

**Annual summaries of ongoing or new studies
on the island of Moloka'i, Hawai'i**

**No. 9
December 31, 2015**



USFWS TE146777 Native endangered species recovery

**Arleone Dibben-Young
Ahupua'a Natives
2380 Kamehameha V Hwy, Kaunakakai
Moloka'i, Hawai'i 96748**



Introduction

In 2007, I began marking endemic Hawaiian Coots and Hawaiian Stilts, both endangered, and migratory waterfowl and shorebirds for avian influenza surveillance and to monitor individuals rehabilitated from avian botulism, and have since expanded to include the studies within this report. The close proximity of wetlands along Moloka'i's south shore and site conditions provide uncomplicated resighting of marked birds, monitoring of nesting sites, and investigation of family structure and mating systems. These new and ongoing studies are expected to contribute to the conservation and recovery of these species.

Photo front cover A. Dibben-Young
Female Bristle-thighed Curlew



Contents

Long-term movement and life history study of the Hawaiian Coot and the Hawaiian Stilt on Moloka'i: 2001-2015	1
Avian botulism in the Hawaiian Islands	4
Molt of the Hawaiian Coot	6
Study skins	6
Migration of Bristle-thighed Curlew and Whimbrel and movements on Moloka'i	8
Serial polygyny of a Hawaiian Coot at the Kaunakakai Wastewater Reclamation Facility	9
Survival of Hawaiian Stilts with leg injuries and amputations	10
Mate fidelity of the Hawaiian Stilt	11
Multigenerational marking of Hawaiian Stilt	12
Occurrence of cooperative breeding of Hawaiian Stilt	12
Genealogy of Moloka'i Hawaiian Stilt family	13

Long-term movement and life history study of the Hawaiian Coot (*Fulica alai*) and the Hawaiian Stilt (*Himantopus mexicanus knudseni*) on Moloka'i: 2001 to 2015

Since 2007, 108 Hawaiian Stilts (96 with known hatch dates) and 82 Hawaiian Coots (14 with known hatch dates) have been banded. During 2015, 17 Hawaiian Stilts and 1 Bristle-thighed Curlew were captured and uniquely marked (Table 1).

During 2015, observations were made at ten wetlands on Moloka'i of marked 365 Hawaiian Coots (Table 2), 2,161 Hawaiian Stilts (Table 3), 216 Bristle-thighed Curlew, 44 Whimbrel, and 4 Pacific Golden-Plover including one banded in 2010 with a natural leg amputation. The current longevity record for a Hawaiian Coot in this study is nine years, while that of a Hawaiian Stilt is a minimum of 17 years.

Table 1
Species and individuals banded in 2015

Species	USFWS Band	Flag	Leg Combo	Banding Location	Banding Date	Comments
HAST	91438756		GA:GI	Puuhala	4/6/2015	Hatched 2/13/2015
HAST	91438757		GA:BI	Puuhala	4/6/2015	Hatched 2/13/2015
HAST	91438758		GA:YI	Puuhala	4/6/2015	Hatched 2/13/2015
HAST	91438759		GA:LL	KWWRF	4/11/2015	Hatched 3/25/2015
HAST	91438760		GL:GA	KWWRF	4/11/2015	Hatched 3/27/2015
HAST	91438761		RL:GA	KWWRF	4/11/2015	Hatched 3/25/2015
HAST	91438762		GA:WI	KWWRF	5/5/2015	Hatched 4/28/2015 Parental adults are 1/2-siblings
HAST	91438763		GA:OI	KWWRF	5/5/2015	Hatched 4/28/2015 Parental adults are 1/2-siblings
HAST	91438764		GA:KI	KWWRF	5/5/2015	Hatched 4/28/2015 Parental adults are 1/2-siblings.
HAST	91438765		GA:WR	KWWRF	5/25/2015	Hatched 5/5/2015
HAST	91438766		GA:YL	KWWRF	5/25/2015	Hatched 5/6/2015
HAST	91438767		GA:OL	KWWRF	5/25/2015	Hatched 5/7/2015
HAST	91438768		GA:WK	KWWRF	6/5/2015	Hatched 5/17/2015 Recovered 6/27/2015
HAST	91438769		KO:GA	KWWRF	6/5/2015	Missing 8/22/2015
HAST	91438770		PG:GA	Ohiapilo Pond	7/20/2015	Hatched 7/5/2015 Missing 7/30/2015
HAST	91438771		PR:GA	Ohiapilo Pond	7/20/2015	Hatched 7/5/2015 Missing 7/30/2015
HAST	91438772		GA:KK	Ohiapilo Pond	7/22/2015	Banded as After Third Year adult
BTCU	99404023	9B	RW:gA	Pahuauwai	1/10/2015	Over-summered 2012-2014

Darvic® Band Color Codes

A Aluminum	W White	R Red	S Shamrock
B Blue	K Black	O Orange	P Purple
L Light Blue	G Green	Y Yellow	I Pink

Table 2
2015 Banded/Collared Hawaiian Coot Observations

USFWS Band	Collars/ Color Bands	Banding Location	Banding Date	Observations			Comments
					Kaunakakai WWRF	Ōhiapilo Pond BS	
111625111	WK:AAL	Kaunakakai WWRF	1/13/2008	4	✓		1/21/2015 Molted and flightless, missing next day
113600836	WK:ACB	Kaunakakai WWRF	7/19/2009	2	✓		1/12/2015 Salvaged in clarifier, territory of aggressive banded pair
109697001	WK:ACH	Kaunakakai WWRF	12/11/2009	23	✓		Forced out of territory of nine years by aggressive hybrid Mallard - Hawaiian Duck, missing next day (8/26/2015)
109697034	WK:AFD	Kaunakakai WWRF	3/17/2012	5	✓	✓	At 'Ōhi'apilo Pond BS 1/22/2015 - 5/2/2015, then vacated
109697037	WK:AFJ	Kaunakakai WWRF	3/17/2012	50	✓		Constructed multiple nests, no eggs
109697039	GA:--	Kaunakakai WWRF	7/9/2012	9	✓		Lost collar WK:AHB in 2012
109697040	WK:AFP	Kaunakakai WWRF	10/20/2012	50	✓		Mate forced out of territory by aggressive hybrid Mallard - Hawaiian Duck on 8/26/2015, moved to general population 9/18/2014
109697044	WK:AFV	Kaunakakai WWRF	5/26/2013	4	✓		
109697047	GO:GA	Kaunakakai WWRF	11/16/2013	51	✓		Constructed multiple nests, no eggs
109697049	WK:AFZ	Kaunakakai WWRF	9/29/2014	50	✓		
109697050	WK:AHA	Kaunakakai WWRF	9/29/2014	51	✓		
109697051	--:GA	Kaunakakai WWRF	9/29/2014	1	✓		1/11/2015 Salvaged in drain pipe
109697052	WK:AHC	Kaunakakai WWRF	9/29/2014	51	✓		
109697053	WK:AHD	Kaunakakai WWRF	9/29/2014	12	✓		3/27/2015 Forced submersion by aggressive banded pair

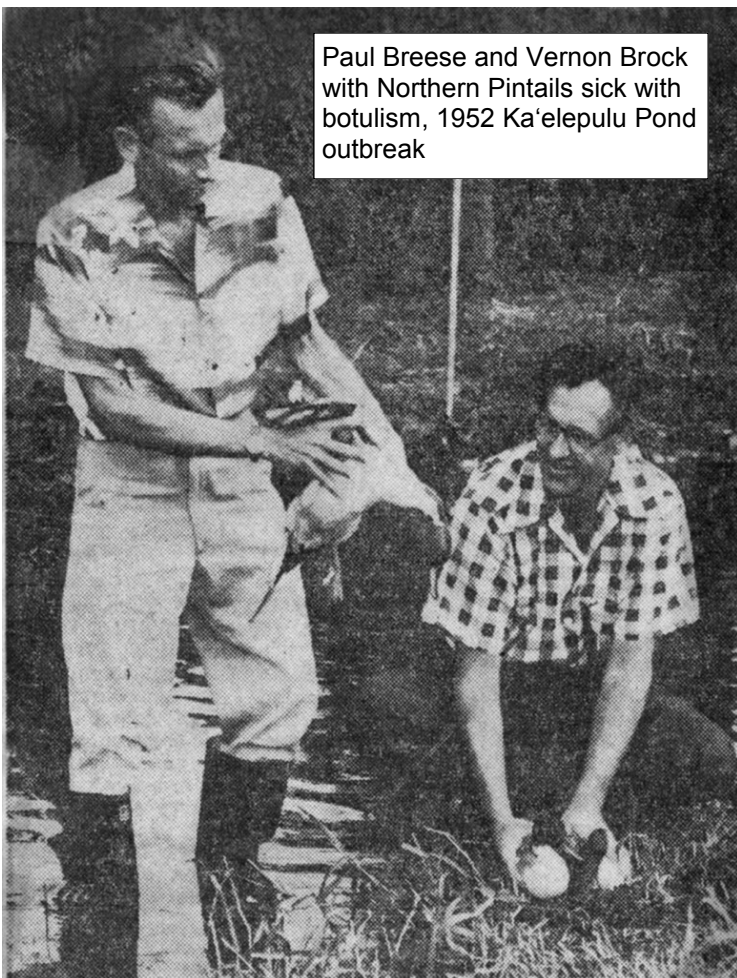


Avian botulism in the Hawaiian Islands

Avian botulism is a paralytic and often fatal disease typically found in waterbirds caused by ingestion of a neurotoxin produced by the cells of bacterium *Clostridium botulinum* Type C (Locke and Friend 1989). The bacterium was first confirmed as the cause of avian botulism in the early 1900s (Giltner and Couch 1930, Klambach and Gunderson 1934).

The first recognized outbreak in the Hawaiian Islands occurred in winter 1952 at Ka'elepulu Pond, O'ahu: more than 1,000 migratory and endemic waterbirds died (Breese pers. comm., Brock and Breese 1953). A 1922 (Fow) account of affected waterfowl and chickens during the dredging of the Ala Wai canal on O'ahu is suspected of having been an outbreak, and conditions conducive to an outbreak are noted in 1871 (Kanoa) at Kakahai'a Pond on Moloka'i where fish and domestic ducks were raised and migratory waterfowl frequented during the winter season. Avian botulism outbreaks in the Hawaiian Islands have occurred sporadically, however few of these outbreaks were documented and then only minimally (Table 4). The numbers of bird deaths in the Islands from the disease are unknown, but suspected to be in the thousands. All five endemic Hawaiian waterbird species are endangered thus any loss is significant, making immediate response to and management of avian botulism outbreaks essential.

This project utilizes banding to track movements of Hawaiian Coot and Hawaiian Stilt in order to identify potential disease dispersal routes and determine connectivity of wetlands with a history of suspected and/or confirmed botulism cases.



Paul Breese and Vernon Brock with Northern Pintails sick with botulism, 1952 Ka'elepulu Pond outbreak

Literature cited

- Brock, V., and P. Breese 1953. Duck botulism at Ka'elepulu Pond, Kailua, O'ahu. 'Elepaio. 13:12.
- Fow, C. 1922, 23 May. Letter to the Bishop Trust Company.
- Giltner, L.T., and J.F. Couch. 1930. Western duck sickness and botulism. Science 72: 660.
- Kanoa, J.W. Ka Nūpepa Kū'oko'a. He mea hou. 4 November 1871. (44) p3. Retrieved 19 October 2013: <http://www.papakilodatabase.com/pdnupepa/cgi-bin/pdnupepa?d&d=KNK1871110401.2.21&srpos=17&e=-----en-20--1--txtIN|txNU-molokai+kawela+pipi----->
- Klambach, E.R., and M.F. Gunderson. 1934. Western duck sickness: a form of botulism. Technical Bulletin No. 411. U.S. Department of Agriculture. Washington, D.C. 82 pp.
- Locke, L.N., and M. Friend. 1989. Avian botulism: Geographic expansion of a historic disease. In Waterfowl Management handbook. Fish and Wildlife Leaflet 13. Sect.13.2.4. pp 1-6.

Table 4
Avian botulism cases in the Hawaiian Islands

Island	Location	Confirmed	Suspected	Year
Hawai'i	Kaloko-Honokōhau NHP	✓	✓	1994
Hawai'i	Kealakehe WWTP	✓	✓	1994
Hawai'i	Kona Village Resort	✓	✓	1987, 1995
Hawai'i	ʻŌpaeʻula Pond	✓		1993
Hawai'i	Wailoa Pond	✓		2015
Kaua'i	Hanalei NWR	✓	✓	1990, 1993, 1994, 1995, 2000, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015
Kaua'i	Kalapakī Stream, Kalapakī Bay	✓	✓	2009, 2010
Kaua'i	Kalihi Wai Reservoir	✓		2014
Kaua'i	Kaua'i Lagoons Resort	✓		2000, 2012
Kaua'i	Kapa'a	✓		2015
Kaua'i	Kekaha Landfill	✓		1996
Kaua'i	Līhu'e Plantation Company Settling ponds	✓		1966, 1995
Kaua'i	Po'ipū Sheraton	✓		2006
Kaua'i	Līhu'e	✓		2015
Kaua'i	Private pond near Brenneke's Beach, Po'ipū	✓		2006
Kaua'i	South Shore Community Wastewater Facility (aka Koloa Wastewater Treatment Plant)	✓		2007, 2009, 2010
Kaua'i	Westin Kaua'i	✓		1993
Lāna'i	Lāna'i Wastewater Reclamation Facility	✓		2012, 2014
Laysan	Lake Laysan	✓		2003, 2008, 2011
Maui	Kanahā Pond SWS	✓	✓	1997, 2001, 2003, 2005, 2006, 2008, 2011, 2012
Maui	Keālia Pond NWR	✓	✓	1998, 2000, 2001, 2002, 2004, 2006, 2008, 2009, 2013
Maui	Polipoli Springs	✓		2006
Midway	Midway Atoll	✓	✓	2007, 2008, 2009, 2010, 2011, 2012, 2013, 2015
Moloka'i	Kakahai'a Pond		✓	1871
Moloka'i	Kaunakakai WWRF	✓	✓	2003, 2011
Moloka'i	Kōheo Wetland		✓	2004
Moloka'i	Kualapu'u WTP		✓	2003
Moloka'i	ʻŌhi'apilo Pond Bird Sanctuary	✓	✓	2003, 2004, 2007, 2008
O'ahu	Chevron Oil Refinery	✓		1997, 1998
O'ahu	James Campbell NWR	✓		1998, 2002, 2005, 2008, 2009, 2011, 2012
O'ahu	Ka'elepulu Pond (Enchanted Lakes)	✓	✓	1952, 1953, 2003, 2005, 2009, 2011
O'ahu	Marine Corps Base Hawaii	✓		2015
O'ahu	Kapunahala Stream	✓		2014
O'ahu	Waikīkī duck ponds		✓	1922
O'ahu	Kawainui Park Stream	✓		2013
O'ahu	Waimea Valley Park	✓		2013, 2014
O'ahu	Kawainui Marsh Mitigation Site	✓		2013, 2014

Molt of the Hawaiian Coot

Previously thought to undergo one partial (body contour feathers) and one complete (all body and remiges) molts per year, this study, now in its third year, has revealed that multiple periods of flightlessness can occur annually in the Hawaiian Coot and that molt may not be confined to specific time periods. Little is known about the molt cycle in the Hawaiian Coot, yet it is essential for comprehensive habitat and predator management. Additional study is needed to gain a better understanding of the timing and nature of Hawaiian Coot molts, and the associated plumages.

Table 5
2015 Molts of marked Hawaiian Coots

Observation Date	USFWS Band	Collar/ Color Bands	Banding Date	Age in 2015	Comments
1/2/2015	109697034	WK:AFD	3/17/2012	Min 6 Yrs	Remiges molted
1/2/2015	111625111	WK:AAL	1/13/2008	Min 9 Yrs	Remiges molted
8/10/2015	109697052	WK:AHC	9/29/2014	1 Yr 4 Mos	Remiges molted 1st time in 2015
10/26/2015	109697052	WK:AHC	9/29/2014	1 Yr 6 Mos	Remiges molted 2nd time in 2015

Study Skins

Bird collections at museums are curated for ornithological purposes and are a valuable source for researchers. Birds salvaged under USFWS Permit SPDAVE-122751 were made into study skins (flats, rounds, and partials) and a total of 36 study skins were deposited in 2015 at the Bernice Pauahi Bishop Museum in Honolulu (Table 6), as well as a collection of owl pellets, some containing the remains of Hawaiian Stilt chicks. Prior to this transfer, the museum housed only 85 specimens from the island of Moloka'i as part the overall collection of 35,000 specimens.



(Top) Study skins of Hawaiian Coots salvaged 2003 - 2015 on Moloka'i and used for molt and plumage study. Most deposited at the Bernice Pauahi Bishop Museum in 2015.

Table 6
Study skins delivered to the Bernice Pauahi Bishop Museum in 2015

Species	Label ID	Salvaged	Location	Prepped	Delivered	Comments
Pacific Golden-Plover	ADY-0003	4/9/2011	Kaunakakai	7/2/2011	3/25/2015	Vehicular impact. Lost L. leg on 1/10/2010, migrated twice
Barn Owl	ADY-0009	11/7/2009	Ohiapilo Pond	4/17/2011	3/15/2015	Fractured R. tibia w/gangrene, emaciated
Barn Owl	ADY-0013	4/10/2013	Kamahuehue Pond	6/28/2013	3/15/2015	Found on highway, fractured R & L humerus.
Hawaiian Stilt	ADY-0015	6/14/2006	Ohiapilo Pond	6/26/2013	3/25/2015	R. eye out of socket, multiple puncture wounds on belly
Hawaiian Stilt	ADY-0016	5/28/2013	KWWRF	6/29/2013	3/25/2015	Found in sludge stabilization pond, emaciated. Band 91438736
Black-crowned Night-Heron	ADY-0017	6/10/2008	Ohiapilo Pond	6/29/2013	3/15/2015	Vent discolored and w/gangrene.
Black-crowned Night-Heron	ADY-0018	8/7/2009	Ohiapilo Pond	7/5/2013	3/15/2015	R. eye punctured
Black-crowned Night-Heron	ADY-0019	6/26/2008	Ohiapilo Pond	7/5/2013	3/15/2015	R. metatarsal joint desiccated
Hawaiian Coot	ADY-0020	12/20/2012	KWWRF	7/5/2013	3/15/2015	USGS Case Report: 21881: Drowned
Black-crowned Night-Heron	ADY-0022	6/10/2008	Ohiapilo Pond	7/6/2013	3/15/2015	Submerged on edge of canal
Hawaiian Coot	ADY-0023	12/27/2012	KWWRF	7/6/2013	3/15/2015	Obd 12/9/2012 w/both feet hobbled w/string. Hand captured and died immediately
Short-eared Owl	ADY-0028	10/22/2008	Ohiapilo Pond	7/20/2013	3/15/2015	Fractured skull, R. humerus, R & L tibia
Cattle Egret	ADY-0032	5/6/2013	KWWRF	8/9/2013	3/15/2015	Open wound R. humerus, gangrene on belly and vent, emaciated
Hawaiian Coot	ADY-0033	4/30/2012	KWWRF	8/9/2013	3/15/2015	Band 109697026, USGS Case Report 21771: Forced submersion
Cattle Egret	ADY-0034	9/24/2012	Puuhala Pond	8/9/2013	3/15/2015	Compound fractures L. humerus, ulna & radius
Hawaiian Coot	ADY-0035	1/24/2012	KWWRF	8/10/2013	3/15/2015	USGS Case Report 21714: Fractured L. tibia, emaciation.
Pacific Golden-Plover	ADY-0037	9/27/2007	Hoolehua	8/10/2013	3/25/2015	Multiple neck fractures, fractured R. humerus
Hawaiian Stilt	ADY-0039	6/6/2006	Ohiapilo Pond	8/11/2013	3/25/2015	Found on edge of pond during botulism outbreak, maggots stuck to feathers
White-rumped Shama	ADY-0040	4/24/2013	Kamiloloa	8/11/2013	3/25/2015	Dent on R. side of skull, fractured L. tibia
Apapane	ADY-0041	2/25/2005	Kamakou	8/11/2013	3/25/2015	Impact, hemorrhaged
White-rumped Shama	ADY-0043	3/22/2008	Kalamaula	8/12/2013	3/25/2015	Fracture L. side skull
Hawaiian Coot	ADY-0046	8/14/2009	Pahuauwai	8/16/2013	3/15/2015	Cat depredation, fractured humerus, ulna chewed
Hawaiian Coot	ADY-0047	12/5/2010	Kaunakakai	8/16/2013	3/15/2015	Fractured R. ulna
Hawaiian Coot	ADY-0048	8/21/2009	Puuhala Pond	8/16/2013	3/15/2015	USGS Case Report 21314: Nematodes, E. coli, enteritis
Hawaiian Coot	ADY-0049	5/10/2006	Ohiapilo Pond	8/16/2013	3/15/2015	Found on edge of canal
Hawaiian Coot	ADY-0050	6/22/2009	KWWRF	8/17/2013	3/15/2015	Impact, hemorrhaged
Hawaiian Coot	ADY-0051	12/12/2003	KWWRF	8/17/2013	3/15/2015	Fractured tibia
Hawaiian Coot	ADY-0053	8/12/2010	KWWRF	8/17/2013	3/15/2015	Cat depredation, missing head
Cattle Egret	ADY-0054	6/10/2013	Puuhala Pond	6/10/2013	3/15/2015	Fractured R. humerus
Black-crowned Night-Heron	ADY-0057	6/12/2008	Ohiapilo Pond	8/24/2013	3/15/2015	Cat depredation, multiple wounds, gangrene on belly
Pacific Golden-Plover	ADY-0059	10/29/2013	Kamakaipo	11/2/2013	3/25/2015	Both legs paralyzed, euthanized

Table 6 (Cont'd.)
Study skins delivered to the Bernice Pauahi Bishop Museum in 2015

Species	Label ID	Salvaged	Location	Prepped	Delivered	Comments
Pacific Golden-Plover	ADY-0060	10/22/2013	Kaunakakai	11/3/2013	3/15/2015	Fractured R. femur
Black-crowned Night-Heron	ADY-0061	10/12/2013	Ohiapilo Pond	11/3/2013	3/15/2015	Vent w/gangrene
Hawaiian Coot	ADY-0062	10/11/2013	KWWRF	11/3/2013	3/15/2015	Multiple fractures both legs and wings, skull & bill fractured
Hawaiian Coot	ADY-0064	11/22/2013	KWWRF	2/22/2014	3/15/2015	Fractured L. femur, multiple neck fractures
Hawaiian Coot	ADY-0067	3/23/2014	KWWRF	3/28/2014	3/15/2015	Band 109697045, USGS Case Report: Hepatitis

Migration of Bristle-thighed Curlew and Whimbrel and movements on Moloka'i

In October 2012, the Bristle-thighed Curlew was proclaimed the Official Bird of Kaunakakai and the District of Moloka'i. The species figures prominently in ancient Hawaiian proverbs unique to the island, and for residents symbolizes the connection between culture and natural resources. In 2015, one curlew was captured and banded and one geolocator was retrieved from a curlew banded in 2014. This migration study is in cooperation with the U.S. Geological Survey Alaska Science Center Shorebird Research Project.



Serial Polygyny of a Hawaiian Coot at the Kaunakakai Wastewater Reclamation Facility

Polygyny – a male paired with two or more females - is very rare in wild birds and estimated to occur in only 2% of avian species worldwide. Within Rallidae, only five species are known to utilize a non-monogamous mating system – Corncrake, Purple Swamphen, Common Moorhen, Dusky Moorhen and Tasmanian Native-hen (Taylor and van Perlo 1998). No records are known to exist within *Fulica* (B. Lyon, email dated 11 December 2013).

A male Hawaiian Coot hatched at the Kaunakakai Wastewater Reclamation Facility, Moloka‘i 15 March 2006 and by 17 March 2007 formed a polygynous trio and was observed constructing two nests on the bodyboard it hatched on after having ousted its parental adults. The nests were later abandoned, however, the trio remained intact for the next several months. The male was banded 11 December 2009, #109697001 with collar WK:ACH.

On 5 June 2011, the male paired with a new mate, a female banded 26 May 2013, #109697044 and collar WK:AFV. In February of 2012 the male was observed with WK:AFV and a second female nesting on opposite sides of the hub of the clarifier; this female was found dead 5 March 2012 with impacted egg. A new trio was formed 14 August 2013, with the new female



Male WK:ACH (L) and female WK:AFV (R) in clarifier

deserting shortly afterwards. In September another trio was formed with a female hatched 12 May 2012 (banded #109697040 WK:AFP). The two females were observed in 2013 and 2014, intermittently attempting to oust an adult pair off of the artificial nesting island the male had hatched on in 2006, each time returning to the clarifier tank. WK:AFP abandoned the territory on 3 January 2015, and returned after a 13 day absence on 22 January 2015. At this time, WK:AFV was observed with severe ankle swelling and a healed fracture of the right outer toe on the right foot, and vanished the next day, thus ending the trio.

On 27 March 2015, male WK: AHD #106997053 (hatched 5 April 2014, offspring of banded parental adults with two siblings also banded) was found dead in the clarifier tank territory of WK:ACH and WK:AFP while they were nesting. A large patch of feathers was plucked from the back of the head and cause of death undetermined (USGS Case Report 25183).

An aggressive hybrid Hawaiian Duck - Mallard began a hostile takeover of the nesting site of WK:ACH and WK:AFP, on 19 August 2015, which resulted in the abandonment of the nest on 26 August 2015 by WK:ACH. Within two weeks WK:AFP returned to the general population. Three months later, 2 December 2015, WK:AFP began constructing a new nest on the hub of the clarifier with one of the banded siblings previously mentioned, WK:AHA #109697050. This pair remains in the clarifier tank.

Literature cited

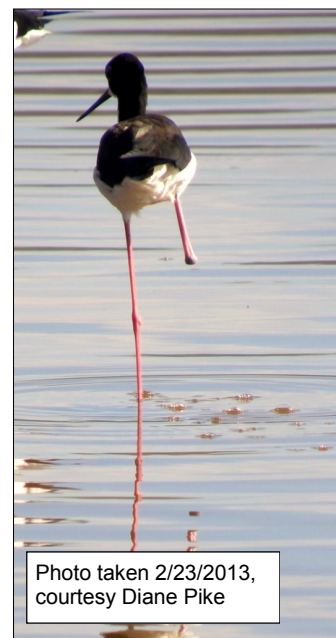
Taylor, B and van Perlo, B. 1998. Ralls, a guide to the rails, crakes, gallinules and coots of the world. Pica Press, Sussex

Survival of Hawaiian Stilts with leg and foot injuries

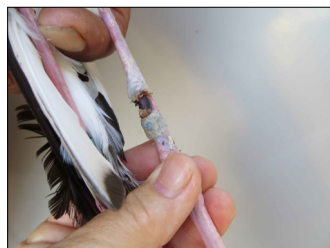
Hawaiian Stilts are sporadically observed with leg injuries, the most common resulting in swelling of the foot or metatarsal joint. Catastrophic leg losses - most likely due to striking an object with the legs or feet - are less frequently seen. Occasionally stilts have been observed with injuries from entanglement with nylon fishing line or fibrous fishing nets, attacks by oysters (pers. comm. A. Nadig) and failed capture attempts by predators such as mongooses (pers. comm. M. Silbernagle). Banded birds are put at additional risk of injury by sand or dirt caught between the band and leg which can cause swelling around the bands, loss of circulation, infection, and eventual loss of the leg.

From 1960 through 2015, 83,289 Hawaiian Stilts were observed on Moloka'i in 3,844 observations (Dibben-Young unpub. data): 12,673 of the observations were of banded birds. Duplicate observations of injured birds were removed to isolate 16 banded and 20 unbanded individuals with leg or foot injuries. Of the banded birds, four injuries were not band-induced, however developed into band-related when swelling of the metatarsal joint advanced proximally to the bands: one bird vanished shortly after the injury, the other made a minimum of two round trips to Lāna'i in the latter months of 2014, and in 2015 two were captured with compacted mud beneath the bands, rehabbed and released. The leg amputation of one stilt was not attributed to bands due to the location of the amputation site.

Seven stilts (unbanded and banded) were observed with natural leg amputations, with three surviving for several years. A female that lost a leg in April 2009, nested and hatched chicks in 2014 (Top right photo): The territory was fiercely defended but abandoned two days after the four chicks were mongoose predated. A banded female (bottom photo center) hatched in May 2013, lost the right leg mid-tarsus 10 September 2013, and remains with banded parental male and mate as a cooperative breeding helper (bottom photo).



YK:GA Swelling around bands



YK:GA Injury due to band



YK:GA Bands with mud



YK:GA Healed leg at release

In 2015, male Hawaiian Stilt YK:GA #93492269, was observed 12 April 2015 with left swollen metatarsal joint and by 18 May 2015, the swelling had moved up the leg to the bands. In July, YK:GA with a banded mate, nested in muddy conditions and hatched two chicks, which were banded and believed to have been mongoose predated by the next day. The male was captured 19 August 2015, and brought into rehabilitation, where the two color bands on the left leg were removed and found to be compacted with mud (four photos above). YK:GA was released 7 November 2015.



Mate fidelity of Hawaiian Stilts

Coleman (1981) suspected pair formation of the Hawaiian Stilt any time of year, although less frequently in winter, and on two occasions documented mate retention beyond the fledging of offspring into the fall and first winter. Beyond this, however, no long-term monitoring was continued and degree of mate fidelity in the species has remained unknown. Long-term and multigenerational banding in this study has revealed that pairs are monogamous and remain together from year to year. Based on data through 2015, at least three banded pairs remained intact for four to seven years with these known to be faithful to either a breeding or post-fledging/nonbreeding site.

Literature cited

Coleman, R. A. 1981. The reproductive biology of the Hawaiian subspecies of the Black-necked Stilt, *Himantopus mexicanus knudseni*. Phd Thesis. Pennsylvania State Univ. University Park

Long-term monogamous banded pairs of Hawaiian Stilt



Photo courtesy Forest Starr & Kim Starr

YY:GA #93492265 Female (sibling to 93492269 and 93472065)

GA:YY #91438712 Male

This pair has remained together since February 2009. During 2015 the female was observed 231 times and the male 220. The majority of observations were made at Pu'uhala Pond, a site where the pair has not nested yet brought offspring to after fledging and then remained until the next breeding season (See Hawaiian Stilt Genealogy Chart 2015 for offspring). In 2015 this pair fledged three offspring in February, abandoned the subadults in November and re-nested.



Photo courtesy Patricia Lucas

YK:GA #93492269 Male (sibling to 93492265 and 93472065)

KR:GA #93492270 Female

Paired in May 2009, these two stilts remained together through mid-2015, when the male was brought into rehab. The female was last observed harassing and in pursuit of a Black-crowned Night-Heron flying towards the highway fronting Pu'uhala Pond, and was salvaged on the highway the following morning.

Multigenerational banding of Hawaiian Stilt

This long-term banding study includes the marking of four generations of Hawaiian Stilt (See Hawaiian Stilt Genealogy Chart 2015), and has revealed that not only do family groups (adults and offspring) remain intact beyond fledging (Wetmore 1925), but have continued to associate throughout the duration of this study. Twenty family members consisting of three generations and three different years of direct lineage siblings have been observed in a group at one time. In 2015, two pairs of banded half-siblings nested, with one fledging three offspring and the other eggs mongoose predated. Continuance of this study is expected to expose the previously unknown extent of family structure, thus providing a better understanding of the species.

Literature cited

Wetmore, A. 1925. Food of American phalaropes, avocets, and stilts. Bull. 1359. U.S. Dept. Agric. Washington, D.C



Photo A. Dibben-Young

Occurrence of cooperative breeding of Hawaiian Stilt

Exceptionally rare in shorebirds, cooperative breeding (where helpers assist in a breeding attempt by caring for parental offspring) has been recorded but in a few species. Robinson and Oring (BNA 449, Reed pers. comm.) affirm no cooperative breeding of stilts or association of nonbreeding adults with a breeding pair has been observed, thus this study is the first documentation of such family structure.

In a family genealogy of 80 Hawaiian Stilts on Moloka'i, 64 individuals have been marked to date, including three consecutive years of offspring of one banded pair. As of 2015, 49 of these banded individuals are known to be alive. Observations revealed nesting by multiple family members within a well-defined and defended territory, comingling of parental adults and chicks, and cooperative caring of chicks by both unpaired and nonbreeding but paired older adult siblings. The parental female (a minimum of 16 years old) and her second mate continue to associate with second and third generation offspring indicating that some family groups may remain together for much longer than previously thought. Continued study will provide more insight into family and mating structure.

Literature cited

<http://bna.birds.cornell.edu/bna/species/449> retrieved 15 December 2013

Hawaiian Stilt Genealogy Chart 2015

