‘ELEPAIO

Journal of the Hawai‘i Audubon Society

For the Protection of Hawai‘i’s Native Wildlife

VOLUME 76, NUMBER 6 NOVEMBER / DECEMBER 2016

# The epic journeys of the plover

by Eric Wagner (reprinted with permission from Cosmos Magazine)

**On 19 June 2014**, a few miles outside of Nome, Alaska, a biologist named Wally Johnson trapped a male Pacific Golden Plover sitting on a nest. After weighing and measuring the bird, Johnson attached a small satellite transmitter to his back and let him go.

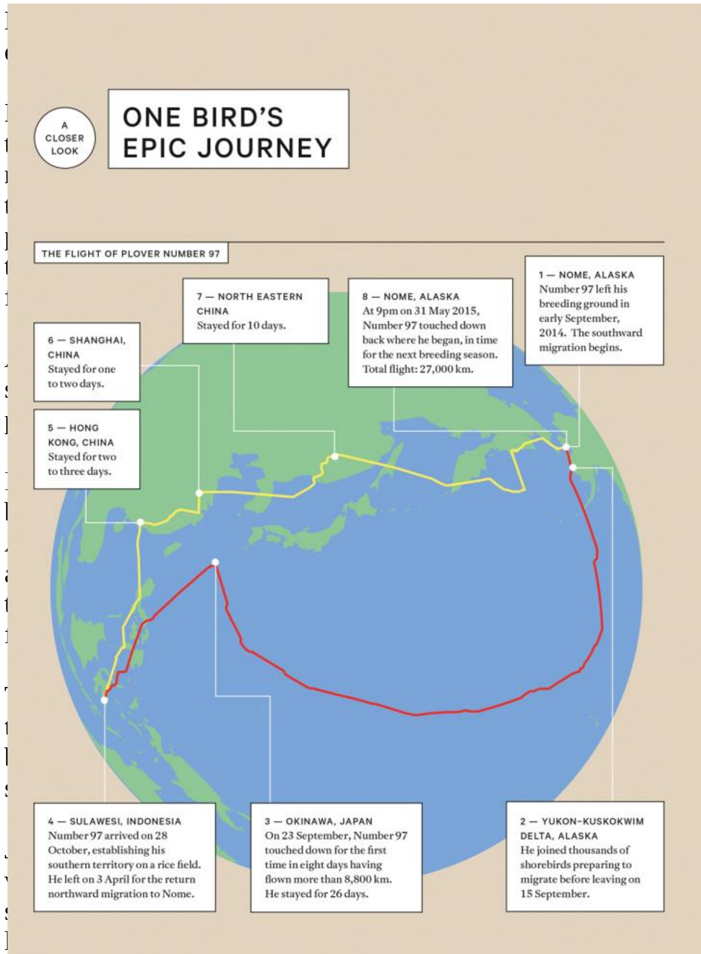
The transmitter’s identification number ended in 97, so Johnson called the plover Number 97. Number 97 stayed in Nome for another month, helping his mate incubate their clutch and tend their chicks. In early September he left Nome and flew south to the Yukon-Kuskokwim Delta. There he joined thousands of other shorebirds as they prepared to migrate to places throughout North and South America, Asia and Oceania.

On 15 September, Number 97 left and flew towards Hawai‘i, following a direct route until he was above the archipelago, when he veered west, perhaps to skirt a storm. He traced a shallow arc across the Pacific Ocean, covering more than 8,800 kilometers before he landed in Okinawa, Japan, on 23 September. It was the first time he had touched land in eight days.

Number 97 stayed in Okinawa for the next 26 days before leaving for Sulawesi, an island in Indonesia. He arrived on 28 October, established his territory on a rice field, and set about eating insects and worms.

By March, Number 97 was restless. He left on his northward migration on 3 April. He stopped near Hong Kong, then spent a few days near Shanghai. He next flew east over the Yellow Sea and the Korean Peninsula, then ducked into northeastern China, staying for 10 days. Finally, he left for Nome, touching down at 9.00 pm on 31 May. He had flown more than 27,000 kilometers.

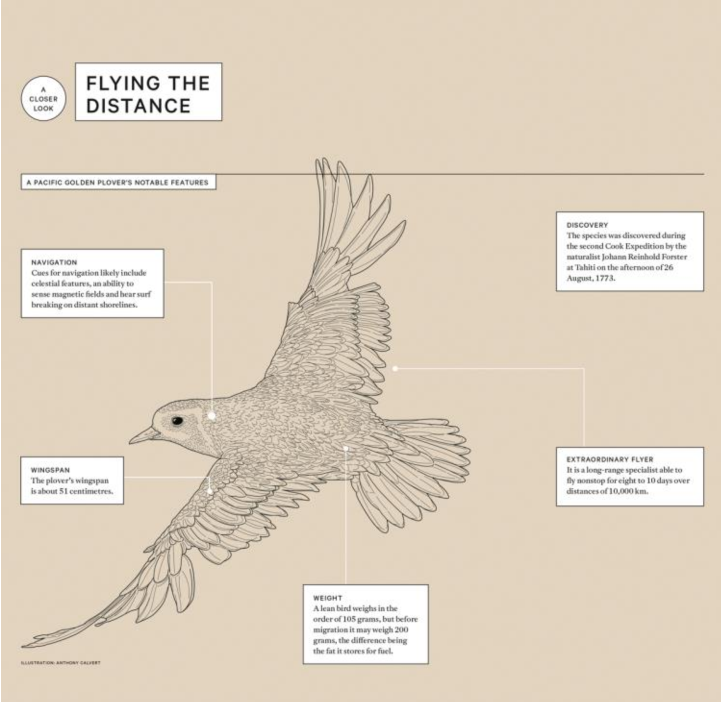
Johnson has studied these birds for nearly 40 years, but this flight astonished him. “I’d never seen a path like that,” he says. “It was amazing – more so because other plovers probably do it, too.” Only within the past few years have scientists begun to grasp the incredible journeys of which shorebirds are capable. Their non-stop flights take them farther and faster than any other creature, even rivaling the greatest human feats of aerial endurance. Plover migrations recall the 1986 flight of Rutan Model 76 Voyager, the first aircraft to fly around the world without refueling. The aircraft’s nine-day, 42,200-kilometre flight captured the public’s imagination. Shorebirds are supremely optimized for such acts, testing the definitions of extreme behavior.




was a species that nobody knew much about. Johnson is a physiologist and histologist – someone who studies the body at the organ-wide and intracellular level.

The plover’s internal machinery – the way it uses body fat to fuel its migration, for instance – was what interested Johnson at first. But his attention moved from the plover’s physiological engine to its wayfaring lifestyle. Johnson retired from teaching 20 years ago, but has not stopped following plover migrations. Asked why he hasn’t stopped, Johnson confesses: “I can’t.”

The plover’s life cycle involves vast geographic shifts. They breed in the far north, disappear for a while, then reappear thousands of kilometers away. Johnson wondered: Are their flights non-stop? What paths do they follow?




The notion that plovers and other shorebirds might migrate great distances without stopping had tantalised biologists for decades. All kinds of animals migrate –birds, mammals, fish, butterflies.

They venture far afield to find food, or more favorable climes, or to breed. But shorebirds take the practice beyond even its logical extreme. How their behavior evolved is a tricky question. Did it happen gradually, with birds that already migrated long distances overland slowly expanding their breeding ranges across the seas, say from Siberia to Alaska, obligating them to fly across the oceans as well? Or has the migratory flight itself slowly lengthened, as birds flew from their breeding grounds to new non-breeding sites that were farther and farther south and east from the Arctic? No one can say for sure, although biologists do know the behavior has arisen independently several times, and in several taxa of shorebirds.

In 1989 Johnson calculated that the plover's maximum non-stop flight range might be about 9,200 kilometers. Other researchers, too, suggested that shorebirds might journey great distances in a single flight. The evidence, while circumstantial, was powerful and connected with the remarkable physiological transformation shorebirds experience before they leave. The birds gorge themselves when they gather at their staging areas; golden plovers can more than double their weight before migratory flights. The food the birds seek provides fuel as well as other, secondary benefits. Some of the amphipods on which semipalmated sandpipers feast, for example, contain fatty acids that may increase the birds' aerobic capacity. (Anders Hedenström, a Swedish biologist, has likened this to "self-doping.") By the time the birds leave, more than half their mass might be fat, with yellowish deposits straining against the skin. Like the aircraft Rutan Voyager, they jettison all excess equipment. The organs that are not needed for their flight – the gizzard, the digestive system and the like – atrophy to shave precious grams. As Hedenström has written, migrating shorebirds are "quite close to the 'optimal design'" for long-distance, non-stop flights.

Still, definitive proof of extended, non-stop flight was elusive. Investigations into the achievements of plovers has become possible in recent years as, in Johnson's words, the equipment used by researchers "has gotten smaller and lighter." The technologies in question are minuscule geolocators and satellite transmitters, which have shrunk so much that birds weighing only a few hundred grams can carry them without being unduly burdened.

The instruments' influence has been profound. In 2007, biologists surgically implanted a satellite transmitter in a female bar-tailed godwit. The godwit in question was a bit smaller than a crow. It flew nearly 12,000 kilometers from Alaska to New Zealand in close to nine days – the longest recorded non-stop flight made by any bird.

Subsequent work has shown the remarkable godwit has long-distance rivals. Johnson found that some plovers probably fly non-stop from Alaska all the way to Queensland, Australia – a trip of some 11,000 kilometers. Much smaller sharp-tailed sandpipers may make a similarly long non-stop flight, as juveniles no less. A squat shorebird called a ruddy turnstone flies from the Arctic to Australia. What once struck scientists as incredible is, it seems, routine for several species.

"If you look at almost any shorebird in the Pacific basin, you're going to find a migration strategy that falls into the extreme endurance side of things," says Bob Gill, a biologist with the US Geological Survey (USGS) who led the team that uncovered the godwit's flight. And this has led to another question: how might these birds find their way across the vast, seemingly featureless Pacific ocean? To find an answer, some biologists are turning to another species: homing pigeons.

**On 29 June 1997**, Britain's Royal Pigeon Racing Association held a race to

celebrate its centenary. At 6.30 am, more than 60,000 pigeons were released in France to fly up to 800 kilometers back to their lofts in England. By late morning they were heading over the English Channel. The quickest pigeons were expected to arrive at their lofts by early afternoon.

None did.

Over the next few days, a few thousand birds trickled back, but tens of thousands were never seen again. In the parlance of a pigeon race, this is called a smash, and the 1997 royal pigeon smash was one of the worst ever recorded. When Jonathan Hagstrum, a USGS geophysicist with a side interest in bird navigation, read of the smash a year later, he had a hunch about its cause. “I was looking for an acoustic source,” he says. When he checked airline schedules, his hunch was confirmed: on that June day, a Concorde jet had taken off from Paris and flown across the path of the racing pigeons. The sonic boom, Hagstrum says, disrupted what he calls the pigeons’ infrasonic map – one that relies on low-frequency soundwaves. His finding was published in the Journal of Experimental Biology in 2000.

Any creature needs a compass and a map to navigate. Birds use several compasses: they can find their way by the night stars, or the Sun’s position during the day. They can also sense the Earth’s magnetic field, which offers them a built-in sense of direction. But, as Hagstrum points out, a compass only points north or south. It cannot tell you where you want to go. “For that, you need a map,” he says. “So the big mystery is: what is the map?”

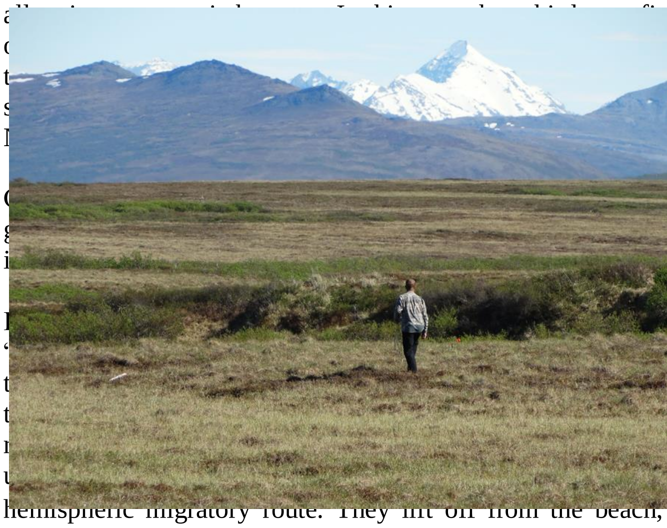
Scientists have proposed two potential maps. Birds detect consistent variations in the Earth’s magnetic field and may use them to generate a kind of X-Y coordinate system. They may also plot their flyways by piecing together olfactory cues – a whiff of a cypress forest, a city socked in smog.

The problem is the proposed maps don’t seem applicable to shorebirds. In the Pacific basin the magnetic map is – for complex geophysical reasons – unavailable. And although scent maps might work well on smaller scales, the idea that such a map could guide a bird from Alaska to Australia, across a vast ocean and through unstable atmosphere strains credulity, Hagstrum says.

He thinks he has found a new map that may help account for shorebirds’ remarkable long-distance sojourns: the Earth’s low-frequency background noise, known as infrasound.

Infrasounds include the heavy murmur of the planet’s unceasing seismic activity, or the rumble of ocean waves. Such sounds can reverberate thousands of kilometers, over land or through the atmosphere. “They’re very low frequency, but ubiquitous,” Hagstrum says.

Infrasounds may be well below the range of human hearing, but birds can hear them. Hagstrum believes infrasounds generate an aural map for birds – so that the sea becomes, for instance, a vast infrasonic soundscape. It is a structured space, he argues, with predictable patterns of trade winds, equatorial winds and so on



hemispheric migratory route. They lift off from the beach, fly around until they have sensed whatever it is they need to sense and then decide whether to return to land or continue.

Hearing this, I picture a flock of birds circling the beach, in effect sounding out a potential route that will take them over Hawai‘i, over the equator, and perhaps all the way to New Zealand or Australia. I think of how I have felt when I take a transoceanic flight, the sea far below, blank and forbidding. Then I think of that moment when the birds commit themselves to their journey. They don’t throw caution to the wind, but trust their fate to it. The wind is at their backs. How must those deepest of thrums sound, over a great distance?

Hagstrum thrills a bit when asked to imagine it. “I think birds might be listening to the landscape or the seascape the way we look at it, getting information from it, using it to make decisions,” he says. “For them, it’s like the song of the sea.”

**The June sky** is spitting rain when Johnson pulls off the road next to Anvil Mountain, near Nome. We are looking for Number 97.

According to the transmitter’s daily update, Number 97 was on this hillside a few hours ago, but Johnson fears he may have gone. If that’s the case, it bodes ill for the bird. “He was late getting back to Nome, and I think he may have lost his territory to another male,” Johnson says. “He might just be wandering around.”

We spread out to search. I observe Johnson’s method as he starts up the mountain. He is tall and soft-spoken. His pace is deliberate. I try to match it. The vegetation of the tundra is wet and soft; it swallows my boots and slows my pace, allowing me to better appreciate the subtleties of the landscape. What I took to be flat, drab ground has gentle rolls and grassy tussocks, bursting with greens, yellows and pinks. Somewhere, Number 97 might lie flattened over a nest, invisible to the predatory (or scientific) eye. But after a while Johnson decides he was correct: Number 97 is not here.

We drive to another field, where Johnson thinks plovers have established territories as large as 50 hectares. This year he plans to put geolocators on five birds, filling in more details of their preferred habitats during migration. “These things are amazing,” he says, holding up a coin-size geolocator. “We’ve found out things about plovers’ routes and stopovers that are critical to their conservation.” Chief among those stopovers, he has learned, are vital refueling sites among Japanese rice fields, where plovers bulk up on their way back to Nome.

We start surveying, and have walked for 15 minutes when I hear a high, thin whistle: Eeeeeeeep! A black head pops up 60 meters away. Johnson freezes. “He’s letting us know he sees us,” he says, and quickly sits down.

The plover is not Number 97 but another bird alarmed at the intruders on his territory. He watches Johnson with an affectless animal curiosity. Now a peculiar dance begins between bird and biologist. To catch the plover we need to find his nest. We have an idea of where it is, but if we stomped over we would never find it, so well hidden are the eggs.

We wait for the plover to show us where to go. He stops eeeeeping, runs a few meters and pauses, runs a few meters, pauses again. He does this a few times before stopping with a special finality: he is at his nest. “OK, now you walk in that direction,” Johnson whispers. “When you get close he’ll get up again, so you really try to focus on the spot, but stop a few feet before you get there – you don’t want to crush the eggs.”

No, I don’t. I start walking. The plover pops up, eeeeeeping. I fix on a rock near him and stride forward. The plover flails before me, eeeeeeping urgently, pretending to have a broken wing. But I am not so easily fooled. I reach the rock and stare at the tundra’s visual chaos until I see a small cup of lichen and moss: the nest. The eggs, olive with dark green speckles, are arranged about the center, pointed inward. Their camouflage is extraordinary.

Johnson marks the nest with a flag. We will return to set a trap for the plover and put the geolocator on him, but before we go we want to see the plover go back to his clutch. This will serve as a proximal gesture of forgiveness, a way of letting us know he is OK. We wait as he scuttles to his nest and melts into the tundra’s mosaic.

**As we drive away**, Johnson muses about what the future holds for these creatures, so small and delicate, but also capable of such feats of endurance. “These birds are tough, but they’re also so finely calibrated,” he says. “They are already living at the extreme edge of what they can do, and it’s a shame when we make things harder for them.”

Plovers face two main challenges: the future of the winds that carry them and changes to the places the winds carry them. Biologists worry that climate change will upset the winds shorebirds depend on to sling them across the oceans: the trade winds, the equatorial currents, the lower bounds of the jet stream and so on, all of them forming a kind of conveyor belt across the hemispheres. How those effects will manifest is unknown, but climate models project shifts of varying severity, as some winds slacken and others increase. For creatures so attuned to the weather, even small shifts matter.

On top of large-scale changes, shorebirds may also contend with sudden, less predictable weather events. Most models predict that as the climate changes storms will spring up more frequently over the oceans, as one did during Number 97’s journey. Such storms could blow birds off course to unfamiliar lands that might not suit their needs so well. Although Number 97 wasn’t deposited someplace inhospitable, Johnson suspects the detour knocked him off schedule, which may explain how he lost his territory and is now so hard to find. “Birds have been making these flights on these oceanic flyways for a long time,” Johnson says. True, many species are long-lived – the oldest known golden plover was 21 years old – and they are accustomed to day-to-day changes in the weather.

But while they may be adept at withstanding short-term anomalies in wind speed and direction, it’s an open question whether they are flexible enough to keep up with future meteorological shifts.

An even more pressing issue is habitat loss. The effects of cli-

mate change on shorebirds are – for the time being – largely theoretical, but wetlands are disappearing now. In the Pacific basin, many shorebirds fly to their northern breeding grounds via the East Asian coast. Their northward flights are not as spectacular as their southward ones, but they are still long, requiring refueling stops as the birds prepare to breed. One of the most important stopovers on this East Asian-Australasian flyway is the complex of estuaries and tidal flats on the Yellow Sea, between China and the Korean Peninsula. More than 40% of individuals from some species depend on a single 180,000-hectare coastal wetland at the mouth of the Yalu River.

“For many shorebirds, that is the only place they stop when going north,” says Gill, the USGS biologist. The food they pick out of the wetland mud “is what gets them to the breeding grounds.”

Unfortunately for the shorebirds, these vital checkpoints in China and South Korea are also subject to intense development pressures. Many of the wetlands are being filled in with sand, walled off from the tides, drained and built upon. In spite of a series of international agreements designed to slow development, 65% of coastal wetlands have disappeared in the past 50 years and the rate of loss is accelerating. Also, rising sea levels may inundate up to 40% of suitable mudflats and marshes. Deprived of their former stopping sites, tired and hungry shorebirds must find other places to feed and rest as they head north. Whether they will succeed is, again, unclear.

Two days later, we are back to capture the plover and place the geolocator on him. We find his nest again; the male stands near us, eeeeeeeping. Paul Brusseau, Johnson's former student, sets a trap. The trap is a metal ring of Russian design called a "luchok", the Russian word for "hoop." Brusseau first replaces the plover's eggs with wooden dummies and arranges the hoop over the nest, with fishing line across the dummy eggs. When the plover settles on the eggs, the trap will spring and a net will snare him.

We retreat and wait as the plover goes through his coy routine of return. When he sits on the eggs at last the trap springs and Brusseau rushes over to extract him. In the van, Johnson weighs him and measures the length of his wing and leg. Although it is still early in the breeding season, the bird is thin, his feathers ragged. Johnson puts a series of colored bands and a geolocator on his slender legs. The geolocator will track the plover when he leaves Alaska for the Central or South Pacific and follow him as he comes back to this same field next year.

The transmitter's frequency ends in 36, and so I think of the plover as Number 36. "You want to let him go?" Johnson asks, holding out Number 36.

Of course I do. I clasp Number 36 in my hands, pinning his wings to his sides. I can feel his sternum, and the panicked tremor of his heart. He is impossibly light; Johnson found that he weighed 116 grams. Before he leaves he will fatten to perhaps 200 grams, but he seems too fragile now. The thought of Number 36 winging across the Pacific gives me pause, and I am reluctant to let him go. But this is a test of my understanding and imagination, not his. He has made the trip before. He will do it again, maybe 10, 15, 20 more times. He struggles against my grip. I open my hands and he flings himself away.

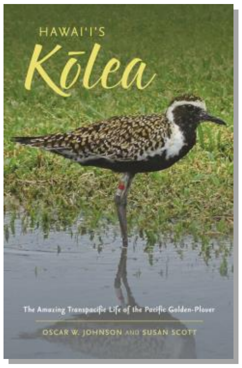
*Mahalo to Eric Wagner, the author, and to Elizabeth Finkel, Editor-in-Chief, Cosmos Magazine, for permission to reprint this article. Mahalo to Anthony Calvert and Robyn Adderly of the Art Department, Cosmos Magazine, for permission to use their images.*

*This article originally appeared in Cosmos Magazine, 25 March 2016. https://cosmosmagazine.com/life-sciences/epic-journeys-plover*

## HAWAIʻI AUDUBON SOCIETY'S 2016 ANNUAL MEETING

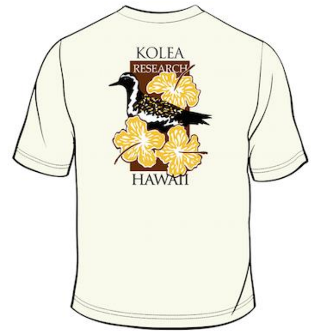
### Book Signing Event, Banquet, and Seasonal Sale

Thursday, December 1st 2016 * 6:00 pm - 8:30 pm * Treetops Restaurant, Paradise Park, Mānoa




*We are pleased to present our featured speakers:*
Dr. Oscar "Wally" Johnson and Susan Scott
Co-Authors of the new book
**Hawaiʻi's Kōlea: The Amazing Transpacific Life of the Pacific Golden-Plover**

*"Oscar "Wally" Johnson, the undisputed world expert on Pacific Golden-Plovers, and Susan Scott, a popular-science writer, have combined their knowledge and enthusiasm to create a book for everyone who admires the exceptional birds known as Kōlea in Hawaiian. With easy-to-understand, yet scientifically accurate, text and outstanding color photographs, Hawaiʻi's Kōlea: The Amazing Transpacific Life of the Pacific Golden-Ploveris a handy, reliable source of information for both general readers and ornithology specialists."* (UH Press). Just in time for the holiday season, their book will be available to purchase for $15, regularly $16.99. The authors will be available for book signing that night.




2016 Kōlea T-Shirt
$20 from our online store

Tickets: $45 per person. Learn much more about this event and purchase your tickets in advance through our website:

### 117th Annual Christmas Bird Count Citizen Science Opportunity

December 14th 2016 through January 5th 2017
*Across the Hawaiian Islands*

Audubon CHRISTMAS BIRD COUNT

Spend the day with other birders and volunteers at your local bird count. The results are used as a guide to create conservation strategies to protect the birds and their habitat, and to understand the long-term health of bird populations. Contact your local bird count coordinator (http://www.hawaiiaudubon.org/citizen-science) or visit http://birds.audubon.org/christmas-bird-count to find out how you can join in the fun and make a difference!

#### Oʻahu

**Honolulu CBC, Oʻahu: Dec 18th 2016**
Contact: Pete Donaldson, pdnldsn.bird@mac.com or (808) 456-5662

**Waipio CBC, Oʻahu: Dec 17th 2016**
Contact: Lance Tanino, lance.tanino@gmail.com or (808) 495-6545

#### Maui

**ʻĪao CBC: Dec 26th 2016**
Contact: Sonny Gamponia, sgamponia@yahoo.com or (808) 244-0727

**Puʻu Kakae Circle CBC: Jan 3rd 2017**
Contact: Sonny Gamponia, sgamponia@yahoo.com or (808) 244-0727

**Hana Circle (New!): Dec 28th 2016**
Contact: Barry Solomon, barry.solomon428@gmail.com

#### Hawaiʻi Island

**North Kona CBC, Big Island: Dec 24th 2016**
Contact: Lance Tanino, lance.tanino@gmail.com or (808) 495-6545

**Volcano CBC, Big Island: Dec 17th 2016**
Contact: Thane Pratt, thane-linda@earthlink.net

**Kulani NAR, Big Island: Dec 17th 2016**
Contact; Anya Tagawa, anya.h.tagawa@hawaii.edu

**Kahoʻolawe CBC – Dec 13-15th 2016**
(space is very limited)
Access Kahoʻolawe Dec 13th, CBC Dec 15th
Contact: James Bruch, jbruch@kirc.hawaii.gov

**Molokaʻi CBC – Dec 19th 2016**
Kualapu'u Circle
Contact: Arleone Dibben-Young, researcbirds@yahoo.com

**Kaua'i CBC – Dec 17th 2016**
Kapaʻa Circle CBC
Contact: Bryn Webber, cbckauai@gmail.com or (808) 639-1388

**Lanaʻi CBC – Dec 19th 2016**
Contact: Sonny Gamponia sgamponia@yahoo.com or (808) 244-0727

## Hawaiʻi Audubon Society Renewal/Donation Form

- ❑ $25 Regular Member
- ❑ $15 Student Member
- ❑ $40 Family Membership
- ❑ $100 Supporting Member
- ❑ International Membership
- ❑ $28 Canada & Mexico
- ❑ $33 Other Countries
- ❑ Donation: $_______

*Donations are tax-deductible and greatly appreciated.*

Name: ________________________________

Address: ________________________________

Phone: ________________________________

Email: ________________________________

- ❑ Send me the digital ʻElepaio Journal to my email.
- ❑ Send me the printed ʻElepaio Journal to my address.
- ❑ E-mail me volunteer opportunities, updates, & field trips.

Pay by credit/debit card at http://www.hawaiiaudubon.org.
Please make checks payable to **Hawaiʻi Audubon Society**
Mail form and payment to 850 Richards St., Suite 505, Honolulu, HI 96813

*Thank you for your concern and commitment to protecting Hawaii's native wildlife and ecosystems.*

## Hawaii's Rare and Endangered Birds

Patrick Ching Art Collection Note Cards

Set of 8 cards with envelopes

**AVAILABLE NOW for only $5.00**

In time for the holidays, the Hawai'i Audubon Society offers a deep discount on a set of eight stunning notecards featuring the acclaimed artwork of Patrick Ching. Images of nene (Hawaiian goose), 'i'iwi (honeycreeper),'io (Hawaiian hawk), 'akohekohe (crested honeycreeper), 'apapane (honeycreeper), ae'o (Hawaiian stilt), pueo (Hawaiian owl) and the now extinct po'ouli adorn these cards, so beautiful that you will be reluctant to use them. The back panel includes a description of each bird. View each of these images at our website store.

**ʻElepaio ISN 0013-6069**
**Scientific Editor: Glenn Metzler**
**Managing Editor: Jody Smith**

*The ʻElepaio is printed on recycled paper and published six times per year.*

Hawaiʻi Audubon Society
850 Richards St, Suite 505 Honolulu, HI 96813
Phone: (808) 528-1432
Email: hiaudsoc@pixi.com
http://www.hawaiiaudubon.org
http://www.facebook.com/hawaiiaudubonsociety

## Upcoming Events, Field Trips, & Volunteer Opportunities

*For full descriptions of our Events, Field Trips and Volunteer Opportunities, go to our website: http://www.hawaiiaudubon.org/*

### EVENTS

*Endangered Bird Conservation: Contrasting Pacific Islands and North America*
Dr. Loyal Mehrhoff, Endangered Species Recovery Director, Center for Biological Diversity
November 1, 2016, St. John 11, UH Mānoa, 7:00 pm - 8:00 pm

### FIELD TRIPS

**Pearl Harbor National Wildlife Refuge: Honouliuli Unit**
Sunday October 30th 2016 3:00 pm – 5:00 pm
Sunday November 6th 2016 3:00 pm – 5:00 pm
Leaders: Richard (Dick) May & Tony Leiggi
Tour size limited to 6 people. *HAS Members & ʻElepaio Subscribers have first preference for this program.*

Join HAS for a guided tour of the Honouliuli Unit of the Pearl Harbor NWR. Participants should be able to see similar species as Campbell NWR plus White-faced ibis, laughing Gull, wintering ducks, Northern Pintail, Northern Shoveler, American and Eurasian Wigeon and Green-winged Teal. **RSVP by OCT 20** to hiaudsoc@pixi.com, subject line: Honouliuli Tour.

### VOLUNTEER OPPORTUNITIES

#### Freeman Seabird Preserve 2016 Fieldwork Season

*Seeking Volunteers for Habitat Restoration!*
9 am to Noon, Every Saturday morning JAN through MAR 2017

In November and early December, Wedge-tailed Shearwater adult birds and chicks leave the Freeman Seabird Preserve at Black Point to forage at sea for several months before returning in the latter part of March to nest.

Volunteers are needed for fieldwork at the site on Saturday mornings from 9 am to noon beginning January 7th. Activities will include maintenance of native plants and man-made landscape features, along with removal of invasive plants, trash and debris. Other dates and times can be arranged for groups wishing to contribute their time in an effort to preserve rare Hawaiian coastal vegetation and seabird nesting habitat.

Contact the Hawaiʻi Audubon Society office by phone at (808) 528-1432 or e-mail at hiaudsoc@pixi.com in advance if you would like to participate. We will meet each Saturday at Triangle Park near Diamond Head at 8:45am to carpool to the site. Plan on bringing drinking water, sun and rain protection, gloves, weeding tools, clippers and loppers.

#### Hui Manu-o-Kū

The Hui Manu-o-Kū is a group of conservationists and citizens that all have one thing in common: an interest and admiration for White Terns, or manu-o-Kū. Visit: http://www.whiteterns.org/

**Volunteer with Hui Manu-o-Kū:** If you are interested in becoming a citizen scientist you may review the Volunteer Training Packet and begin making observations.

http://www.whiteterns.org/citizenscience.html

HAWAI‘I AUDUBON SOCIETY
850 RICHARDS ST, SUITE 505
HONOLULU, HI 96813-4709

www.hawaiiaudubon.org
(808) 528-1432
hiaudsoc@pixi.com
www.facebook.com/hawaiiaudubonsociety

Nonprofit Organization
U.S. Postage
**PAID**
Honolulu, Hawai‘i
Permit Number 1156

‘Elepaio · 76:6 · NOVEMBER / DECEMBER 2016

ADDRESS SERVICE REQUESTED

# Table of Contents

Patrick Ching Art Collection Note Cards
Set of 8 cards with envelopes
**AVAILABLE NOW for only $5.00**
now until early December.  Photo credit: D. Hyrenbach