

Vegetation and Seabirds on Manana Island, O'ahu, Hawaii

by G. C. Whittow¹, S. Conant²,
D. R. Herbst³, and T. J. Motley⁴

The last comprehensive study of plant species on Manana Island (Rabbit Island) was carried out by Dixon (1973) in 1972. Compared with a previous survey in 1964 (Tomich et al. 1968), there were two species of plants on the Island in 1972 that had not been reported previously from Manana. However, five species recorded in 1964 were not reported in 1972. Consequently, over the eight year period from 1964 to 1972, there was a decline in the number of species identified on Manana.

Since 1972, only isolated observations on the vegetation of Manana have been reported in the literature. Shallenberger (1979) considered that the growth of the common sandbur (*Cenchrus echinatus*), reported to be

on the island by Richardson and Fisher (1950), Tomich et al. (1968), and Dixon (1973), seemed to be inhibiting the nesting activities of Sooty Terns (*Sterna fuscata*). Sweet and Sweet (1985) and Newman (1986) confirmed the presence of the prickly poppy (*Argemone glauca*) on the Island in 1984. In addition, Newman (1986) reported that the seaside heliotrope (*Heliotropium curassavicum*) and alena (*Boerhavia diffusa*) were still growing on the Island. In the same year (1986), Swenson reported the appearance in 1985, of the hairy merremia (*Merremia aegyptia*) on Manana, and noted that it had begun to interfere with the nesting of Sooty Terns. This was confirmed by Whittow et al. (1992) several years later. Swenson believed that the growth of *merremia aegyptia* on Manana was correlated with the disappearance of the rabbits

(the last rabbit was seen on Manana in 1984). Swenson urged future visitors to Manana to record the changes in the Island's vegetation following the demise of the rabbits.

The present report stems from the identification of 14 species of plants on Manana during 1988 and 1989, in the course of seabird studies. The species were identified primarily from color slides and checked against the taxonomic treatment of Wagner et al. (1990) (Table 1). They are divided into species previously recorded from Manana, and species newly reported for the Island. It could not be decided from the slides whether one plant was *cenchrus ciliaris* or *pennisetum polystachion*. It is possible that both species of amaranthus (*Amaranthus spinosus* and *A. viridis*) were on the Island but it is certain that at least one of them was present. The list in Table 1 is not



Fig. 1. Golden crown-beard (*Verbesina encelioides*) growing on the western crater slopes of Manana Island. Photo © G. C. Whittow.

Table 1. Plant species identified on Manana Island in the present study together with the month when the species was photographed. The years in parentheses are the years when the species has been reported (in the literature) to be on Manana.

Family	Species reported previously	New species for Manana
Amaranthaceae		Amaranthus spinosus L. (Spiny amaranth). April, August. and/or Amaranthus viridis L. (Slender amaranth). April, August.
Areaceae	Cocos nucifera L. (Coconut palm). All months (1950, 1955, 1964, 1972).	
Asteraceae		Pluchea carolinensis (Jacq.) G. Don (Sourbush). August. Verbesina encelioides (Cav.) Benth. & Hook. ex. A. Gray (Golden crown-beard). March, April.
Convolvulaceae	?*Merremia aegyptia (L.) Urb. (Hairy merremia). April, August (1986, 1989).	*Jacquemontia ovalifolia subsp. sandwicensis (A. Gray) K. Robertson (Pa'u-o-hi'iaka). March, April, August.
Nyctaginaceae		*Boerhavia repens L. (Alena). August.
Papaveraceae	*Argemone glauca (Nutt. ex Prain) Pope (Prickly poppy). March, April, August (1930, 1964, 1972, 1984).	
Poaceae	Cenchrus echinatus L. (Common sandbur). March, August (1930, 1934, 1936, 1950, 1955, 1964, 1972). Setaria verticillata (L.) P. Beauv. (Bristly foxtail). March (1936, 1955, 1964, 1972).	Cenchrus ciliaris L. (Buffel-grass). August. or Pennisetum polystachion (L.) Schult. (Feathery pennisetum). August. Chloris barbata (L.) Sw. (Swollen fingergrass). March, August.
Portulacaceae	Portulaca oleracea L. (Pig-weed). August (1930, 1934, 1936, 1950, 1955, 1964, 1972)	
Solanaceae	Nicotiana tabacum L. (Tobacco). March, April, July (1930, 1934, 1936, 1950, 1955, 1964, 1972)	

*Native species

exhaustive—no attempt was made to identify every plant species on the Island. Furthermore, some species, eg. merremia, are difficult to find during dry weather. Consequently, the absence of a species in Table 1 does not necessarily mean that the species does not occur on Manana. On the other hand, the identification of a species hitherto unrecorded from Manana is a significant finding in view of previous comprehensive catalogs (Tomich et al. 1968, Dixon 1973). Similarly, the identification of species previously reported from Manana is positive confirmation of their continued presence on the Island.

The most striking feature of the data in Table 1 is the relatively large (7 or 8) number of species on Manana that had not been observed to grow there before. It is not known when, subsequent to 1972, the species became established on the Island, but it is tempting to attribute their appearance to the decrease, and finally disappearance, of rabbits from the Island, as suggested by Swenson (1986). However, accidental introduction by visitors to the Island, or dispersal from O'ahu by wind or birds are other possibilities. Of the species reported in the present study, four (common sandbur, bristly foxtail, tobacco, and pigweed) are known to have been eaten by the rabbits (Tomich et al. 1968, Dixon 1973). Whether the newly-identified species (Table 1) would have been consumed by the rabbits is not known. It is possible that these species had been present on Manana prior to the introduction of the rabbits but there is no evidence for this suggestion.

Of the new species included in Table 1, the golden crown-beard (*Verbesina encelioides*) was the most extensive, covering a large part of the crater. It is a conspicuous plant, (Fig. 1) often a meter or more tall with large yellow flower heads and a strong root system (Wagner et al. 1990). It has the potential of interfering with the flight of Wedge-tailed Shearwaters (*Puffinus pacificus*) within the crater, and also with their burrowing activities. The golden crown-beard is not confined to the crater; at the time of writing this note there is sufficient coverage of the western slopes of the Island to render the slopes yellow, as seen from the shores of O'ahu. Consequently, this species may preclude the nesting of many Sooty Terns (which are found in large numbers on the slopes) as well as Wedge-tailed Shearwaters, nesting on the western slopes. The golden crown-beard is a threat to seabirds elsewhere in the Hawaiian Islands: on Green Island, Kure Atoll, in the Northwestern Hawaiian

Islands, it is considered to be a danger to ground-nesting seabirds such as the Masked Booby (*Sula dactylatra*) and Laysan Albatross (*Diomedea immutabilis*), and also to native species of plants (Kepler, 1969; Woodward, 1972; Fleet, 1974). On Midway also there is extensive invasion of seabird-nesting areas by golden crown-beard (Seto, 1994). The species was naturalized in the Hawaiian Islands prior to 1871 (Wagner et al. 1990).

The seabird species least affected by changes in the vegetation on Manana is probably the Brown Noddy (*Anous stolidus*) which nests on the rocky ridges of the crater where there is little vegetation. However, as a reminder that the relationships between plants and seabird nesting sites are not always simple, the establishment of pluchea (*Pluchea carolinensis*) in the crater gullies on Manana has provided nesting sites for the Black-crowned Night-Heron which preys on Brown Noddy nestlings (Whittow 1992). Increased vegetation and species diversification on Manana may not be entirely deleterious to seabirds: it may provide shade, particularly for Sooty Tern nestlings, and it may help to reduce soil erosion. It may be some time before Manana has relatively stable plant communities; meanwhile it would be interesting to follow successional changes. Because of the potential impact on the seabird colonies it would seem important to monitor the changes in vegetation with a view to controlling the growth of inimical species.

Acknowledgements

We are grateful to the State of Hawaii, Division of Forestry and Wildlife (Department of Land and Natural Resources), and the U.S. Fish and Wildlife Service for permits, and to the National Geographic Society and the Frank M. Chapman Fund for financial support. Special thanks are due to Dr. Michael Fry and Makai Engineering for helping with the boatwork.

Literature cited

Dixon, J.D. 1973. Natural history of a small, insular population of rabbits, *Oryctolagus cuniculus* (L.), in Hawaii. M.S. thesis, University of Hawaii, Honolulu.

Fleet, R.R. 1974. The Red-tailed Tropic-bird on Kure Atoll. Ornithological Monographs No. 16, 64 pp. The American Ornithologists Union.

Kepler, C.B. 1969. Breeding biology of the Blue-faced Booby (*Sula dactylatra personata*) on Green Island, Kure Atoll. Publications of the Nuttall Ornithological Club No. 8, Cambridge, Massachusetts. 97 pp.

Newman, A. 1986. Three field trips to Manana

Island. 'Elepaio 46:101-102.

Richardson, F. and H.I. Fisher. 1950. Birds of Moku Manu and Manana Islands off O'ahu, Hawaii. Auk 67:285-306.

Seto, N.W.H. 1994. The effects of rat predation (*Rattus rattus*) on the reproductive success of the Bonin Petrel (*Pterodroma hypoleuca*). MS thesis in Zoology, University of Hawaii, 92 pp.

Shallenberger, R.J. 1979. Sierra Club Manana Island Trip. 'Elepaio 40:47.

Sweet, P. and J. Sweet. 1985. Manana Island Field Trip-May 1984. 'Elepaio 45:90.

Swenson, J. 1986. "Is Manana Island now "rabbitless" Island? 'Elepaio 46:125-126.

Tomich, P.Q., N. Wilson and C.H. Lamoureux. 1968. Ecological factors on Manana Island, Hawaii. Pac. Sci. 22:352-368.

Wagner, W.L., D.R. Herbst and S. H. Sohmer. 1990. Manual of the flowering plants of Hawaii, Vols. 1 & 2. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publication 83.

Whittow, G.C. 1992. Black-crowned Night-Heron nests on Manana Island. 'Elepaio 52:38.

Whittow, G.C., L.M. Kurata and Q. G. Zhang. 1992. Failure of the 1989 Sooty Tern breeding season on Manana Island, following heavy rain. 'Elepaio 52:36-37.

Woodward, P.W. 1972. The natural history of Kure Atoll, Northwestern Hawaiian Islands. Atoll Research Bulletin No. 164.

¹Department of Physiology
John A. Burns School of Medicine
University of Hawaii
Honolulu, Hawaii 96822

²Department of Zoology
University of Hawaii
Honolulu, Hawaii 96822

³U.S. Army Corps of Engineers
Environmental Division
Fort Shafter, Hawaii 96858

⁴Department of Botany
University of Hawaii
Honolulu, Hawaii 96822

Birders Network

HAS has a list of birders who are interested in informal trips with other members, allowing members to find others to go along with them on their outings—for the sake of safety, to share information on good spots, or simply to increase the fun. If you are interested in putting your name on the list, which would be circulated to all those on the list, call or write HAS, attention Andy Cowell.

Neighbor Island Paradise Pursuits Preliminaries

by Wendy Johnson

Preliminary competitions were held on Maui, Kaua'i, and Hawai'i the first three weekends in March. Hawaii's high school students had the opportunity to test their knowledge about Hawaii's unique ecosystems and the need to protect them.

Maui

Three lively teams from around the island competed at Maui High School for the chance to advance to the semi-finals and finals of Paradise Pursuits. Even the students who had come all the way from Hana that morning were bright-eyed and ready to do their best answering the challenging quiz questions. Baldwin students also showed their determination and skill, but the team from Lahainaluna High School remained undefeated after playing two tough matches against Baldwin High School and Hana High School. Nan Cabatbat, of Haleakala National Park, was a wonderful host who took a personal interest in each of the student participants. After the games, Maui veterinarian consultant and naturalist Renate Gassmann-Duvall arranged for native plant specialist Rene Silva to join Paradise Pursuits staff and participants on a hike to the Iao Tablelands. It was a wonderful opportunity to learn about native plants and habitats.

Kaua'i

Paradise Pursuits games were held at the education center of the National Tropical Botanical Gardens (NTBG) in Lawai. NTBG staff graciously assisted in organizing the event and acted as judges, scorekeepers, and timers. Jan TenBruggencate, environmental journalist for the *Honolulu Advertiser*, hosted the games and added some timely information to the Paradise Pursuits question material. Students from Kaua'i High School and Kapa'a High School agreed to play a two-out-of-three match format to determine which team would be the Kaua'i Champion. And it took three games for Kaua'i High School to come out ahead, with the second game requiring a tie-breaker question to decide the winner. All the students were well-prepared and poised, sharing their impressive knowledge about Hawaii's environment.

Hawai'i

On the Big Island, four teams competed in the preliminary competitions. Several other

Chevron Donates \$15,000 to Oiled Wildlife Recovery Program



From left: Reggie David, Linda Paul, Rick Roberts, Linda Elliott, and Susan Colburn.

by Linda Paul

On 14 March the Chevron Companies provided a grant of \$15,000 to the Hawaii Audubon Society to help continue the work of the Oiled Wildlife Recovery and Rehabilitation Program (OWRRP). Rick Roberts, Manager of Chevron's refinery in Hawaii, presented the check to Linda Elliott, HAS Oiled

Wildlife Program Coordinator. Also present were HAS president Linda Paul, HAS First Vice President Reggie David, Susan Colburn, Chevron Wildlife Biologist, and Dave Young, Chevron's Public Affairs Manager in Hawaii. Chevron has taken the initiative with this program and, in addition to contributing its own funds, continues to look for additional support to keep it going.

high schools were scheduled to participate, but some students had scheduling conflicts and a double case of chicken pox decimated one team. Christian Liberty School from Hilo was the only team new to the Paradise Pursuits program, with St. Joseph High School, Pahoehoe High School, and Parker School all returning. Competitions were held at Parker School in Waimea with Hugh Montgomery, a psychologist and eco-tour leader as host. Hugh did a great job keeping the students relaxed and comfortable. Parker High School was the Big Island winner for the second year in a row, but the individual team members are all new this year.

The current funding will help Elliott complete the oil spill contingency planning process and begin work on the development of a trained oil spill response team. Program goals for 1995 include recruitment and training of a resident response team and volunteers, establishment of a newsletter and a volunteer hotline to keep volunteers informed, and completion of the contingency plan, together with the necessary facilities and supplies. The overall goal of this program is to prepare for and facilitate actual response efforts in the event of a catastrophic oil or hazardous substance spill in order to minimize the damage to Hawaii's wildlife.

Students and teacher/coaches from each winning team flew to Honolulu courtesy of Aloha Airlines on 7 April for semi-final and final competitions which were taped at KITV studios on 8 April. Complimentary hotel accommodations were provided by Outrigger Hotels Hawaii. A big mahalo to these corporations and to all the volunteers on each island who helped make the Paradise Pursuits preliminaries a big success!

high schools were scheduled to participate, but some students had scheduling conflicts and a double case of chicken pox decimated one team. Christian Liberty School from Hilo was the only team new to the Paradise Pursuits program, with St. Joseph High School, Pahoehoe High School, and Parker School all returning. Competitions were held at Parker School in Waimea with Hugh Montgomery, a psychologist and eco-tour leader as host. Hugh did a great job keeping the students relaxed and comfortable. Parker High School was the Big Island winner for the second year in a row, but the individual team members are all new this year.

Students and teacher/coaches from each winning team flew to Honolulu courtesy of Aloha Airlines on 7 April for semi-final and final competitions which were taped at KITV studios on 8 April. Complimentary hotel accommodations were provided by Outrigger Hotels Hawaii. A big mahalo to these corporations and to all the volunteers on each island who helped make the Paradise Pursuits preliminaries a big success!

Kamehameha Wins

As we went to press, we learned that Kamehameha Schools had won the 1995 Paradise Pursuits competition. Full details in the next issue.

Hawaii Audubon Society

1088 Bishop Street, Suite 808
Honolulu, Hawaii 96813
Telephone and FAX (808) 528-1432

Board of Directors

President: Linda Paul,
262-6859 (H)

First Vice President: Reginald David, on
Hawai'i, 329-9141 (W), 329-1245 (FAX)

Second Vice President: Emily Gardner,
734-3921 (H)

Treasurer: Joyce Stanney, 533-0204 (H),
543-0827 (W), 526-0225 (FAX)

Corres. Sec.:

Recording Sec.: Sherilyn Garrett, 924-8037 (H),
921-6535 (W), 921-6715 (FAX)

Directors

Andy Cowell, 944-6421 (H)

John T. Harrison, 263-4863 (H), 956-7361 (W),
262-7795 (FAX)

David Michael Hill, 988-7460 (H)

Wendell Lee, 678-1636 (H), 531-3436 (W),
531-3433 (FAX)

Lynne Matusow, 531-4260 (H)

Janice McCain, 239-1135 (H), 254-2866 (W),
254-6409 (FAX)

Kevin Shaney, 988-5626 (H), 548-4811 (W),
548-6690 (FAX)

Flo Thomas, 536-6124 (H)

Committees

Conservation: Andy Cowell, (as above)

Education: Emily Gardner (as above)

Field Activities:

Finance: Joyce Stanney (as above)

Grants & Scholarships: Phil Bruner,
293-3820 (W)

Membership: Robert Pyle, 262-4046 (H)

Programs: Linda Paul (as above)

Publications: Reginald David (as above)

Publicity: Janice McCain (as above)

Island Representatives

Hawai'i: Reginald David (as above)

Maui: Renate Gassmann-Duvall,
1-572-1584 (H)

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.

Mahalo Donors!

The Hawaii Audubon Society thanks the following members and friends for their generous donations:

Meleana Blaich, Amelia Starr Ceglia, Patricia Engelhard, Michael Fischer, Leonard Freed, Desiree Groesbeck, Jill Jordan, John D. Kronen, Jr., Cathy Lowder, Robert Petersen, Mr. and Mrs. Burton Roberts, Kurt Schwarz, Leon Slawewski, Richard Soehren, Ben Torke, Janis Yamamoto, and Kevin Young.

Science Fair Winners

by Emily Gardner

The 38th Hawaii State Science and Engineering Fair was held 4-8 April at the Neil Blaisdell Exhibition Hall. HAS gave awards to the best junior and senior research projects in the special category of Hawaiian natural history.

Johnathan Eveland, an eighth grader from Mid-Pacific Institute, won the junior award for his project on differences in sand at selected sandy beaches on O'ahu in relationship to geographic features.

Jenny Sakuoka won the senior category. A ninth grader from Leilehua High School, her project identified the subspecies of acacia koa through growth morphology.

HAS Dues for 1995

All amounts are in U.S. dollars.
Includes delivery of 'Elepaio.

Regular Member

Delivery to U.S. zip code addresses

Via bulk mail \$ 10.00

(Not forwardable to new address)

Via first class mail 16.00

(Hawaii residents: there is no significant time difference between bulk and first class mail to addresses within the state of Hawaii.)

Junior Member (18 and under) 5.00

Contributing Member 30.00

Sustaining Member 100.00

Life Member (one-time payment) 250.00

(three annual payments) 100.00, 100.00, 50.00

Benefactor (one-time payment) 500.00

Patron (one-time payment) 1,000.00

Delivery to non-U.S. addresses:

Mexico (airmail only) 16.00

Canada (airmail only) 17.00

All other countries (surface mail) 18.00

All other countries (airmail) 28.00

Introductory dues for

National and Hawaii Societies: 20.00

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

Bird Habitat Reclassified as Conservation

The Land Use Commission has reclassified 195 acres of essential forest bird habitat on the Big Island from the Agricultural District to the Conservation District. W. H. Shipman, Ltd., owns the property located on the slopes of Mauna Kea at Pua Akala, which contains some of the finest strands of koa-ohia forest. This area has been identified as essential forest bird habitat for the Hawai'i Creeper, Hawai'i 'Akepa, 'Akiapola'au, and the 'O'u.

'ELEPAIO

ISSN 0013-6069

Managing Editor:

Lynne Matusow 531-4260

Editorial Assistants:

Robert L. Pyle

Reporters:

Andy Cowell

Distribution:

Christi Moore, Robert Pyle, Alice Zacherle

The 'Elepaio is printed on recycled paper.

Calendar of Events

First Tuesday of Every Month

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).

Monday, May 8

Board meeting, 7:00 p.m., HAS office.

Saturday, May 27

Field trip to Makapu'u Lighthouse. Among the species seen on previous outings to this site are humpback whales, green sea turtles, three species of booby, two species of tropicbird, two species of noddy, Sooty Terns, and a Peregrine Falcon. Meet at the State Library on Punchbowl Street at 7:30 a.m. or along Kalaniana'ole Highway next to the gate on Makapu'u Lighthouse Road at 8:30 a.m. Bring water, sun screen, hat, binoculars, and field scope. For more information call Linda Paul, 262-6859 (H). Suggested donation: \$2.00.

Birding in Hawaii

A two-page guide listing areas on O'ahu where interesting birds may be found and where access is not a problem is now available. Written by Peter Donaldson, it offers important information for birders unfamiliar with Hawai'i. The guide is not designed to give detailed directions or information on bird identification.

Also available is a guide to birding in the Hawaiian Islands which highlights birding spots on several islands.

For a free copy, send a self-addressed stamped envelope to O'ahu Birding Guide, Hawaii Audubon Society, 1088 Bishop Street, Suite 808, Honolulu, HI 96813, indicating which two page guide you want.

Table of Contents

Vegetation and Seabirds on Manana Island, O'ahu, Hawaii.....	23
by G. C. Whittow, S. Conant, D. R. Herbst, and T. J. Motley	
Neighbor Island Paradise Pursuits Preliminaries.....	26
by Wendy Johnson	
Chevron Donates \$15,000 to Oiled Wildlife Recovery Program.....	26
by Linda Paul	
Mahalo Donors.....	27
Science Fair Winners.....	27
by Emily Gardner	
Bird Habitat Reclassified.....	27

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.

HAWAII AUDUBON SOCIETY • 1088 BISHOP STREET, SUITE 808 • HONOLULU, HAWAII 96813

Non-Profit Organization
U.S. Postage
PAID
Honolulu, Hawaii
Permit Number 1156

'ELEPAIO

