



White Tern Nest Sites in Altered Habitat

by Mark J. Rauzon¹ and Karl W. Kenyon²

Habitat alteration through human occupation is rarely thought to benefit indigenous wildlife. We report here on the increase of nest sites made available to White Terns (*Gygis alba*) through the military development of Tern Island (23° 52'N, 166° 17'W), French Frigate Shoals, Hawaii. From 18 February to 26 May 1977, we gathered quantitative data there in the survival or loss of White Tern eggs from all nest substrate types.

French Frigate Shoals is comprised of 12 coral sand islets and the 125 foot volcanic remnant, La Perouse Pinnacle. Construction of an airstrip by the U.S. Navy began in July, 1942 at Tern Island (Amerson 1971). Prior to this time, Tern Island resembled the other sandy islets of the atoll in its vegetation type and lack of nesting White Terns. Only La Perouse Pinnacle provided rock ledge habitat for nesting White Terns (Wetmore 1923).

By March, 1943, the airstrip on Tern Island was completed. The island's length was extended from 1800 feet to 3100 feet and the width standardized at 350 feet by partially surrounding the original islet with 5000 feet of steel sheet pilings. Behind these, coral rock and sand dredged from the surrounding lagoon raised the airstrip to 6.5 feet above mean high tide and enlarged the island area from 11 to 57 acres (Amerson 1971). In addition to the airstrip, buildings were constructed and eventually ironwood trees (*Casuarina litorea*) were planted. During the 1950's and 1960's, naupaka (*Scaevola taccada*) and tree heliotrope (*Tournefortia argentea*) became established. Thus, every surface element, from broken coral rock to vegetation and structures, resulted directly or indirectly from human occupation and manipulation of the island.

Although White Terns were seen flying at Tern Island earlier, the first two eggs were recorded there on the limbs of the ironwood trees in 1965 (Amerson 1971.) This was the first recorded nesting at French Frigate Shoals outside of La Perouse Pinnacle. White Terns build no nest, but lay a single egg on unmodified surfaces where the egg is subject to loss by wind or the sudden departure of the incubating adult. Once the egg hatches, the chick has an excellent chance of surviving wind storms because of its long strong claws which enable it to cling to almost any surface texture (Figure 1).

We obtained observations on 57 eggs. Among these, the ultimate fate of ten eggs was not ascertained because the observation period ended before hatching occurred; 47 eggs were followed from first observation until hatching, fledging or loss (Table 1). At 15 out of 27 locations where eggs were lost, a second and sometimes a third egg was laid. If unsuccessful at first, White Terns sometimes continue breeding efforts by laying replacement eggs over an unusually long period (Ashmole 1968).

Because birds were not marked for recognition, it is not known whether the original pair re-nested or a new pair took over the site. Dorward (1963) assumed that eggs laid in precisely the same site on Ascension Island belonged to the same parents. Ashmole (1968) found that on Christmas Island, where good potential sites were scarce, especially attractive sites were used by several pairs. The same situation may exist on Tern Island. Our limited study did not permit us to obtain survival data for all hatchlings to fledging.

Complete hatching success was observed for three eggs laid on circular spigot valve handles. These had raised edges and spokes which cradled the egg. They were also near tanks which blocked the wind. On coral rock with numerous indentations, four eggs hatched and three were lost. These rocks were often under sheltering vegetation. Of seven eggs laid on the relatively rough-barked limbs of the tree heliotrope, four hatched and three were lost. Limbs of the ironwood are relatively smooth and the long slender branches are subject to considerable wind movement. Two of the three eggs laid there were lost.

Egg survival to hatching was poor on some man-made wood structures (such as the tops of pilings, sign posts, parts of racks, and buildings) which attracted nesting terns. Of 19 eggs laid, seven hatched and twelve were lost to wind and human disturbance. Cement structures having broken surfaces offered satisfactory nest sites, but smooth surfaces exposed to winds did not. Of eight eggs laid on cement surfaces, two hatched and six were lost.

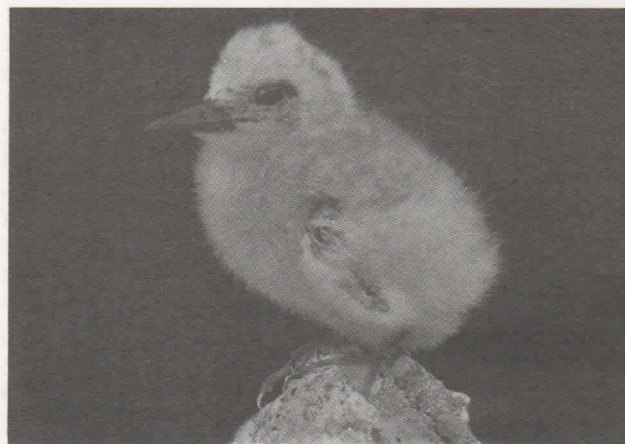


Figure 1: White Tern chick on broken cement slab. Note well developed claws. Tern Island, French Frigate Shoals, Hawaii.

Photograph by M.J. Rauzon, March 1977.

TABLE 1: Hatching Success of White Tern Eggs at Tern Island, French Frigate Shoals, Hawaii 18 February-26 May 1977.

Location of Eggs	Number of Eggs		
	Total	Lost	Hatched
Spigot valve	3	0	3
Coral rock	7	3	4
Heliotrope	7	4	3
Ironwood	3	2	1
Wood structures	19	12	7
Cement structures	8	6	2
Totals	47 (100%)	27 (57%)	20 (43%)

Of a total of 47 eggs laid, 20 hatched and 27 were lost. Our overall observed hatching success of 43% is intermediate to the rates of 46% and 34% observed in two successive seasons on Ascension Island by Dorward (1963). Natural egg mortality appears high regardless of nest site substrate. A relatively high reuse rate of nest sites (56% of 27 nest sites were reused) suggests that sites are limited in number but that the population will maintain itself and continue to grow in spite of seemingly precarious nest sites and periodic wind storms.

Environmental changes brought about by human occupation have caused a White Tern population to become established on Tern Island where none existed before 1965. It appears that terns select nest sites with varying degrees of "security". Further research is necessary to determine the degree of difference in hatching success among the various sites as well as the effects of human disturbance.

ACKNOWLEDGEMENTS

We thank the U.S. Fish and Wildlife Service; National Fish and Wildlife Laboratory and the Hawaiian and Pacific Islands National Wildlife Refuge and the U.S. Coast Guard, 14th District, for their support and the opportunity to work on Tern Island, French Frigate Shoals. We also thank Drs. G. Grant, C. Kepler, and R.J. Shallenberger for their reviews.

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HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE ANNIVERSARY

February 3, 1984 marks the 75th anniversary of Executive Order 1019, by which President Theodore Roosevelt established the Hawaiian Islands Reservation. It set aside the islands and reefs extending from Nihoa to Kure, excepting Midway Atoll, "...for the use of the Department of Agriculture as a preserve and breeding ground for native birds." This order made it "...unlawful for any person to hunt, trap, capture, willfully disturb or kill any bird of any kind whatever, or take the eggs of such birds...". Kure was placed under Navy jurisdiction in 1936, and transferred to the Territory of Hawaii in 1952. Administration of the Hawaiian Islands Reservation was transferred to the Secretary of the Interior in 1939 and its name was changed to the Hawaiian Islands National Wildlife Refuge (NWR) in 1940. This action placed the unique string of islands and reefs into a nationwide system of refuges which now numbers over 400, includes more than 90 million acres of land and water, and is represented in 49 states and five territories.

Human interest in the Leeward or Northwestern Hawaiian Islands (NWHI) extends back more than 700 years. Early Polynesian visitors built garden terraces, house-sites and primitive temples on Nihoa and Necker Islands. The first record of European visitors was in 1786, less than a decade after Capt. James Cook discovered the main Hawaiian Islands. Over the next century, dozens of sailing ships visited the NWHI. Several of these were claimed by the treacherous reefs and shoals and never returned. Not surprisingly, it was the commercial potential of various resources that attracted most of the early interest. Fish, monk seals, turtles, pearl oysters, sea cucumbers and other marine species became a source of revenue. But ultimately it was interest in the rich seabird resource and its by-products, particularly guano, that changed the course of biological and political history in the NWHI.

In 1890, the North Pacific Phosphate and Fertilizer Company was granted a 20-year permit from the Hawaiian Kingdom to mine guano deposits on Laysan and Lisianski Islands for a royalty fee of 50 cents per ton. The first shipment of 80 tons was removed from Laysan in April, 1891. The first intensive scientific collecting expedition to these Islands took place in the same year, under the sponsorship of Walter Rothschild. A founder of

the Hawaiian Audubon Society, George C. Munro, was a field assistant to Henry C. Palmer on that expedition.

Guano mining on Laysan ceased in 1910, but not before rabbits, released for food in 1902, had begun to leave their mark on the fragile ecology of this island. Within a few short years, rabbits virtually denuded the island of vegetation. Ultimately, three species of birds unique to this two-square-mile island would go extinct as a result of this event. Yet, it was the uncontrolled harvest of the rich seabird resources in the NWHI that attracted the attention of the American public and led to the establishment of the Hawaiian Islands Reservation in 1909. In the following year, Japanese feather gatherers were arrested on Laysan. Records indicated that they had harvested and processed more than 300,000 bird wings.

Scientific interest in the Northwestern Hawaiian Islands grew steadily throughout the first half of this century. Military interest was growing as well, eventually leading to the construction of facilities at Kure, Midway, and French Frigate Shoals. At the latter site, Tern Island became a Coast Guard navigational facility in 1952. The U.S. Fish and Wildlife Service (USFWS) established a field station at Tern Island in 1979.

The Department of the Interior entered into an agreement with the Territory of Hawaii in 1951 that resulted in a series of cooperative expeditions into the refuge. To facilitate management, the area was also designated a Territorial Wildlife Refuge in the following year. The first refuge manager, Eugene Kridler, was stationed in Hawaii in 1964. In 1967, the refuge was designated a Research Natural Area. Hitching rides on Coast Guard vessels, Kridler and other cooperating researchers increased the frequency of wildlife surveys in the refuge. Smithsonian Institution biologists gathered extensive data on the refuge's biological resources in the mid-1960's. The most intensive study of NWHI resources began in 1978, with the signing of a Tripartite Agreement between the USFWS, the State of Hawaii, and the National Marine Fisheries Service. The results of the 5-year Tripartite project were presented at a symposium in Honolulu in May, 1983.

What we have learned over several decades of research in the refuge is both encouraging and alarming. On the positive side, the seabird population of the NWHI includes 18 species, now numbering in excess of 12 million birds. Green Sea Turtles breed successfully on refuge islands, and, as a result of recent protective status, are showing initial signs of recovery

from the effects of more than a century of harvest. Refuge islands and reefs continue to provide unique opportunities for study in relatively pristine ecosystems. On the negative side, we've witnessed the extinction of three unique bird species in the refuge, and four more remain vulnerable. Furthermore, the NWHI monk seal population has declined more than 50% since mid-century, and, despite an aggressive research program, we still lack the knowledge necessary to reverse the trend.

Utilizing the research data generated by decades of study in the NWHI, and with the continuing input of other agencies and the public, the USFWS recently initiated a master planning process for the Hawaiian Islands NWR. The plan will address growing public interest in the Refuge, including a resurgence of interest in commercial fishery resources of the NWHI. The planning process will result in the development and evaluation of an array of resource management options, ultimately resulting in the selection of the alternative which best addresses key wildlife objectives while accommodating appropriate compatible public use.

Robert Shallenberger

(Editors' note: If you are interested in receiving more information about how you can participate in this planning process for the Hawaiian Islands NWR, write or call Refuge Manager, Hawaiian Islands NWR, P.O. Box 50167, Honolulu, Hawaii 96850 (808) 546-5608.)

JANUARY FIELD TRIP REPORT: HALAWA VALLEY

The trail in Halawa Valley, Oahu, follows Halawa Stream, as is common with valley trails in Hawaii. The small party that crossed and recrossed that stream several times in the Society's 8 January 1984 field trip acquitted itself very well in negotiating slippery rocks with a minimum of wet feet. White-rumped Shamas, Northern Cardinals, Japanese White-eyes, and Japanese Bush-Warblers were heard frequently, but sightings were few. Characteristically, the Japanese Bush-Warbler was not seen at all. The thick vegetation which provided good cover for the birds also made spotting difficult.

The day was dry and sunny, the trail reasonably good for walking and mostly level. Interesting groves of big trees (some eucalyptus) and small stands of royal palms provided an occasional variation from the prevalent fern/hau/small tree growth.

The walk began from the Halawa industrial area about 8:10 a.m. and ended there about noon.

George Campbell

NEW FUNDS FOR HAWAII'S NATIVE WILDLIFE?

Hawaiian wildlife desperately needs help! Hawaii has the unfortunate distinction of being home to more than half of the endangered bird species for the entire United States. How much of Hawaii's natural history heritage will we be able to leave for our children?

Encouragingly, Senate Bill 459, introduced in the 1983 state legislature, was intended to provide Hawaii's citizens with the opportunity to help save some of our unique wildlife treasures. This bill, called "Relating to Taxation", was introduced to the Senate and made it to the House, where it currently lies. The title of the bill is misleading, since it does not propose to raise any taxes; it actually proposes to include, on state income tax forms, a checkoff section for a donation to a Native Wildlife Account. Any money donated by an individual or joint taxpayer would be subtracted from his/her tax refund or added to his/her tax liability. The money would be given to the Dept. of Land and Natural Resources and designated for use for native wildlife programs. The money could be used for such things as developing and managing Kawainui Marsh as a waterbird habitat, protecting and managing sensitive native forest habitats, predator control, forest bird disease research and control, and public information/education.

As of December 1983, 31 other states had passed similar legislation, aimed generally at benefitting nongame, native, and endangered species. (Ten other states do not have a state income tax, so this type of donation system can not be tried in those states.)

Why do we need to look toward alternate funding sources for wildlife preservation?

Traditionally, programs carried out by state Fish and Game agencies dealt mainly with "game" or huntable/fishable species. In most states these programs are funded largely by "Pittman-Robertson" funds, which are collected and disbursed by the federal government. These funds are generated by a nationwide tax on guns and ammunition, and doled out to each State using a formula based on the area and the number of licensed hunters. However, Pittman-Robertson money is given to each state with "strings" attached; the state itself must pay out the whole sum of money for an

approved wildlife program, and this sum is then reimbursed (up to the state's overall allotted limit) 75% by the Pittman-Robertson money.

With the passage of the Federal Endangered Species Act of 1973 and an increased public interest in "the other species", some states initiated "nongame" (species which are not hunted or fished for sport) programs. The funding for these nongame programs also largely utilized federal Pittman-Robertson money. In Hawaii, the State's portion is allocated from the General Fund.

Within the past seven years, the innovative state income tax "checkoff" idea has caught hold nationwide, and allowed many additional states to initiate or expand nongame and endangered species programs, utilizing their checkoff donations as the state portion in the Pittman-Robertson scheme.

The recently-enacted state income tax checkoffs in 31 states are partly an attempt to encourage all wildlife enthusiasts to donate money to nongame. Thus, the so-called "non-consumptive" wildlife users (e.g. bird-watchers, hikers, and nature study enthusiasts) could donate their "fair share" for the preservation of native wildlife and endangered species.

Hawaii has lost over \$0.5 million in Pittman-Robertson money since 1976 simply because the State cannot "front" enough money to qualify for its entire share. Senate Bill 459 would increase the State's ability to capture more of the Pittman-Robertson money, without increasing our taxes or reducing the State's General Fund.

When S.B. 459 was first introduced in 1983 Dr. Charles Lamoureux (then Vice-President and Conservation Chairperson for Hawaii Audubon) submitted eloquent testimony for the Society that advocated passage of the Bill, with one change: that the fund be for native wildlife and not restricted to endangered wildlife. Conservation Council for Hawaii, Sierra Club Hawaii Chapter, and the Oahu Pig Hunters Association also supported the Bill.

In 1983, the opposition of Tax Dept. Director George Freitas was based partly on the bookkeeping burden that would result. However, last year the legislature funded a two-year computerization process which should speed up processing the tax forms. Initially, the Dept. of Land and Natural Resources also was opposed to it.

Leaders of local conservation groups plan to meet in early 1984 with the new Tax Dept. Director Herbert Dias, to help resolve any remaining problems. Additionally, the Dept. of Land and Natural Resources also seems to be more willing this year to encourage

the Bill's passage.

The need now is for the Chairman of the House Finance Committee, Ken Kiyabu of Kaimuki, to grant the Bill a hearing, so that the Bill doesn't "die" this year. A hearing will only occur if the House leadership is convinced that the Bill has popular support. It is important to contact your local representative and encourage them to support this native wildlife checkoff bill, or call Ken Kiyabu at 548-7860 and express your support.

Dr. Sheila Conant

ALOHA TO NEW MEMBERS

We welcome the following new members and encourage them to join in our activities.

Local: Sam Bateman, San Mateo, CA; Raymond J. Barnett, Chico, CA; Gina Bernier, Lahaina; Mildred A. Bowers, Decatur, GA; Dennis D. Buss, Richardson, TX; Ed Coffin, Victoria, B.C.; Reginald E. David, Kailua-Kona; Yarick Fix, Kurtistown; Jon G. Griffin, Kamuela; Alida F. Given, Kailua; Leona M. Haggert, Vancouver, B.C.; Geary Hund, Anaheim, CA; Lynn K. Hurst, Vienna, VA; Ivars Kops, Ancaster, Ont.; N.L.H. Krauss, Honolulu; Renee Lieb, Pleasantville, NY; Elizabeth F. Massie, San Francisco, CA; Paul McConnell, Santa Barbara, CA; Phyllis Turnbull, Honolulu; Alfred D. Voss, Kailua.

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Susan Schenck & Kammy Wong

WAIKIKI AQUARIUM: FEBRUARY LECTURE

The Waikiki Aquarium is sponsoring a series of Natural History lectures this year. The February lecture will be by Dr. Sheila Conant on "Hawaii's Living Treasures: An Endangered Resource". Dr. Conant's talk will feature many of the rare, endangered, or extinct plants and animals of Hawaii.

The lecture is Wednesday, 22 February, at 7:30 p.m. in the Waikiki Aquarium foyer. Phone 923-4725 for information. A \$1.50 donation will be appreciated.

1984 ACTIVITIES AND PROGRAMS AT THE WAIKIKI AQUARIUM

The Waikiki Aquarium announces its educational and travel opportunities for Spring 1984. Evening lectures, day and night reef walks, mini-courses on marine mammals, microscopic marine life, intertidal ecology, natural dyes from the sea, and more are offered. This year's travel program includes natural history study tours to the outer islands, South Pacific, and Caribbean. For more information and an activities brochure, call the Waikiki Aquarium Education Section at 923-4725.

MAHALO TO CONTRIBUTORS

We would like to thank the following contributors whose gifts have arrived since the last 'Elepaio acknowledgements:

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Norris Henthorne

FEBRUARY FIELD TRIP: KAHUKU WATERBIRDS

The Sunday, 12 February, field trip will tour the James Campbell National Wildlife Refuge in Kahuku, Oahu. The trip will be led by a U.S. Fish and Wildlife Service biologist, and will feature endangered Hawaiian waterbirds plus other migratory waterbirds which winter in Hawaii.

Wear appropriate footwear, such as tennis shoes, rubber boots, or tabis. It is also recommended that participants bring binoculars, spotting scopes (if available), raingear and perhaps water and lunch.

Honolulu participants should gather at 7:45 a.m. at Punchbowl St. next to the Hawaii State Library, where directions and carpooling will be available. North Shore and Windward residents can join the car "caravan" by meeting in the parking lot of the Kahuku Sugar Mill at 9 a.m. Call 456-5662, if more information is needed. See you there!

1984 FORESTRY-WILDLIFE CONFERENCE PLANNED

The 1984 Forestry-Wildlife Conference has been scheduled for May 10 and 11, at the Hale Koa Hotel in Honolulu. A field trip for Saturday, May 12, is scheduled as well.

The theme is "Natural Resource Management on Hawaii's Public Lands."

Tentatively, the 2-day conference will be divided into four sessions.

Some topics for the conference will probably include: water resource management, forest resource management, land management conflict resolution, land use planning in the context of conservation of natural resources, sustaining native ecosystems on public lands, managing renewable resources for the people of Hawaii, controlling the impacts of exotic organisms in Hawaii, and outdoor recreation on public lands.

For more information contact: Ronald L. Walker, Conference Chairman, 1151 Punchbowl St., Rm. 325, Honolulu, HI 96813, (808) 548-2861
OR Peter A. Stine, Program Chairman, 1151 Punchbowl St., Rm. 325, Honolulu, HI 96813, (808) 546-7530.

CHANGE OF ADDRESS

Are you planning to move? If so, please let us know ahead of time, or as soon as you know your new address.

FEBRUARY PROGRAM: ALASKA WILDLIFE

The guest speaker for the Tuesday, 21 Feb. general meeting is Walter Donagho. Walter will take us on a "tour" of Alaska, including visits to Glacier Bay, Denali (McKinley) National Park, the Pribilof Islands, and Katmai National Park and Preserve. This fascinating journey will feature slides of Alaska's abundant wildlife.

The meeting will be held at the McCully-Moiliili Library on S. King St., Honolulu, at 7:30 p.m. The public is welcome.

PLEASE NOTE THAT THIS FEBRUARY MEETING IS AT THE MCCULLY-MOILIILI LIBRARY, IN OUR "USUAL" ROOM.

AUSTRALIAN RAINFOREST FILM

John Seed, of the Rainforest Information Center, New South Wales, Australia, will be showing "Give Trees a Chance", a film depicting the battles to save Australian rainforest and show a 20-minute film on the successful struggle against a Tasmanian dam project, similar to the Alakai Swamp Dam proposal, at a general meeting of the Conservation Council for Hawaii on Tues., 13 March 1984.

Dr. Seed will also discuss conservation efforts in Australia. The meeting will be held at the Manoa Library, 2716 Woodlawn Dr., at 7:30 p.m. The general public is invited, free of charge.

HELP WITH 'ELEPAIO

The March issue of the 'Elepaio will be pasted-up 18 February (Sat.) at 1415 Victoria St., beginning at 12 noon. The entry phone is #198. Call Marie at 533-7530 after 5 pm or call Peter at 847-3511 ex. 156 during the day for more information. Everyone welcome to come and learn!

HURRICANE IWA TALK

Friday, 17 February, in St. John, Rm. 7, at U.H. Manoa, beginning at 7:30 pm, Dave Boynton will present a slide show "Storm in the Forest". This slide show will be about the 1982 Hurricane Iwa damage, and post-Iwa management practices (such as proposed planting of kikuyu grass on widened roadsides). Call Steve at 941-4974 for more information. Free to the public.

PAY YOUR 1984 DUES

1984 dues for those who are only local Hawaii Audubon Society members should be paid this month, since all local memberships expired on 31 December, 1983.

Dues for 1984 are \$6.00 for the regular memberships (see below on this page for other categories). Dues may be mailed to Hawaii Audubon Society, P.O. Box 22832, Honolulu, Hawaii 96822. Make the check payable to "Hawaii Audubon Society".

Hawaii Audubon Society members who are "joint with National" (have paid the \$30.00 membership) do not have to pay these \$6.00 local dues, since part of the \$30.00 is returned automatically to the local Hawaii Chapter as local dues.

IF NOT A MEMBER, PLEASE JOIN US

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Special rates for full-time students and Senior Citizens (65 years of age or older) are available. Please write for application form.

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CALENDAR OF EVENTS

- Feb. 12 (Sun.) Field trip; see page 84.
Meet 7:45 am State Library on
Punchbowl St. or 9:00 am at Kahu-
ku Sugar Mill parking lot. Call
456-5662 for more info.
- Feb. 13 (Mon.) Board meeting at George
Campbell's home, 1717 Ala Wai, #2302,
at 7:00 pm. Call 941-1356 for info.
- Feb. 17 (Fri.) See page 84.
- Feb. 21 (Tues.) General meeting at McCully-
Moiliili Library, 2211 S. King St.,
at 7:30 pm. Walter Donagho on
Alaskan Wildlife.
- Feb. 22 (Wed.) See page 83.
- Mar. 13 (Tues.) See page 84.

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U. S. POSTAGE
PAID
Honolulu, Hawaii
Permit No. 1156

