to Larry Katahira no later than 30 November.

Kaua'i

Kapa'a. Wednesday, December 28. Contact: Barbara Stuart, 826-9233 (H).

Waimea. Sunday, 2 January. Contact: Kate Reinard, 335-9975 (W).

Maui

Pu'u O Kaka'e. Contact: Fern Duvall, 572-1584 (H).

Moloka'i

Kualapu'u. Contact: Nature Conservancy on Moloka'i, 553-5236, or Lynn Carey on O'ahu, 262-0254 (H).

O'ahu

Honolulu. Sunday, 18 December. Contact: Tony McCafferty, 523-1940 (W) or 833-0812 (H).

Waipi'o. Tuesday, 20 December. Contact: David Bremer, 623-7613 (H) or 224-9384.

Calendar of Events

First Thursday of Every Month
Monthly meeting of the Education Committee, 7:30 p.m., at the Coffee Line, 1820 University Avenue (in the YWCA). To join or for more information call Emily Gardner, 734-3921 (H). The Committee is actively seeking new members to work on the 1994-'95 Paradise Pursuits Program. All are welcome.

Monday, December 5
General membership meeting to discuss history of Hawaii Christmas bird counts and plans for this year's counts. Learn how you can participate and see slides of interesting species. Paki Conference Room, Bishop Museum, 7:30 p.m. Refreshments will be served.

December 17-January 2
Annual Christmas bird counts, see story on page 79.

Monday, December 12
Annual Meeting and Election of Officers and Directors, 7:00 p.m., immediately followed by Board meeting, 7:15 p. m., HAS office.

Wednesday, January 4
Monthly meeting of the Conservation Committee, 6:30 p.m., at the Coffee Line, 1820 University Avenue (in the YWCA). To join or for more information call Andy Cowell, 944-6421 (H).

Sunday, January 8
Field Trip to Ka'ena Point Natural Area Reserve. There is a 2 1/2-mile hike each way. Bring hiking shoes, rain gear, sun screen, lunch, water, and binoculars and/or spotting scope. This hike features native plants, whales, monk seals, and birds (including the possibility of nesting Laysan Albatross). Meet at 7:00 a.m. at the State Library on Punchbowl Street or 8:15 a.m. at the end of Yokohama Bay Beach Park. For more information call trip leader Lance Tanino, 247-5965 (H), Monday or Thursday evening. Suggested donation: $2.00.

Monday, January 9
Board meeting, 7:00 p.m., HAS office.

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Notice: Effective in 1995, there will be nine issues of *'Elepaio* annually. This is a combined issue, for December 1994 and January 1995. The next issue you will receive is February 1995.

Moving?

Please allow four weeks for processing address changes. Because our records are kept in order by zip code, we need both old and new addresses.

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