



## On the foraging behavior of the Kaua'i 'Akepa

Craig W. Benkman

The 'Akepa (*Loxops coccineus*) has asymmetric jaw musculature, and its mandibles are asymmetric at the tip (Richards and Bock 1973). How 'Akepas use their mandibles to forage, however, has not been recorded. Richards and Bock (1973) suggested that 'Akepas forage in a manner similar to that previously described for crossbills (*Loxia*), which also have asymmetric jaw musculature and mandibles. Unfortunately, the descriptions they relied on do not apply to North American crossbills (Benkman 1987a), nor may they even apply to other crossbills in general. I had made extensive observations of foraging crossbills (Benkman 1987a,b) and I was interested to determine how the 'Akepa foraged. On 11 March 1986, I observed one 'Akepa near Pu'u O Kila Lookout, Kaua'i, foraging on about ten leaf buds of *Metrosideros collina* before it flew out of view. I was five to eight meters from the bird while I watched with 10x50 binoculars.

The 'Akepa laterally abducted its lower mandible to the side to spread apart the imbricated leaves of *Metrosideros* leaf buds (see Fig. 3 in Benkman 1987a), apparently to expose insects hidden between the leaves. The head was not twisted to separate the leaves as had been suggested (Richards and Bock 1973). Several leaves may be separated in each bud. It was not clear how the 'Akepa initially got its bill between the overlapping leaves before laterally abducting its mandibles. Presumably, 'Akepas force their pointed bills between the leaves.

Crossbills also laterally abduct their mandibles, but to separate conifer cone scales and expose seeds (Benkman 1987a). Foraging crossbills orient with their bills parallel to the long axis of the cone scales. The lower mandible pushes toward the cone axis and the upper mandible forces the overlapping scales away from the cone axis. 'Akepas may orient to the buds in an analogous fashion. 'Akepas, like crossbills, probably only laterally abduct their lower mandibles to the side to which they point. The jaw muscles are largest on this side (see Richards and Bock 1973), presumably to increase the force that can be exerted while the mandibles are spread apart laterally.

The similarities in foraging behavior and morphology between 'Akepas and crossbills are not surprising, since lateral abduction enables them to rapidly spread apart leaves and cone scales to expose underlying insects and seeds, respectively. These adaptations apparently evolved in parallel, since the 'Akepa and crossbills are in the same

subfamily (Carduelinae). In fact, at least one other species in the Carduelinae (*Carduelis flammea*) uses lateral abduction when foraging (Benkman pers. obs.). Nevertheless, important differences exist between 'Akepas and crossbills that are related to the structure of the substrates and food items on which they forage. Closed cone scales are tightly secured and the scales can be thick and woody. This is in contrast to the thin, more pliable leaves of *Metrosideros* leaf buds. Thus crossbills require both larger, deeper mandibles and larger muscles to get between the scales and spread them apart. The crossbill's more extreme mandible crossing is essential for providing biting forces to get between the tightly overlapping cone scales (Benkman 1987a, 1988). Their deeper bills also enable them to handle seeds, particularly large seeds, rapidly (Benkman 1987a). On the other hand, 'Akepa can apparently use their pointed bills to push between the leaves, as well as to forage on other substrates (e.g., koa pods, phyllodes, and leaves from a variety of trees [H.F. James pers. comm.]), and their bills are adequate for handling insects. Thus despite some important differences between the behaviors and morphologies of 'Akepas and crossbills, the similarities can be thought of as adaptations to a structurally similar problem.



Juvenile Hawaii 'Akepa

by J. Lepson

## ACKNOWLEDGMENTS

Helen F. James provided helpful comments on this manuscript and an NSF Postdoctoral Grant in Environmental Biology provided funding.

## LITERATURE CITED

- Benkman, C.W. 1987a. Crossbill foraging behavior, bill structure, and patterns of food profitability. *Wilson Bull.* 99:351-368.
- Benkman, C.W. 1987b. Food profitability and the foraging ecology of crossbills. *Ecol. Monogr.* 57:251-267.
- Benkman, C.W. 1988. On the advantage of crossed mandibles: an experimental approach. *Ibis* 129:288-293.
- Richards, L.P. and W.J. Bock. 1973. Functional anatomy and adaptive evolution of the feeding apparatus in the Hawaiian honeycreeper genus *Loxops* (Drepanididae). *Ornith. Monogr. No. 15. American Ornithologists' Union.*

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NATIVE SONS AND DAUGHTERS.  
HAWAIIAN GOOSE.

*Wildlife artist Daniel Van Zyle of Honolulu, has been commissioned by HAS to produce a limited edition of fifty multicolored stone lithographs celebrating the 50th anniversary of HAS.*

*The fifty collector's prints will premiere at the opening reception of the HAS 50th Anniversary Wildlife Art and Photo Exposition hosted by Pacific Island Arts Gallery in Haleiwa, June 17, 1989.*

When Bruce Eilerts asked me to coordinate this year's art exhibition, I was especially excited to learn that 1989 would mark the 50 years of Audubon Society in Hawaii. Here was an opportunity to participate in a project where my talents would be used by Audubon to expand their interests.

This year I hope to add a new dimension to the show by enjoining the resources of Pacific Island Arts Gallery and the Hawaii Audubon Society, to promote the talents of wildlife artists and photographers in Hawaii. Being an artist more than a promotions man, my pet part of this whole project, the part that excites me most, is the opportunity for me to produce a commemorative issue of a stone lithograph for Hawaii Audubon Society's 50th anniversary.

Dating back to the 1700's stone lithography was the first form of reproduction that allowed the artist to draw and produce their own art. Prior to that, an artist drew an image and it was turned over to a craftsman to copy onto a steel plate or woodblock. I liken this to handing over your only child for someone else to raise.

With a stone lithograph, I draw a reverse image directly onto a limestone slab, which is then treated with chemicals.

The stone is then wet with water and a roller charged with a greasy ink is passed over the surface. The lines of the image retain the ink, while the wet surface rejects it. Paper is laid on the stone and hand rolled under pressure, through a press. The inking of the stone is repeated for every color used in the image. After the edition is printed, and all the documentation completed, the artist defaces the image and the image is ground off the stone.

Many of the finest biological illustrations were printed with this process. In this tradition I am producing "Native Sons and Daughters" to commemorate the fifty years Audubon Society has been in Hawaii. After spending New Year's Eve in Haleakala Crater, I have selected a clutch of Nene goslings as the subject for this commemorative lithograph, hence the name "Native Sons and Daughters". I take great pride in producing this lithograph, as it is an opportunity for me to artistically render a unique symbol of Hawaii and at the same time make a contribution to the Hawaii Audubon Society. Proceeds will benefit the Hawaii Audubon Society. If you are interested in reserving a print, please call Sue Callahan at Pacific Island Arts Gallery, 637-7880

*Daniel Van Zyle*

HAWAII AUDUBON SOCIETY  
ANNUAL TREASURER'S REPORT  
31 DECEMBER 1988

In our April 1989 issue, the balance sheet for the report was omitted. That information appears below.

Assets	
Checking Account	\$ 2,998.43
Savings Accounts - general	20,561.85
book reserve	31,725.70
funds	11,484.02
life	12,977.00
Inventory - Hawaii's Birds 4th ed.	26,660.00
Hawaii's Birds 3rd ed.	13,596.87
Pacific Birds	<u>10,266.97</u>
Total equity	\$130,270.84
Retained earnings from 1987	\$128,828.58
Net income from 1988	<u>1442.26</u>
Total	\$130,270.84

## HOOMALUHIA BIRD WALKS

Learn the common birds of Kaneohe on a bird walk at Hoomaluhia. Walks are scheduled for Saturday, May 20, Sunday, May 21, Saturday, August 19 and Sunday August 20 from 7:00 to 9:00 AM. Participants must wear comfortable, sturdy walking shoes, bring their own binoculars and mosquito repellent. Walks start from the Hoomaluhia Visitor Center. RESERVATIONS ARE REQUIRED. For reservations and more information call 235-6636.



*Final drawing, "Native Sons and Daughters. Harems in Goose." Stone Lithograph.*

50th Anniversary Collector's Print by Daniel Van Zyle

## \*\*AUDUBON SOCIETY SEEKS ASSISTANT FOR HAWAII STATE OFFICE\*\*

-- The National Audubon Society seeks qualified applicants for the position of administrative assistant in the newly opened Hawaii State office located in downtown Honolulu. This is a full-time, entry-level position with a salary of \$15,000 per year, plus excellent benefits. Candidates should have demonstrated clerical skills, including word-processing. Previous involvement in conservation activism in Hawaii is a plus, as well as a willingness to learn and work on conservation issues.

The administrative assistant's primary responsibilities will be 1) day-to-day maintenance of the Hawaii State Office and 2) recruiting and training volunteers to serve as phone receptionists, typists, etc.

As time permits, the administrative assistant may assist the Hawaii State Director with conservation and fund-raising by drafting letters and action alerts, assisting with fund-raising administration, and recruiting new volunteer activists.

Candidates should be able to get along with a variety of people. Skill in motivating others will be important.

Interested applicants should request an application form and send a cover letter, resume, and non-returnable writing sample to: National Audubon Society, Hawaii State Office, 212 Merchant Street, Suite 320, Honolulu, HI 96813.

## HELP WANTED

Office manager and staff - The Hawaii Audubon Society would like to establish regular daytime office hours, preferably for several hours a day, three or four days a week. We are looking for a volunteer office manager and others to staff the office. Office duty includes scheduling the use of the office for meetings, preparing and mailing meeting notices, updating membership records, answering phone calls, helping with publicity and fundraising, etc. If you can help please call Lynne Matusow at 528-1432.

## PLOVER WATCH

Pacific Golden-Plovers (*Pluvialis fulva*) have been banded on Oahu, Hawaii and near Nome, Alaska. Each bird wears a United States Fish and Wildlife Service band on one leg (some birds also have a single color band on that leg, and one or more color bands on the other leg. If there is more than one color band, combinations are 2 of the same color, 2 different colors, 3 of 2 colors, or 3 of 3 colors. Observers are asked to note the colors and the exact sequence of all bands on the bird. It is important that we know which leg carries the particular color(s) and, where used together, whether the color band is above or below the metal band. In an effort to improve knowledge of trans-Pacific migration routes and the locations of breeding grounds, premigrants in Hawaii will be color-marked in April 1989. Observers in Alaska and northeastern USSR should be alert to possible sightings of plovers with yellow dye applied to white areas of breeding plumage. Please send observations with as much information as possible to OSCAR JOHNSON, Department of Biology, Moorhead State University, Moorhead, MN 56560, phone (218) 236-2360 or PHILLIP BRUNER, Natural Science Division, BYU-

## KAENA POINT FIELD TRIP REPORT

The 26 February Hawaii Audubon Society field trip was an outing to Kaena Point Natural Area Reserve (NAR) on Oahu's west shore. The field trip was attended by over forty-five participants. The walk to the point started at Yokohama Bay around 9:15 AM under sunny skies with light winds. A pod of Hawaiian spinner dolphins was observed just east of Yokohama Bay and several humpback whales were seen off-shore. Laysan Albatross were sighted flying along the coast and over the sand dunes throughout the outing. Recreational off-road vehicles have been recently prevented from entering the NAR due largely to the efforts of State Division of Forestry and Wildlife personnel. HAS commends the accomplishments of Michael Buck and Dave Smith who are responsible for such efficient management practices. The endangered *Sesbania tomentosa* (ohai) was observed during the field trip and seedlings of this rare species were found growing in the middle of barren, sandy areas previously over-run by off-road vehicles. The regeneration of *Sesbania* and other coastal plants, after the banning of off-road vehicles from the area, shows that adverse recreational impact can be reversed with appropriate management. Other native plants that were encountered included *Achyranthes splendens*, *Gossypium tomentosum* (mao), *Sida fallax* (ilima), *Scaevola frutescens* (naupaka), *Santalum ellipticum* (iliahi aloe), and *Heliotropium anomalum* (ahinahina). In addition to Laysan Albatross, most participants were able to observe Brown Boobies, a Greater Frigatebird, Lesser Golden-Plovers, Wandering Tattlers, Barred and Spotted Doves, Northern and Red-crested Cardinals, Common Mynas, House Sparrows, and Red-vented Bulbuls. The group ate lunch at the Kaena Point Lighthouse and explored the sand dunes and tide pools in the area. Several participants were given an added treat when Dr. Robert Hommon, an archaeologist participating in the outing, pointed out some of the area's archaeological features. The field trip ended back at Yokohama Bay around 1:30 PM.

Bruce D. Eilerts.



Kaena Point Outing Participants

by Bruce Eilerts

**HAS APRIL PROGRAM**

Michael Sherwood of The Sierra Club Legal Defense Fund will speak on the function of his organization in Hawaii on Monday, May 15 at 7:30 PM. He is best known for his role in the protection of the Palila on Mauna Kea.

**CALENDAR OF EVENTS**

- May 8 (Mon.) Board Meeting at HAS office at 7:00 PM. Call Bruce Eilerts for details 599-4795.
- May 15 (Mon.) General Meeting at Atherton Halau, Bishop Museum at 7:30 PM. Program: Sierra Club Legal Defense: Our Role in Hawaii by Michael Sherwood.
- May 25 (Mon.) National Audubon Open House Call 522-5566 for information.

HAS is located at 212 Merchant Street (Arcade Building), Room 320. The building doors are locked at 6:00 PM on weekdays and 4:30 PM on Saturdays. A person will be posted at the Merchant Street door to let you in for meetings. If you are late, please call 528-1432. Parking is available on the street, free after 6:00 PM on weekdays and all day on Sundays (even in the red zones). Check the signs at other times.

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**BEQUESTS**

A bequest to Hawaii Audubon Society is an excellent way to help in our conservation efforts. George Munro, tireless and enthusiastic field ornithologist and naturalist provided for a fund to be used exclusively for the protection of native dry forests. Today, the George C. Munro fund provides monies for research projects on dry forest .

Although an attorney should be consulted in the drafting of your will, a model clause for bequests is set in forth below. "I hereby, give, devise and bequeath to the Hawaii Audubon Society, Honolulu, Hawaii, the sum of \_\_\_\_\_ dollars (or set forth a description of the property), to be used for the general purpose of said organization."

For more information and assistance, contact Hawaii Audubon Society, 212 Merchant Street, Suite 320, Honolulu, Hawaii 96813.

**WISH LIST**

Needed items for the HAS office are a desk, file cabinets and bookcases. If you can donate any of these items, please call the office, 528-1432. All donations are tax deductible to the extent allowed by law.

