

THE NEST, EGG, YOUNG, AND ASPECTS OF THE LIFE HISTORY OF THE ENDANGERED HAWAII CREEPER

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The Hawaii Creeper (*Oreomystis mana*), an endangered species (USF&WS 1975), occurs only on the Island of Hawaii and is limited to higher forests in a patchy distribution (J.M. Scott pers. comm.). The bird is about 11-13 cm long, drab-green with a whitish throat and a slightly decurved bill (Scott et al. 1979). The species is not known to be sexually dichromatic (Scott et al. 1979) but we and others have noticed plumage variation among adults.

Very little is known of the breeding biology of this species (Berger 1981). Only recently have even partial nests and their placement been described (Scott et al. 1980, Sakai and Ralph 1980). We report here, for the first time, on a successful Hawaii Creeper nest and its eggs and young.

STUDY AREA AND METHODS

The nest was found in the Kilauea Forest Reserve 16 km NNW of Hawaii Volcanoes National Park headquarters, on 11 August 1980. The nest was 14 m high in an 18 m Ohia (*Metrosideros collina*) tree with a diameter at breast height of 28 cm. The nest tree was in an undisturbed, closed-canopy forest of Ohia and Koa (*Acacia koa*) trees at 1690 m elevation, about 40 m from the edge of Keauhou Ranch, a forest disturbed by logging and grazing. The understory vegetation consisted of mainly tree fern (*Cibotium* spp.), pilo (*Coprosma* spp.), ohelo (*Vaccinium* spp.), Olapa (*Cheirodendron trigynum*) and other native plants.

We observed the nest for 48.3 hours from a blind 30 m from the nest tree using spotting scope and binoculars. In addition, we made five climbs for nest checks. These checks were conducted towards the end of incubation and into the brooding period during optimal weather conditions in an effort to cause as little disturbance as possible.

RESULTS

Distinguishing Features of This Nesting Pair

Although these birds were not color banded, we were able to recognize them individually and later determine their sex. The female was paler with an overall green-yellow tinge to her back and breast, and a distinct white throat. The male had no yellow tinge to its back and breast, and a dull gray-white

throat. The male sang near the nest during the nest building and incubation period, and once chased a banded Hawaii Creeper that intruded into his territory. As in the Common Amakihi (*Hemignathus virens*) (van Riper 1978), only the female incubated and brooded, and only she solicited food from the male during the nest building, incubation and brooding stages of the breeding cycle.

The Nest

The nest was cup-shaped, in the crotch of three small (3 to 4 cm diameter) vertical branches, and was sheltered from above by foliage (Figure 1). The measurements were nest rim thickness, 1.0 to 1.7 cm; outside diameter, 9.1 to 13.2 cm; height, 9.3 cm; inside diameter, 5.2 to 6.1 cm; and cup depth, 3.2 cm.

The outside nest wall was well camouflaged with mosses and liverworts, which also grew on the branches supporting the nest. The body of the nest consisted primarily of liverworts and various parts of ferns, and the cup was lined with *Cheirodendron* branch fibers (Table 1). The nest has been deposited with the U. S. National Museum (No. 47765).

Nest Building

Nest construction probably lasted about 14 days (Table 2). When discovered, the nest was 2 to 4 cm high with distinct holes in the wall. We estimated it to have been 3 days old.

The female did most of the nest construction. The male brought nesting material only once at the beginning of construction. The female worked nesting materials into the nest by moving her head sideways or up and down and then rotating her body. In the 122 trips to the nest that we observed, she carried the following nesting material: *Cheirodendron* fiber (n = 16); moss and liverwort (n = 83); rootlet (n = 3); *Metrosideros* bark (n = 3); lichen (n = 4); no visible nesting material (n = 10); and parts of spider egg casing (n = 3).

The female obtained all nesting materials 8 to 50 m from the nest tree in the following situations: (1) the female gathered moss and liverwort from the trunk of *Metrosideros* trees at heights of 1 to 3 m; (2) she obtained lichen from fallen *Acacia* limbs and from branches of 23 m *Acacia* trees; (3) she plucked rootlets from the ground along feral hog trails; (4) she gathered *Cheirodendron* branch fibers by prying the loose, dead bark of small branches then plucking the dangling fibrous strands (in one observation, she plucked five strands of fiber before flying to the nest); and (5) she obtained spider webbing from egg casings found under *Metrosideros* and *Acacia* foliage (webbing was not seen in the bird's beak, but her immediate flight to the nest with no visible nesting material, and much head movement at the nest, suggested to us that webbing was being incorporated into the nest as Sakai and Ralph [1980] reported).

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Flights to the nest to deposit nesting material were not direct; the adults always landed 0.5-1.5 m below or above the nest, then hopped and flew to the nest. They were always silent in flight near the nest.

We observed courtship feeding on 15 and 21 August. In both instances, before being fed, the female arranged nesting material in the nest as the male foraged nearby. She flew from the nest to a perch about 2 m from the male, and began to beg. She emitted several "sweet-sweet" calls and quivered her wings, with her head protruding slightly forward. The male perched next to the female and, after a slight pause, fed her. He continued foraging after the feeding bout, and the female returned to continue nest construction.

Table 1. The taxa of plants and, in parentheses, the materials used in construction of the Hawaii Creeper nest.

NEST LINING	Abundance ¹
Vascular plants	
<i>Cheirodendron trigynum</i> (branch fibers)	+ + +
<i>Grammitis</i> sp. (rhizomes)	+
NEST BODY	
Vascular plants	
<i>Acacia koa</i> (phyllodes)	+
<i>Metrosideros collina</i> (leaves)	+
<i>Metrosideros collina</i> (bark)	+ +
<i>Uncinia uncinata</i> (sedge leaves)	+
<i>Cheirodendron trigynum</i> (bark)	+
Ferns and fern allies	
<i>Cibotium glaucum</i> (hair)	+ + +
<i>Cibotium</i> spp. (trunk fibers)	+ + +
<i>Grammitis</i> sp. (rhizomes)	+ + +
<i>Adenophorus</i> sp. (rhizomes)	+ + +
Family Hymenophyllaceae (rhizomes)	+ + +
Bryophytes	
<i>Jamesoniella</i> sp. (liverwort)	+ + +
<i>Leucobryun gracile</i> (moss)	+
<i>Homaliodendrom flabelatum</i> (moss)	+ +
<i>Lepidozia</i> sp. (liverwort)	+ + +
<i>Bazzania</i> sp. (liverwort)	+ + +
<i>Campylopus</i> sp. (?) (moss)	+
<i>Acroporium</i> sp. (?) (moss)	+
<i>Frullania</i> sp. (liverwort)	+
<i>Usnea</i> sp. (lichen)	+
Bryophytes (pieces of approx. 6 other species)	+

¹ + + + Dominant components used in construction (n = 26).

+ + Species in low numbers (n = 10-25).

+ Species present only as traces (n = 1-9).

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Table 2. Summary of the nest observations of Hawaii Creeper.

Days of cycle	Observation date (1980)	Hours: minutes of observation	Nest status
1, 2	9-10 Aug	—	estimated first day of nest building
3	11 Aug	1:00	nest building—nest discovered
4,5	12-13 Aug	5:02	nest building
6	14 Aug	—	no nest observation
7	15 Aug	1:00	nest building
8, 9	16-17 Aug	—	no nest observation
10, 11	18-19 Aug	2:00	nest building
12	20 Aug	—	no nest observation
13, 14	21-22 Aug	3:00	nest building
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15, 16	23-24 Aug	—	no nest observation—suspect eggs were laid
17 to 20	25-28 Aug	6:00	incubation
21 to 24	29 Aug-1 Sep	—	no nest observation
25, 26	2-3 Sep	2:30	incubation
27	4 Sep	1:30	incubation—first nest check
28	5 Sep	1:00	incubation
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29, 30	6-7 Sep	—	no nest observation
31	8 Sep	3:00	brooding—second nest check
32	9 Sep	2:10	brooding
33	10 Sep	1:30	brooding—third nest check
34, 35	11-12 Sep	5:07	brooding
36, 37	13-14 Sep	—	no nest observation
38	15 Sep	2:00	brooding—fourth nest check
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39, 40	16-17 Sep	2:30	no brooding
41	18 Sep	2:30	no brooding—last nest check
42 to 44	19-21 Sep	—	no nest observation
45 to 48	22-25 Sep	6:30	no brooding
49	26 Sep	0:45	fledged—at 1530 both juveniles were about 8 m from the nest tree

Eggs

The two eggs were virtually identical in color. The background was dull white with a faint blue tinge. Brown splotches formed a dense cap around the larger end of each egg with scattered, irregularly shaped brown speckles covering the remaining surface (Figure 1). The eggs measured 20.1 × 14.6 mm and 19.2 × 14.1 mm.

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Incubation

If Hawaii Creepers lay one egg per day like the Common Amakihi (van Riper 1978), then the eggs of this pair were probably laid on 23 and 24 August (Table 2). The incubation period was either 13 or 14 days, and only the female incubated. During 660 min of nest observation, excluding our nest checks, the female made 19 trips off the nest for an average of 1.73 trips per hour and an average time off the nest of 299 sec (range 10-682 sec.; S.D. = 210 sec). The average female attentive period was 1469 sec (range 303-4163 sec; S.D. = 1213 sec). She left the nest 11 times to be fed by the male. Only once, during a moderate drizzle, did the male fly to the nest to feed the incubating female. Near the nest tree the male always emitted a soft, single note "sweet" and the female responded with wing quivers and begging calls before flying off silently to join her mate. The female was not totally dependent on the male for food; she left the nest eight times to forage within the nest tree or in a tree 8-12 m away.

Parental Care of the Young

The period of brooding, or the covering of the young (Pettingill 1970), lasted approximately 9-10 days (Table 2). Only the female brooded. During 827 min of observation, excluding our nest checks, she left the nest 31 times for an average of 1.38 trips per hour; time off the nest averaged 418 sec



Figure 1. Hawaii Creeper (*Oreomystis mana*) nest and egg photographed 16 km NNW of Hawaii Volcanoes National Park headquarters, Hawaii, on 4 September 1980.

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(range 5-1320 sec; S.D. = 313 sec). The average female attentive period was 837 sec (range 6-2520 sec; S.D. = 599 sec). During this stage, the female left the nest to forage and was no longer dependent on the male for food. The male did provide some food for the female and nestlings, by regurgitating into their throats. He always fed the female before the nestlings. During the entire period, the male fed the female and young a total of 24 times, an average feeding rate of 1.14 visits per hour and an average visit of 42 sec (range 9-180 sec; S.D. = 37 sec) at the nest.

Once, when the nestlings were about 9 days old and the female was away, a heavy drizzle occurred and the male flew to the nest and fed the nestlings, but did not brood them.

Table 3. Developmental patterns of two Hawaii Creeper nestlings.

Date of nest check	8 Sep 80	10 Sep 80	15 Sep 80		18 Sep 80	
Figure			2			
Estimated age (days)	1 to 2	4 to 5	8 to 9		11 to 12	
Size of nestling	1 larger about 30%	1 larger about 20%	1 larger about 10%		1 larger about 10%	
Head movement	larger-yes smaller-no	yes-both	yes		yes	
Begging response	larger-yes smaller-no	yes-both	no		no	
Oral cavity color	bright orange- pink	orange- pink	not determined		not determined	
Status of eye	closed	closed	open		open	
Egg tooth present	yes	no	no		no	
Beak color	bright yellow	yellow	light yellow		brown-yellow	
General body characteristics	naked	naked	partly covered		covered	
Cowering response	no	no	yes		yes	
Fecal sac in nest	0	0	1		2	
Feather tract location ¹	<u>all</u>	<u>all</u>	s, h <u>s,h</u> <u>c, f</u>		s, h <u>s,h</u> <u>c, f</u>	
Feather type	down	down	pin feather	down	feathered ²	pin feather
Color of feather	gray	gray	gray	gray	gray- green	gray- green
Body feather cover (%)	1-2	5-10	20	60	30	70

¹c = capital, s = spinal, h = humeral and f = femoral

²with basal shaft in sheath

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The post-brooding period lasted 11 days before the nestlings fledged (Table 2). During 8 days of observation in this stage, both adults searched for food and fed the nestlings. In 690 min of observation, excluding our nest checks, both adults made 21 feeding visits to the nest, or 1.82 trips/hr. The female made 10 of the visits, (\bar{X} = 0.87 trips/hr with an average attentiveness of 28 sec at the nest (range 15-59 sec; S.D. = 14 sec). The male made 11 trips (\bar{X} = 0.95 trips/hr), and had an average attentiveness of 19 sec (range 13-31 sec, S.D. = 6 sec).

During observations of the brooding period and the first 3 days of post-brooding, the male and female together removed nine fecal sacs, an average removal rate of 0.70 trips per hour. The nest remained clean throughout the nesting cycle. Five days before fledging, both nestlings were observed defecating over the nest rim.

About 5 to 6 days before fledging, both young actively flapped their wings. Three days before fledging, the young repeatedly left the nest to perch on nearby branches.

On the day of fledging, approximately 35 days after the eggs were laid, both juvenile creepers were 8 m from the nest tree being fed by the parents.

Nestling Development

We determined the nestlings' developmental patterns during the four nest checks (Table 3). On the initial check, no egg shell fragments were found in the nest, nor on the ground below the nest. The larger of the 1-2 day old nestlings lifted its head straight up and gaped. The bare skin of the nestling through day 9 (Figure 2) was orange-pink. On days 11-12, both nestlings were covered with feathers preventing a view of the body.

Fecal sac analysis. Using the methods of S. Nagata and C.P. Ralph (ms), we collected three fecal sacs from the nest and analyzed them microscopically to help identify the ingested foods. Invertebrates were the only items found in the sacs (Table 4).

Breeding Season

All known observations, many previously unpublished, of nesting attempts by the Hawaii Creeper indicate that the creeper has a protracted breeding season of about 7 to 8 months, from January into summer (Table 5).

Adult Behavior During Nest Checks

The behavior of the adults during nest checks changed as the nesting cycle progressed. Both adults were very aggressive towards the climber during the later part of the incubation period. The level of aggression declined as the nestlings grew older.

On the first check the female flew off the nest when the tree was first touched by the climber. She emitted several harsh "whit-whit" calls in flight and continued calling while perched in the nest tree, quite close to the climber.

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Table 4. Contents of fecal sacs of Hawaii Creeper.

Order	Number of individuals	Parts found
Arachnida	10	larva mandibles, spiracles, head parts
Lepidoptera	7	fangs, legs, pedipalps, or chelicerae
Homoptera	1	adult-abdominal structure
Coleoptera	1	larva mandibles, leg pieces
Chelonitheda	1	pinchers
Neuroptera	1	larva mandibles
Diptera	2	whole larva, head, antennae, wings
Hymenoptera	1	wings, head, thorax
Homoptera or Hemiptera	3	ovipositors
Unknown insect	2	sclerotized skin with spine

Table 5. Known nesting attempts of the Hawaii race of the Hawaii Creeper.

Date found	Reported or found by	Nest location	Tree species	Height (m) nest/tree	Nest type ¹	Initial/final status of nest ²
Feb 1975	Scott et al. (1980)	Kilauea Forest	<i>Acacia</i>	11/23	cavity	b/u
Jan 1978	Sakai & Ralph (1980)	Keauhou Ranch	<i>Acacia</i>	13/19	cupped	b/u
Feb 1979	A. Taylor	Kilauea Forest	<i>Metrosideros</i>	14/23	cavity	b/u
Feb 1979	A. Taylor	Kilauea Forest	<i>Acacia</i>	17/20	cupped	b/u
Feb 1979	C.J. Ralph	Kilauea Forest	<i>Acacia</i>	13/19	cupped	b/u
Mar 1979	C.J. Ralph	Kilauea Forest	<i>Acacia</i>	19/22	cupped	b/u
Apr 1979	H. Sakai	Kilauea Forest	<i>Acacia</i>	13/22	cupped	b/u
May 1979	D. Breese	Kilauea Forest	<i>Metrosideros</i>	14/15	cupped	b/u
Aug 1980	This nest	Kilauea Forest	<i>Metrosideros</i>	14/18	cupped	b/s

¹Cavity nests are nests in crevices or holes in trees and cupped nests are "nests elevated, without structure, consisting of loosely assembled materials arranged and compacted to form a cup" (Pettingill 1970).

²b/u = building/unsuccessful; b/s = building/successful

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The male immediately flew into the nest tree to join in the vocal display. Both birds flew from branch to branch as the observer peered into the nest. The female approached the observer to within 0.5 m, with an average distance of 2 m.

During the second check, the female flew off the nest to perch in an adjacent tree, about 4 m away. She called "whit-whit" several times, both while flying and perched, but stopped after about a minute. She remained in the adjacent tree, hopping and calling occasionally, and did not appear excited. The male was not present during the check.

On the third check, the female flew off the nest calling several times then disappeared in the forest canopy. The adults were not present during the rest of the check. No adults were at or near the nest on the fourth and fifth checks.

Other Behavior

Head scratching. On several occasions, we observed both adults using the indirect method to scratch the nape area. They accomplished this by extending the wing away from the body and passing the leg over the wing to scratch.

Intraspecific behavior. On 18 August, while the female worked in the nest and the male foraged 8 m from the nest tree, another male creeper sang twice 20 m away. The foraging male immediately showed some agitation by hopping and flying from tree to tree while singing and calling. The intruder, a



Figure 2. Hawaii Creeper nestlings about 8 to 9 days old; photo taken 15 September 1980.

color-banded bird, sang twice more and the nesting male flew towards the intruder, but no physical contact was made. The intruder immediately left its perch and was driven off with the defender in pursuit; an exchange of raspy, rapid "whit-whit" calls from both birds followed. During this entire episode, the female continued work in the nest.

Interspecific behavior. On 18 August, an liwi (*Vestiaria coccinea*) and, on 26 August, an Apapane (*Himatione sanguinea*) foraged on flowers in the nest tree, approximately 2 m from the nest, but the incubating female showed no reaction.

Food Items Taken

A few observations of food taken by adults during the nesting cycle showed their preference for animal food.

Worms. Once the female obtained an earthworm (about 5 cm long) while foraging on a moss-covered, dead *Metrosideros* branch. She ate it by grasping it in her foot then tearing off portions. The male once plucked a light gray larva (about 1 cm long) from a Kawau (*Ilex sandwicensis*) leaf, and the female plucked a green worm (about 1 cm long) from a *Metrosideros* leaf. In all instances, the creepers pecked the worms against a branch before eating them.

Land snail. Once the female obtained a snail (about 0.5 cm long) from the underside of a *Metrosideros* leaf and consumed pieces of it after pecking and probing through the shell.

DISCUSSION

In the past 5 years, U. S. Forest Service researchers spent approximately 5000 person-days in the Keauhou Ranch and 1800 person-days in the Kilauea Forest Reserve. Keauhou Ranch is open-canopy forest grazed by cattle and logged for *Acacia* for many years. Kilauea Forest Reserve is an unlogged, ungrazed, closed-canopy forest with predominantly mature *Metrosideros* and *Acacia* trees. Despite these greater efforts in Keauhou Ranch, only one Hawaii Creeper nest has been found, as compared to eight in the Kilauea Forest Reserve (Table 5). Although the sample is not large, this difference suggests either that the nesting rate is much higher in the unlogged Kilauea Forest or that creeper nests in the logged and more open Keauhou Ranch are more difficult to locate. During and following the breeding season throughout the years, we have observed young creepers in the Keauhou Ranch.

The breeding biology of the creeper is very similar to the closely related Common Amakihi that was studied by van Riper (1978). A question might be raised as to why the Hawaii Creeper is found in low numbers and the Amakihi is very common (Berger 1981). We believe that this difference lies in their feeding strategy. The Amakihi is basically a generalist (van Riper 1978, C.J. Ralph pers. comm.) feeding on flowers, fruit and insects on bark and leaf surfaces. The Hawaii Creeper, however, is more specialized (C.J. Ralph pers.

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comm.), foraging mostly on bark. There is an ever increasing alteration of native forest habitat caused by dieback of the native *Metrosideros* forest (Pettyeys et al. 1975), logging and grazing (Berger 1981). These habitat disturbances are most likely to affect a specialist (Fisher 1958).

SUMMARY

Very little is known of the breeding biology of the Hawaii Creeper (*Oreomystis mana*). This is the first report of a successful nest of this species. We found the cup-shaped nest in the Kilauea Forest Reserve, Hawaii, at 1790 m elevation, built in an Ohia (*Metrosideros*) tree. The nest consisted primarily of liverworts and tree fern fibers and hair, with Olapa (*Cheirodendron*) branch fibers lining the cup. Nest-building, done mostly by the female, took approximately 14 days. Only the female incubated the two eggs, which hatched in approximately 13 days. She brooded for 9 or 10 days while the male provided some of her food. After an additional 11 days, both nestlings fledged. The species showed a protracted breeding season of about 7 to 8 months, probably from January to July or August.

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Immature (above) and adult (below) Hawaii Creepers

Sketch by Narca Moore